



Summary Principles of Managerial Finance - Chapters 1-10

Finance (University of Jordan)

PART 1

Introduction to Managerial Finance

CHAPTERS IN THIS PART

- 1 The Role and Environment of Managerial Finance**
- 2 Financial Statements and Analysis**
- 3 Cash Flow and Financial Planning**

INTEGRATIVE CASE 1: TRACK SOFTWARE, INC.

CHAPTER 1

The Role and Environment of Managerial Finance

INSTRUCTOR'S RESOURCES

Overview

This chapter introduces the student to the field of finance and explores career opportunities in both financial services and managerial finance. The three basic legal forms of business organization (sole proprietorship, partnership, and corporation) and their strengths and weaknesses are described, as well as the relationship between major parties in a corporation. The managerial finance function is defined and differentiated from economics and accounting. The chapter then summarizes the three key activities of the financial manager: financial analysis and planning, investment decisions, and financing decisions. A discussion of the financial manager's goals – maximizing shareholder wealth and preserving stakeholder wealth – and the role of ethics in meeting these goals is presented. The chapter includes discussion of the agency problem – the conflict that exists between managers and owners in a large corporation. Money and capital markets and their major components are introduced in this chapter. The final section covers a discussion of the impact of taxation on the firm's financial activities.

PMF DISK

This chapter's topics are not covered on the *PMF Tutor*, *PMF Problem-Solver*, or the *PMF Templates*.

Study Guide

The following *Study Guide* example is suggested for classroom presentation:

<u>Example</u>	<u>Topic</u>
1	Earnings per share
3	Income tax calculation

ANSWERS TO REVIEW QUESTIONS

1-1 *Finance* is the art and science of managing money. Finance affects all individuals, businesses, and governments in the process of the transfer of money through institutions, markets, and instruments.

1-2 *Financial services* is the area of finance concerned with the design and delivery of advice and financial products to individuals, businesses, and government.

Managerial finance encompasses the functions of budgeting, financial forecasting, credit administration, investment analysis, and funds procurement for the firm. Managerial finance is the management of the firm's funds within the firm. This field offers many career opportunities, including financial analyst, capital budgeting analyst, and cash manager (Note: Other answers possible).

1-3 Sole proprietorships are the most common form of business organization, while corporations are responsible for the majority of business receipts and profits. Corporations account for the majority of business receipts and profits because they receive certain tax advantages and can expand more easily due to access to capital markets.

1-4 Stockholders are the true owners, through equity in common and preferred stock, of a corporation. They elect the board of directors, which has the ultimate authority to guide corporate affairs and set general policy. The board is usually composed of key corporate personnel and outside directors. The president (CEO) reports to the board. He or she is responsible for day-to-day operations and carrying out policies established by the board. The owners of the corporation do not have a direct relationship with management but give their input through the election of board members and voting on major charter issues. The owners of the firm are compensated through the receipt of cash dividends paid by the firm or by realizing capital gains through increases in the price of their common stock shares.

1-5 The most popular form of limited liability organizations other than corporations are:

- Limited partnerships – A partnership with at least one general partner with unlimited liability and one or more limited partners that have limited liability. In return for the limited liability, the limited partners are prohibited from active management of the partnership.
- S corporation – If certain requirements are met, the S corporation can be taxed as a partnership but receive most of the benefits of the corporate form of organization.
- Limited liability corporation (LLC) – This form of organization is like an S corporation in that it is taxed as a partnership but primarily functions like a corporation. The LLC differs from the S corporation in that it is allowed to own other corporations and be owned by other corporations, partnerships, and non-U.S. residents.
- Limited liability partnership (LLP) – A partnership form authorized by many states that gives the partners limited liability from the acts of other partners, but not from personal individual acts of malpractice. The LLP is taxed as a partnership. This form is most frequently used by legal and accounting professionals.

These firms generally do not have large numbers of owners. Most typically have fewer than 100 owners.

1-6 Virtually every function within a firm is in some way connected with the receipt or disbursement of cash. The cash relationship may be associated with the generation of sales through the marketing department, the incurring of raw material costs through purchasing, or the earnings of production workers. Since finance deals primarily with management of cash for operation of the firm every person within the firm needs to be knowledgeable of finance to effectively work with employees of the financial departments.

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- 1-7** The treasurer or financial manager within the mature firm must make decisions with respect to handling financial planning, acquisition of fixed assets, obtaining funds to finance fixed assets, managing working capital needs, managing the pension fund, managing foreign exchange, and distribution of corporate earnings to owners.
- 1-8** Finance is often considered a form of applied economics. Firms operate within the economy and must be aware of economic principles, changes in economic activity, and economic policy. Principles developed in economic theory are applied to specific areas in finance. From macroeconomics comes the institutional structure in which money and credit flows take place. From microeconomics, finance draws the primary principle used in financial management, marginal analysis. Since this analysis of marginal benefits and costs is a critical component of most financial decisions, the financial manager needs basic economic knowledge.
- 1-9**
- a. Accountants operate on an accrual basis, recognizing revenues at the point of sale and expenses when incurred. The financial manager focuses on the actual inflows and outflows of cash, recognizing revenues when actually received and expenses when actually paid.
 - b. The accountant primarily gathers and presents financial data; the financial manager devotes attention primarily to decision making through analysis of financial data.
- 1-10** The two key activities of the financial manager as related to the firm's balance sheet are:
- (1) Making investment decisions: Determining both the most efficient level and the best mix of assets; and
 - (2) Making financing decisions: Establishing and maintaining the proper mix of short- and long-term financing and raising needed financing in the most economical fashion.
- Making investment decisions concerns the left-hand side of the balance sheet (current and fixed assets). Making financing decisions deals with the right-hand side of the balance sheet (current liabilities, long-term debt, and stockholders' equity).
- 1-11** Profit maximization is not consistent with wealth maximization due to: (1) the timing of earnings per share, (2) earnings which do not represent cash flows available to stockholders, and (3) a failure to consider risk.
- 1-12** *Risk* is the chance that actual outcomes may differ from expected outcomes. Financial managers must consider both risk and return because of their inverse effect on the share price of the firm. Increased risk may decrease the share price, while increased return may increase the share price.
- 1-13** The *goal of the firm*, and therefore all managers, is to maximize shareholder wealth. This goal is measured by share price; an increasing price per share of common stock relative to the stock market as a whole indicates achievement of this goal.
- 1-14** Mathematically, *economic value added (EVA)* is the after-tax operating profits a firm earns from an investment minus the cost of funds used to finance the investment. If the resulting value is positive (negative), shareholders wealth is increased (decreased) by the investment. EVA is used for determining if an existing or planned investment will result in an increase in shareholder wealth, and should thus be continued in order to fulfill the financial management function of maximizing shareholder wealth.

1-15 In recent years the magnitude and severity of "white collar crime" has increased dramatically, with a corresponding emphasis on prosecution by government authorities. As a result, the actions of all corporations and their executives have been subjected to closer scrutiny. This increased scrutiny of this type of crime has resulted in many firms establishing corporate ethics guidelines and policies to cover employee actions in dealing with all corporate constituents. The adoption of high ethical standards by a corporation strengthens its competitive position by reducing the potential for litigation, maintaining a positive image, and building shareholder confidence. The result is enhancement of long-term value and a positive effect on share price.

1-16 Market forces – for example, shareholder activism from large institutional investors – can reduce or avoid the agency problem because these groups can use their voting power to elect new directors who support their objectives and will act to replace poorly performing managers. In this way, these groups place pressure on management to take actions that maximize shareholder wealth.

The threat of hostile takeovers also acts as a deterrent to the agency problem. *Hostile takeovers* occur when a company or group not supported by existing management attempts to acquire the firm. Because the acquirer looks for companies that are poorly managed and undervalued, this threat motivates managers to act in the best interests of the firm's owners.

1-17 Firms incur *agency costs* to prevent or minimize agency problems. It is unclear whether they are effective in practice. The four categories of agency cost are *monitoring expenditures* incurred by the owners for audit and control procedures, *bonding expenditures* to protect against the potential consequences of dishonest acts by managers, *structuring expenditures* that use managerial compensation plans to provide financial incentives for managerial actions consistent with share price maximization, and *opportunity costs* resulting from the difficulties typically encountered by large organizations in responding to new opportunities.

Structuring expenditures are currently the most popular way to deal with the agency problem – and also the most powerful and expensive. Compensation plans can be either incentive or performance plans. *Incentive plans* tie management performance to share price. Managers may receive stock options giving them the right to purchase stock at a set price. This provides the incentive to take actions that maximize stock price so that the price will rise above the option's price level. This form of compensation plan has fallen from favor recently because market behavior, which has a significant effect on share price, is not under management's control. As a result, *performance plans* are more popular today. With these, compensation is based on performance measures, such as earnings per share (EPS), EPS growth, or other return ratios. Managers may receive *performance shares* and/or *cash bonuses* when stated performance goals are reached.

In practice, recent studies have been unable to document any significant correlation between CEO compensation and share price.

1-18 The key participants in financial transactions are *individuals, businesses, and governments*. These parties participate both as suppliers and demanders of funds. Individuals are net suppliers, which means that they save more dollars than they borrow, while both businesses and governments are net demanders since they borrow more than they save. One could say that individuals provide the excess funds required by businesses and governments.

1-19 *Financial markets* provide a forum in which suppliers of funds and demanders of loans and investments can transact business directly.

Primary market is the name used to denote the fact that a security is being issued by the demander of funds to the supplier of funds. An example would be Microsoft Corporation selling new shares of common stock to the public.

Secondary market refers to the trading of securities among investors subsequent to the primary market issuance. In secondary market trading, no new funds are being raised by the demander of funds. The security is trading ownership among investors. An example would be individual “A” buying common stock of Microsoft through a broker.

Financial institutions and financial markets are not independent of each other. It is quite common to find financial institutions actively participating in both the money market and the capital market as both suppliers and demanders of funds. Financial institutions often channel their investments and obtain needed financing through the financial markets. This relationship exists since these institutions must use the structure of the financial marketplace to find a supplier of funds.

- 1-20** The *money market* is a financial relationship between the suppliers and demanders of short-term debt securities maturing in one year or less, such as U.S. Treasury bills, commercial paper, and negotiable certificates of deposit. The money market has no one specific physical location. Typically the suppliers and demanders are matched through the facilities of large banks in New York City and through government securities dealers.
- 1-21** The *Eurocurrency market* is the international equivalent of the U.S. money market and is used for short-term bank time deposits denominated in dollars or other major currencies. These deposits can be lent by the banks to creditworthy corporations, governments, or other banks at the London Interbank Offered Rate (LIBOR) – the base rate used for all Eurocurrency loans.
- 1-22** The *capital market* is a financial relationship created by a number of institutions and arrangements that allows the suppliers and demanders of long-term funds (with maturities greater than one year) to make transactions. The key securities traded in the capital markets are bonds plus common and preferred stock.
- 1-23** Securities exchanges provide a forum for debt and equity transactions. They bring together demanders and suppliers of funds, create a continuous market for securities, allocate scarce capital, determine and publicize security prices, and aid in new financing.
The *over-the-counter market* is not a specific institution, but rather an intangible market for the buyers and sellers of securities not listed on the major exchanges. The dealers are linked with purchasers and sellers through the National Association of Securities Dealers Automated Quotation System (NASDAQ), a complex telecommunications network. Prices of traded securities are determined by both competitive bids and negotiation. The over-the-counter market differs from organized security exchanges in its lack of a physical trading location and the absence of listing and membership requirements.
- 1-24** In addition to the U.S. capital markets, corporations can raise debt and equity funds in capital markets located in other countries. The *Eurobond market* is the oldest and largest international debt market. Corporate and government bonds issued in this market are denominated in dollars or other major currencies and sold to investors outside the country in whose currency the bonds are denominated. Foreign bond markets also provide corporations with the opportunity to tap other capital sources. Corporations or governments issue bonds denominated in the local currency and sold only in that home market. The *international equity market* allows corporations to sell blocks of stock to investors in several countries, providing a diversified investor base and additional opportunities to raise larger amounts of capital.
- 1-25** An *efficient market* will allocate funds to their most productive uses due to competition among wealth-maximizing investors. Investors determine the price of assets through their participation in the financial markets and publicize those prices that are believed to be close to their true value.
- 1-26** The *ordinary income* of a corporation is income earned through the sale of a firm's goods or services. Taxes on corporate ordinary income have two components: a fixed amount on the base figure for its
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income bracket level, plus a progressive percentage, ranging from 15% to 39%, applied to the excess over the base bracket figure. A *capital gain* occurs when a capital asset is sold for more than its initial purchase price. Capital gains are added to ordinary income and taxed at the regular corporate rates. The *average tax rate* is calculated by dividing taxes paid by taxable income. For firms with taxable income of \$10 million or less, it ranges from 15 to 34 percent. For firms with taxable income in excess of \$10 million, it ranges between 34 and 35 percent. The *marginal tax rate* is the rate at which additional income is taxed.

- 1-27** *Intercorporate dividends* are those received by a corporation for stock held in other corporations. To avoid triple taxation, if ownership is less than 20%, these dividends are subject to a 70% exclusion for tax purposes. (The exclusion percentage is higher if ownership exceeds 20%.) Since interest income from intercorporate bond investments is taxed in full, this tax exclusion increases the attractiveness of stock investments over bond investments made by one corporation in another.
- 1-28** The tax deductibility of corporate expenses reduces their actual after-tax cost. Corporate interest is a tax-deductible expense, while dividends are not.
- 1-29** The purpose of a *tax loss carryback* and *carryforward* is to provide a more equitable tax treatment for corporations that are experiencing volatile patterns of income. It is particularly attractive for firms in cyclical businesses such as construction. To illustrate a loss carryback, assume a firm had a positive taxable income in 2000 and 2001 and then experienced a negative taxable income in 2002. The negative amount can first be used to reduce the 2000 taxable income by the amount of the tax loss to as low as zero. If any tax loss from 2002 remains, it can be applied against the 2001 taxable income until the loss is exhausted or 2001 taxable income reaches zero. A tax refund will then be obtained for 2000 and 2001 for the taxes previously paid. Any remaining loss would have to wait for the 2003 tax year to see if it needs to be carried forward.

SOLUTION TO PROBLEMS**1-1 LG 1: Liability Comparisons**

- a. Ms. Harper has unlimited liability.
- b. Ms. Harper has unlimited liability.
- c. Ms. Harper has limited liability, which guarantees that she cannot lose more than she invested.

1-2 LG 2, 4: The Managerial Finance Function and Economic Value Added

a. Benefits from new robotics	\$560,000
Benefits from existing robotics	<u>400,000</u>
Marginal benefits	<u>\$160,000</u>

b. Initial cash investment	\$220,000
Receipt from sale of old robotics	<u>70,000</u>
Marginal cost	<u>\$150,000</u>

c. Marginal benefits	\$160,000
Marginal cost	<u>150,000</u>
Net benefits	<u>\$ 10,000</u>

- d. Ken should recommend that the company replace the old robotics with the new robotics. Since the EVA is positive, the wealth of the shareholders would be increased by accepting the change.
- e. EVA uses profits as the estimate of cost and benefits. Profits ignore the important points of timing, cash flow, and risk, three important factors to determining the true impact on shareholders' wealth.

1-3 LG 2: Annual Income versus Cash Flow for a Period

a. Sales	\$760,000
Cost of good sold	<u>300,000</u>
Net profit	<u>\$460,000</u>

b. Cash Receipts	\$690,000
Cost of good sold	<u>300,000</u>
Net cash flow	<u>\$390,000</u>

- c. The cash flow statement is more useful to the financial manager. The accounting net income includes amounts that will not be collected and, as a result, do not contribute to the wealth of the owners.

1-4 LG 4: Identifying Agency Problems, Costs, and Resolutions

- a. In this case the employee is being compensated for unproductive time. The company has to pay someone to take her place during her absence. Installation of a time clock that must be punched by the receptionist every time she leaves work and returns would result in either: (1) her returning on time or (2) reducing the cost to the firm by reducing her pay for the lost work.
- b. The costs to the firm are in the form of opportunity costs. Money budgeted to cover the inflated costs of this project proposal is not available to fund other projects which may help to increase shareholder wealth. Make the management reward system based on how close the manager's estimates come to the actual cost rather than having them come in below cost.

- c. The manager may negotiate a deal with the merging competitor which is extremely beneficial to the executive and then sell the firm for less than its fair market value. A good way to reduce the loss of shareholder wealth would be to open the firm up for purchase bids from other firms once the manager makes it known that the firm is willing to merge. If the price offered by the competitor is too low, other firms will up the price closer to its fair market value.
- d. Generally part time or temporary workers are not as productive as full-time employees. These workers have not been on the job as long to increase their work efficiency. Also, the better employees generally need to be highly compensated for their skills. This manager is getting rid of the highest cost employees to increase profits. One approach to reducing the problem would be to give the manager performance shares if they meet certain stated goals. Implementing a stock incentive plan tying management compensation to share price would also encourage the manager to retain quality employees.

1-5 LG 6: Corporate Taxes

- a. Firm's tax liability on \$92,500 (from Table 1.4):
- $$\begin{aligned}\text{Total taxes due} &= \$13,750 + [.34 \times (\$92,500 - \$75,000)] \\ &= \$13,750 + (.34 \times \$17,500) \\ &= \$13,750 + \$5,950 \\ &= \$19,700\end{aligned}$$
- b. After-tax earnings: $\$92,500 - \$19,700 = \$72,800$
- c. Average tax rate: $\$19,700 \div \$92,500 = 21.3\%$
- d. Marginal tax rate: 34%

1-6 LG 6: Average Corporate Tax Rates

- a. Tax calculations using Table 1.4:
- \$10,000:** Tax liability: $\$10,000 \times .15 = \$1,500$
 After-tax earnings: $\$10,000 - \$1,500 = \$8,500$
 Average tax rate: $\$1,500 \div \$10,000 = 15\%$
- \$80,000:** Tax liability: $\$13,750 + [.34 \times (\$80,000 - \$75,000)]$
 $\$13,750 + (.34 \times \$5,000)$
 $\$13,750 + \$1,700$
 $\$15,450 = \text{Total tax}$
- After-tax earnings: $\$80,000 - \$15,450 = \$64,550$
 Average tax rate: $\$15,450 \div \$80,000 = 19.3\%$
- \$300,000:** Tax liability: $\$22,250 + [.39 \times (\$300,000 - \$100,000)]$
 $\$22,250 + (.39 \times \$200,000)$
 $\$22,250 + \$78,000$
 $\$100,250 = \text{Total tax}$
- After-tax earnings: $\$300,000 - \$100,250 = \$199,750$
 Average tax rate: $\$100,250 \div \$300,000 = 33.4\%$

\$500,000: Tax liability: $\$113,900 + [.34 \times (\$500,000 - \$335,000)]$ $\$113,900 + (.34 \times \$165,000)$
 $\$113,900 + \$56,100$
 $\$170,000 = \text{Total tax}$

After-tax earnings: $\$500,000 - \$170,000 = \$330,000$

Average tax rate: $\$170,000 \div \$500,000 = 34\%$

\$1,500,000: Tax liability: $\$113,900 + [.34 \times (\$1,500,000 - \$335,000)]$
 $\$113,900 + (.34 \times \$1,165,000)$
 $\$113,900 + \$396,100$
 $\$510,000 = \text{Total tax}$

After-tax earnings: $\$1,500,000 - \$510,000 = \$990,000$

Average tax rate: $\$510,000 \div \$1,500,000 = 34\%$

\$10,000,000: Tax liability: $\$113,900 + [.34 \times (\$10,000,000 - \$335,000)]$
 $\$113,900 + (.34 \times \$9,665,000)$
 $\$113,900 + \$3,286,100$
 $\$3,400,000 = \text{Total tax}$

After-tax earnings: $\$10,000,000 - \$3,400,000 = \$6,600,000$

Average tax rate: $\$3,400,000 \div \$10,000,000 = 34\%$

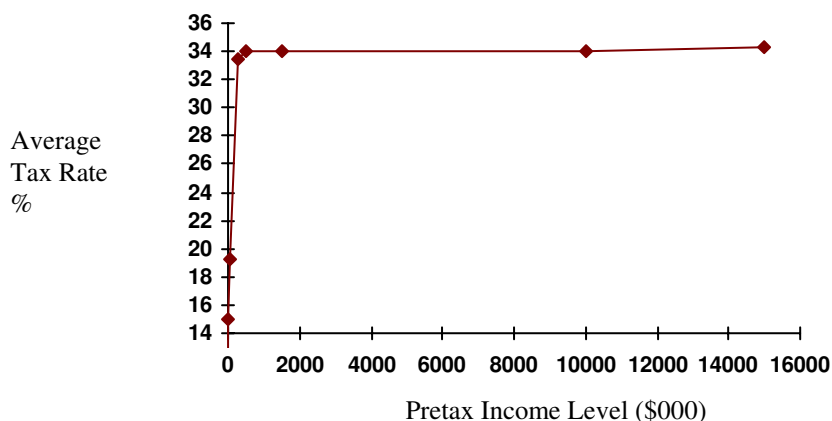
\$15,000,000: Tax liability: $\$3,400,000 + [.34 \times (\$15,000,000 - \$10,000,000)]$
 $\$3,400,000 + (.34 \times \$5,000,000)$
 $\$3,400,000 + \$1,750,000$
 $\$5,150,000 = \text{Total tax}$

After-tax earnings: $\$15,000,000 - \$5,150,000 = \$9,850,000$

Average tax rate: $\$5,150,000 \div \$15,000,000 = 34.33\%$

b.

Average Tax Rate versus Pretax Income



As income increases, the rate approaches but does not reach 35%.

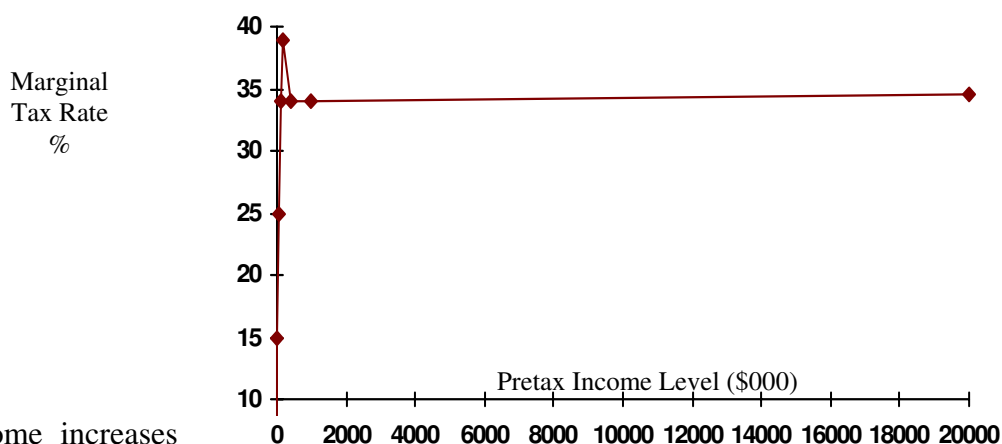
1-7 LG 6: Marginal Corporate Tax Rates

a.

Pretax Income	Tax Calculation						Marginal Rate
	Base Tax	+	%	x	Amount over Base	= Tax	
\$ 15,000	\$ 0	+	(.15	x	15,000)	= \$ 2,250	15.0%
60,000	7,500	+	(.25	x	10,000)	= 10,000	25.0%
90,000	13,750	+	(.34	x	15,000)	= 18,850	34.0%
200,000	22,250	+	(.39	x	100,000)	= 61,250	39.0%
400,000	113,900	+	(.34	x	65,000)	= 136,000	34.0%
1,000,000	113,900	+	(.34	x	665,000)	= 340,000	34.0%
20,000,000	3,400,000	+	(.35	x	10,000,000)	= 6,900,000	35.0%

b.

Marginal Tax Rate versus Pretax Income



As income increases marginal tax rate peaks at 39%. For income in excess of \$335,000, the marginal tax rate declines to 34%, and after \$10 million the marginal rate increases slightly to 35%. to \$335,000, the approaches and income in

1-8 LG 6: Interest versus Dividend Income

a. Tax on operating earnings: $\$490,000 \times .40 \text{ tax rate} = \$196,000$

b. and c.

	(b) <u>Interest Income</u>	(c) <u>Dividend Income</u>
Before-tax amount	\$20,000	\$20,000
Less: Applicable exclusion	0	14,000 (.70 x \$20,000)
Taxable amount	\$20,000	\$ 6,000
Tax (40%)	8,000	2,400
After-tax amount	\$12,000	\$17,600

d. The after-tax amount of dividends received, \$17,600, exceeds the after-tax amount of interest, \$12,000, due to the 70% corporate dividend exclusion. This increases the attractiveness of stock investments by one corporation in another relative to bond investments.

e. Total tax liability:

Taxes on operating earnings (from a.)	\$196,000
+ Taxes on interest income (from b.)	8,000
+ Taxes on dividend income (from c.)	<u>2,400</u>
Total tax liability	<u>\$206,400</u>

1-9 LG 6: Interest versus Dividend Expense

a. EBIT	\$40,000
Less: Interest expense	<u>10,000</u>
Earnings before taxes	\$30,000
Less: Taxes (40%)	<u>12,000</u>
Earnings after taxes*	<u>\$18,000</u>

* This is also earnings available to common stockholders.

b. EBIT	\$40,000
Less: Taxes (40%)	<u>16,000</u>
Earnings after taxes	\$24,000
Less: Preferred dividends	<u>10,000</u>
Earnings available for common stockholders	<u>\$14,000</u>

1-10 LG 6: Capital Gains Taxes

a. Capital gain:

Asset X =	\$2,250	-	\$2,000	=	\$ 250
Asset Y =	\$35,000	-	\$30,000	=	\$5,000

b. Tax on sale of asset:

Asset X =	\$250	x	.40	=	\$ 100
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$$\text{Asset Y} = \$5,000 \times .40 = \$2,000$$

1-11 LG 6: Capital Gains Taxes

a. and b.

Asset	Sale Price (1)	Purchase Price (2)	Capital Gain (1) - (2) (3)	Tax (3) x .40 (4)
A	\$ 3,400	\$ 3,000	\$ 400	\$ 160
B	12,000	12,000	0	0
C	80,000	62,000	18,000	7,200
D	45,000	41,000	4,000	1,600
E	18,000	16,500	1,500	600

CHAPTER 1 CASE

Assessing the Goal of Sports Products, Inc.

- a. Maximization of shareholder wealth, which means maximization of share price, should be the primary goal of the firm. Unlike profit maximization, this goal considers timing, cash flows, and risk. It also reflects the worth of the owners' investment in the firm at any time. It is the value they can realize should they decide to sell their shares.
- b. Yes, there appears to be an agency problem. Although compensation for management is tied to profits, it is not directly linked to share price. In addition, management's actions with regard to pollution controls suggest a profit maximization focus, which would maximize their earnings, rather than an attempt to maximize share price.
- c. The firm's approach to pollution control seems to be questionable ethically. While it is unclear whether their acts were intentional or accidental, it is clear that they are violating the law – an illegal act potentially leading to litigation costs – and as a result are damaging the environment, an immoral and unfair act that has potential negative consequences for society in general. Clearly, Sports Products has not only broken the law but also established poor standards of conduct and moral judgment.
- d. Some specific recommendations for the firm include:
 - Tie management, and possibly employee, compensation to share price or a performance-based measure and make sure that all involved own stock and have a stake in the firm. Being compensated partially on the basis of share price or another performance measure, and owning stock in the firm will more closely link the wealth of managers and employees to the firm's performance.
 - Comply with all federal and state laws as well as accepted standards of conduct or moral judgment.
 - Establish a corporate ethics policy, to be read and signed by all employees.

(Other answers are, of course, possible.)

Lawrence J. Gitman

CHAPTER 2

Financial Statements And Analysis

INSTRUCTOR'S RESOURCES

Overview

This chapter examines the key components to the stockholders' report: the income statement, balance sheet, statement of retained earnings, and the statement of cash flows. On the income statement and balance sheet, the major accounts/balances are reviewed for the student. The rules for consolidating a company's foreign and domestic financial statements (FASB No. 52) are described. Following the financial statement coverage the chapter covers the evaluation of financial statements using the technique of ratio analysis. Ratio analysis is used by prospective shareholders, creditors, and the firm's own management to measure the firm's operating and financial health. Three types of comparative analysis are defined: cross-sectional analysis, time-series analysis, and combined analysis. The ratios are divided into five basic categories: liquidity, activity, debt, profitability, and market. Each ratio is defined and calculated using the financial statements of the Bartlett Company. A brief explanation of the implications of deviation from industry standard ratios is offered, with a complete (cross-sectional and time-series) ratio analysis of Bartlett Company ending the chapter. The Dupont system of analysis is also integrated into the example.

PMF Tutor: Financial Ratios

This section of the Gitman Tutor generates problems to give the student practice calculating liquidity, activity, debt, profitability, and market ratios.

PMF Problem-Solver: Financial Ratios

This module allows the student to compute all the financial ratios described in the text. There are three options: all ratios, families of ratios, and individual ratios.

Principles of Managerial Finance Solution

Lawrence J. Gitman

PMF Templates

Spreadsheet templates are provided for the following problems:

<u>Problem</u>	<u>Topic</u>
Problem 2-4	Calculation of EPS and retained earnings
Problem 2-5	Balance sheet preparation
Problem 2-6	Impact of net income on a firm's balance sheet
Problem 2-8	Statement of retained earnings
Problem 2-15	Debt analysis

Study Guide

Suggested *Study Guide* examples for classroom presentation:

<u>Example</u>	<u>Topic</u>
1	Basic ratio calculation
2	Common-size income statement
3	Evaluating ratios

ANSWERS TO REVIEW QUESTIONS

2-1 The purpose of each of the 4 major financial statements are:

Income Statement - The purpose of the income statement is to provide a financial summary of the firm's operating results during a specified time period. It includes both the sales for the firm and the costs incurred in generating those sales. Other expenses, such as taxes, are also included on this statement.

Balance Sheet – The purpose of the balance sheet is to present a summary of the assets owned by the firm, the liabilities owed by the firm, and the net financial position of the owners as of a given point in time. The assets are often referred to as investments and the liabilities and owners equity as financing.

Statement of Retained Earnings - This statement reconciles the net income earned during the year, and any cash dividends paid, with the change in retained earnings during the year.

Statement of Cash Flows - This statement provides a summary of the cash inflows and the cash outflows experienced by the firm during the period of concern. The inflows and outflows are grouped into the cash flow areas of operations, investment, and financing.

2-2 The notes to the financial statements are important because they provide detailed information not directly available in the financial statements. The footnotes provide information on accounting policies, procedures, calculation, and transactions underlying entries in the financial statements.

2-3 *Financial Accounting Standards Board Statement No. 52* describes the rules for consolidating a company's foreign and domestic financial statements. It requires U.S.-based companies to translate foreign-currency-denominated assets and liabilities into U.S. dollars using the current rate (translation) method. This method uses the exchange rate prevailing on the date the fiscal year ends (the current rate). Income statement items can be translated using either the current rate or an average exchange rate for the period covered by the statement. Equity accounts are converted at the exchange rate on the date of the investment. In the retained earnings account any gains and losses from currency fluctuations are stated separately in an equity reserve account—the *cumulative translation adjustment account*—and not realized until the parent company sells or closes the foreign operations.

2-4 Current and prospective shareholders place primary emphasis on the firm's current and future level of risk and return as measures of profitability, while creditors are more concerned with short-term liquidity measures of debt. Stockholders are, therefore, most interested in income statement measures, and creditors are most concerned with balance sheet measures. Management is concerned with all ratio measures, since they recognize that stockholders and creditors must see good ratios in order to keep the stock price up and raise new funds.

2-5 *Cross-sectional* comparisons are made by comparing similar ratios for firms within the same industry, or to an industry average, as of some point in time. *Time-series* comparisons are made by comparing similar ratios for a firm measured at various points in time. *Benchmarking* is the term used to describe this cross-sectional comparison with competitor firms.

2-6 The analyst should devote primary attention to any significant deviations from the norm, whether above or below. Positive deviations from the norm are not necessarily favorable. An above-normal inventory turnover ratio may indicate highly efficient inventory management but may also reveal excessively low inventory levels resulting in stock outs. Further examination into the deviation would be required.

- 2-7** Comparing financial statements from different points in the year can result in inaccurate and misleading analysis due to the effects of seasonality. Levels of current assets can fluctuate significantly, depending on a company's business, so statements from the same month or year end should be used in the analysis to ensure valid comparisons of performance.
- 2-8** The current ratio proves to be the better liquidity measure when all of the firm's current assets are reasonably liquid. The quick ratios would prove to be the superior measure if the inventory of the firm is considered to lack the ability to be easily converted into cash.
- 2-9** Additional information is necessary to assess how well a firm collects receivables and meets payables. The average collection period of receivables should be compared to a firm's own credit terms. The average payment period should be compared to the creditors' credit terms.
- 2-10** *Financial leverage* is the term used to describe the magnification of risk and return introduced through the use of fixed-cost financing, such as debt and preferred stock.
- 2-11** The debt ratio and the debt-equity ratio may be used to measure the firm's degree of indebtedness. The times-interest-earned and the fixed-payment coverage ratios can be used to assess the firm's ability to meet fixed payments associated with debt.
- 2-12** Three ratios of profitability found on a common-size income statement are: (1) the gross profit margin, (2) the operating profit margin, and (3) the net profit margin.
- 2-13** Firms that have high gross profit margins and low net profit margins have high levels of expenses other than cost of goods sold. In this case, the high expenses more than compensate for the low cost of goods sold (i.e., high gross profit margin) thereby resulting in a low net profit margin.
- 2-14** The owners are probably most interested in the *Return on Equity (ROE)* since it indicates the rate of return they earn on their investment in the firm. ROE is calculated by taking net profits after taxes and dividing by stockholders' equity.
- 2-15** The *price-earnings ratio (P/E)* is the market price per share of common stock divided by the earnings per share. It indicates the amount the investor is willing to pay for each dollar of earnings. It is used to assess the owner's appraisal of the value of the firm's earnings. The level of the P/E ratio indicates the degree of confidence that investors have in the firm's future. The *market/book (M/B)* ratio is the market price per of common stock divided by the firm's book value per share. Firms with high M/B ratios are expected to perform better than firms with lower relative M/B values.
- 2-16** *Liquidity ratios* measure how well the firm can meet its current (short-term) obligations when they come due.

Activity ratios are used to measure the speed with which various accounts are converted (or could be converted) into cash or sales.

Debt ratios measure how much of the firm is financed with other people's money and the firm's ability to meet fixed charges.

Profitability ratios measure a firm's return with respect to sales, assets, or equity (overall performance).

Market ratios give insight into how well investors in the marketplace feel the firm are doing in terms of return and risk.

The liquidity and debt ratios are most important to present and prospective creditors.

- 2-17** The analyst may approach a complete ratio analysis on either a cross-sectional or time-series basis by summarizing the ratios into their five key areas: liquidity, activity, debt, profitability, and market. Each of the key areas could then be summarized, highlighting specific ratios that should be investigated.
- 2-18** The *Dupont system* of analysis combines profitability (the net profit margin), asset efficiency (the total asset turnover) and leverage (the debt ratio). The division of ROE among these three ratios allows the analyst to segregate the specific factors that are contributing to the ROE into profitability, asset efficiency, or the use of debt.

SOLUTIONS TO PROBLEMS**2-1 LG 1: Reviewing Basic Financial Statements**

Income statement: In this one-year summary of the firm's operations, Technica, Inc. showed a net profit for 2003 and the ability to pay cash dividends to its stockholders.

Balance sheet: The financial condition of Technica, Inc. at December 31, 2002 and 2003 is shown as a summary of assets and liabilities. Technica, Inc. has an excess of current assets over current liabilities, demonstrating liquidity. The firm's fixed assets represent over one-half of total assets (\$270,000 of \$408,300). The firm is financed by short-term debt, long-term debt, common stock, and retained earnings. It appears that it repurchased 500 shares of common stock in 2003.

Statement of retained earnings: Technica, Inc. earned a net profit of \$42,900 in 2003 and paid out \$20,000 in cash dividends. The reconciliation of the retained earnings account from \$50,200 to \$73,100 shows the net amount (\$22,900) retained by the firm.

2-2 LG 1: Financial Statement Account Identification

	a.	b.
<u>Account Name</u>	<u>Statement</u>	<u>Type of Account</u>
Accounts payable	BS	CL
Accounts receivable	BS	CA
Accruals	BS	CL
Accumulated depreciation	BS	FA*
Administrative expense	IS	E
Buildings	BS	FA
Cash	BS	CA
Common stock (at par)	BS	SE
Cost of goods sold	IS	E
Depreciation	IS	E
Equipment	BS	FA
General expense	IS	E
Interest expense	IS	E
Inventories	BS	CA
Land	BS	FA
Long-term debt	BS	LTD
Machinery	BS	FA
Marketable securities	BS	CA
Notes payable	BS	CL
Operating expense	IS	E
Paid-in capital in excess of par	BS	SE
	a.	b.
<u>Account Name</u>	<u>Statement</u>	<u>Type of Account</u>
Preferred stock	BS	SE
Preferred stock dividends	IS	E
Retained earnings	BS	SE
Sales revenue	IS	R
Selling expense	IS	E

Taxes	IS	E
Vehicles	BS	FA

* This is really not a fixed asset, but a charge against a fixed asset, better known as a contra-asset.

2-3 LG 1: Income Statement Preparation

a.

Cathy Chen, CPA
Income Statement
for the Year Ended December 31, 2003

Sales revenue		\$180,000
Less: Operating expenses		
Salaries	90,000	
Employment taxes and benefits	17,300	
Supplies	5,200	
Travel & entertainment	8,500	
Lease payment	16,200	
Depreciation expense	<u>7,800</u>	
Total operating expense		<u>145,000</u>
Operating profits		\$ 35,000
Less: Interest expense		<u>7,500</u>
Net profits before taxes		\$ 27,500
Less: Taxes (30%)		<u>8,250</u>
Net profits after taxes		<u>\$ 19,250</u>

- b. In her first year of business, Cathy Chen covered all her operating expenses and earned a net profit of \$19,250 on revenues of \$180,000.

2-4 LG 1: Calculation of EPS and Retained Earnings

a. **Earnings per share:**

Net profit before taxes	\$218,000
Less: Taxes at 40%	<u>87,200</u>
Net profit after tax	\$130,800
Less: Preferred stock dividends	<u>32,000</u>
Earnings available to common stockholders	<u>\$ 98,800</u>

Earnings per share:

$$\frac{\text{Earnings available to common stockholders}}{\text{Total shares outstanding}} = \frac{\$98,800}{85,000} = \$1.162$$

b. **Amount to retained earnings:**

$$85,000 \text{ shares} \times \$0.80 = \$68,000 \text{ common stock dividends}$$

Earnings available to common shareholders	\$98,800
Less: Common stock dividends	<u>68,000</u>

To retained earnings \$30,800

2-5 LG 1: Balance Sheet Preparation

Owen Davis Company Balance Sheet December 31, 2003

Assets

Current assets:

Cash	\$ 215,000
Marketable securities	75,000
Accounts receivable	450,000
Inventories	<u>375,000</u>

Total current assets \$1,115,000

Gross fixed assets

Land and buildings	\$ 325,000
Machinery and equipment	560,000
Furniture and fixtures	170,000
Vehicles	<u>25,000</u>

Total gross fixed assets \$1,080,000

Less: Accumulated depreciation 265,000

Net fixed assets \$ 815,000

Total assets \$1,930,000

Liabilities and stockholders' equity

Current liabilities:

Accounts payable	\$ 220,000
Notes payables	475,000
Accruals	<u>55,000</u>

Total current liabilities \$ 750,000

Long-term debt 420,000

Total liabilities \$1,170,000

Stockholders' equity

Preferred stock	\$ 100,000
Common stock (at par)	90,000
Paid-in capital in excess of par	360,000
Retained earnings	<u>210,000</u>

Total stockholders' equity \$ 760,000

Total liabilities and stockholders' equity \$1,930,000

2-6 LG 1: Impact of Net Income on a Firm's Balance Sheet

	Account	Beginning Value	Change	Ending Value
a.	Marketable securities	\$ 35,000	+ \$1,365,000	\$1,400,000
	Retained earnings	\$1,575,000	+ \$1,365,000	\$2,940,000
b.	Long-term debt	\$2,700,000	- \$ 865,000	\$1,835,000

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	Retained earnings	\$1,575,000	+ \$ 865,000	\$2,440,000
c.	Buildings	\$1,600,000	+ \$ 865,000	\$2,465,000
	Retained earnings	\$1,575,000	+ \$ 865,000	\$2,440,000
d.	No net change in any accounts			

2-7 LG 1: Initial Sale Price of Common Stock

$$\text{Initial sales price} = \frac{(\text{Par value of common stock} + \text{Paid in capital in excess of par})}{\text{Number of common shares outstanding}}$$
$$\text{Initial sales price} = \frac{\$225,000 + \$2,625,000}{300,000} = \$9.50 \text{ per share}$$

2-8 LG 1: Statement of Retained Earnings

$$\begin{aligned}
 \text{a. Cash dividends paid on common stock} &= \text{Net profits after taxes - preferred dividends - change in retained earnings} \\
 &= \$377,000 - \$47,000 - (1,048,000 - \$928,000) \\
 &= \$210,000
 \end{aligned}$$

Hayes Enterprises
Statement of Retained Earnings
for the Year Ended December 31, 2003

Retained earnings balance (January 1, 2003)	\$928,000
Plus: Net profits after taxes (for 2003)	377,000
Less: Cash dividends (paid during 2003)	
Preferred stock	(47,000)
Common stock	<u>(210,000)</u>
Retained earnings (December 31, 2003)	<u>\$1,048,000</u>

$$\text{b. Earnings per share} = \frac{\text{Net profit after tax - Preferred dividends (EACS*)}}{\text{Number of common shares outstanding}}$$

$$\text{Earnings per share} = \frac{\$377,000 - \$47,000}{140,000} = \$2.36$$

* Earnings available to common stockholders

$$\text{c. Cash dividend per share} = \frac{\text{Total cash dividend}}{\text{\# shares}}$$

$$\text{Cash dividend per share} = \frac{\$210,000 \text{ (from part a)}}{140,000} = \$1.50$$

2-9 LG 1: Changes in Stockholders' Equity

$$\begin{aligned}
 \text{a. Net income for 2003} &= \text{change in retained earnings} + \text{dividends paid} \\
 \text{Net income for 2003} &= (\$1,500,000 - \$1,000,000) + \$200,000 = \$700,000
 \end{aligned}$$

$$\begin{aligned}
 \text{b. New shares issued} &= \text{outstanding share 2003} - \text{outstanding shares 2002} \\
 \text{New shares issued} &= 1,500,000 - 500,000 = 1,000,000
 \end{aligned}$$

$$\begin{aligned}
 \text{c. Average issuance price} &= \frac{\Delta \text{Paid-in-capital} + \Delta \text{Common stock}}{\Delta \text{shares outstanding}} \\
 \text{Average issuance price} &= \frac{\$4,000,000 + \$1,000,000}{1,000,000} = \$5.00
 \end{aligned}$$

d.

$$\text{Original issuance price} = \frac{\text{Paid-in-capital} + \text{Common stock}}{\text{Number of shares issued}}$$

$$\text{Original issuance price} = \frac{\$500,000 + \$500,000}{500,000} = \$2.00$$

2-10 LG 2, 3, 4, 5: Ratio Comparisons

- a. The four companies are in very different industries. The operating characteristics of firms across different industries vary significantly resulting in very different ratio values.
- b. The explanation for the lower current and quick ratios most likely rests on the fact that these two industries operate primarily on a cash basis. Their accounts receivable balances are going to be much lower than for the other two companies.
- c. High level of debt can be maintained if the firm has a large, predictable, and steady cash flow. Utilities tend to meet these cash flow requirements. The software firm will have very uncertain and changing cash flow. The software industry is subject to greater competition resulting in more volatile cash flow.
- d. Although the software industry has potentially high profits and investment return performance, it also has a large amount of uncertainty associated with the profits. Also, by placing all of the money in one stock, the benefits of reduced risk associated with diversification are lost.

2-11 LG 3: Liquidity Management

a	<u>2000</u>	<u>2001</u>	<u>2002</u>	<u>2003</u>
Current Ratio	1.88	1.74	1.79	1.55
Quick Ratio	1.22	1.19	1.24	1.14
Net Working Capital	\$7,950	\$9,300	\$9,900	\$9,600

- b. The pattern indicates a deteriorating liquidity position.
- c. The low inventory turnover suggests that liquidity is even worse than the declining liquidity measures indicate. Slow inventory turnover may indicate obsolete inventory.

2-12 LG 3: Inventory Management

a.	Sales	\$4,000,000	100%
	Cost of Goods Sold	?	60%
	Gross Profit	\$1,600,000	40%
	CGS	\$2,400,000	
	Average Inventory	= \$650,000	
	Inventory Turnover	= \$2,400,000 ÷ \$650,000	
	Inventory Turnover	= 3.69 times	
	Average Age of Inventory	= 360 ÷ 3.69	
	Average Age of Inventory	= 97.6 days	

- b. The Wilkins Manufacturing inventory turnover ratio significantly exceeds the industry. Although this may represent efficient inventory management, it may also represent low inventory levels resulting in stockouts.

2-13 LG 3: Accounts Receivable Management

- a. Average Collection Period = Accounts Receivable ÷ Average Sales per Day

$$45 \text{ Days} = \$300,000 \div (\$2,400,000 \div 360)$$

Since the average age of receivables is 15 days beyond the net date, attention should be directed to accounts receivable management.

- b. This may explain the lower turnover and higher average collection period. The December accounts receivable balance of \$300,000 may not be a good measure of the average accounts receivable, thereby causing the calculated average collection period to be overstated. It also suggests the November figure (0-30 days overdue) is not a cause for great concern. However, 13 percent of all accounts receivable (those arising in July, August and September) are sixty days or more overdue and may be a sign of poor receivables management.

2-14 LG 3: Interpreting Liquidity and Activity Ratios

- a. Bluegrass appears to be holding excess inventory relative to the industry. This fact is supported by the low inventory turnover and the low quick ratio, even though the current ratio is above the industry average. This excess inventory could be due to slow sales relative to production or possibly from carrying obsolete inventory.
- b. The accounts receivable of Bluegrass appears to be high due to the large number of days of sales outstanding (73 versus the industry average of 52 days). An important question for internal management is whether the company's credit policy is too lenient or customers are just paying slowly – or potentially not paying at all.
- c. Since the firm is paying its accounts payable in 31 days versus the industry norm of 40 days, Bluegrass may not be taking full advantage of credit terms extended to them by their suppliers. By having the receivables collection period over twice as long as the payables payment period, the firm is financing a significant amount of current assets, possibly from long-term sources.
- d. The desire is that management will be able to curtail the level of inventory either by reducing production or encouraging additional sales through a stronger sales program or discounts. If the inventory is obsolete, then it must be written off to gain the income tax benefit. The firm must also push to try to get their customers to pay earlier. Payment timing can be increased by shortening credit terms or providing a discount for earlier payment. Slowing down the payment of accounts payable would also reduce financing costs.

Carrying out these recommendations may be difficult because of the potential loss of customers due to stricter credit terms. The firm would also not want to increase their costs of purchases by delaying payment beyond any discount period given by their suppliers.

2-15 LG 4: Debt Analysis

Ratio	Definition	Calculation	Creek	Industry
Debt	<u>Debt</u>	<u>\$36,500,000</u>	.73	.51
	Total Assets	\$50,000,000		
Times	<u>EBIT</u>	<u>\$ 3,000,000</u>	3.00	7.30
Interest Earned	Interest	\$ 1,000,000		
Fixed Payment Coverage				
	<u>EBIT + Lease Payment</u>	<u>\$3,000,000 + \$200,000</u>	1.19	1.85
	Interest + Lease Payments	\$1,000,000 + \$200,000 +		
	+ {[(Principal + Preferred Stock	{ [(\$800,000 + \$100,000)]		
	Dividends)] x [1 ÷ (1-t)]}	x [1 ÷ (1-.4)]}		

Because Creek Enterprises has a much higher degree of indebtedness and much lower ability to service debt than the average firm in the industry, the loan should be rejected.

2-16 LG 5: Common-Size Statement Analysis

Creek Enterprises Common-Size Income Statement for the Years Ended December 31, 2002 and 2003

	<u>2003</u>	<u>2002</u>
Sales Revenue	100.0%	100.0%
Less: Cost of goods sold	<u>70.0%</u>	<u>65.9%</u>
Gross profits	30.0%	34.1%
Less: Operating expenses:		
Selling	10.0%	12.7%
General	6.0%	6.3%
Lease expense	.7%	.6%
Depreciation	<u>3.3%</u>	<u>3.6%</u>
Operating profits	10.0%	10.9%
Less: Interest expense	<u>3.3%</u>	<u>1.5%</u>
Net Profits before taxes	6.7%	9.4%
Less: Taxes	<u>2.7%</u>	<u>3.8%</u>
Net profits after taxes	<u>4.0%</u>	<u>5.6%</u>

Sales have declined and cost of goods sold has increased as a percentage of sales, probably due to a loss of productive efficiency. Operating expenses have decreased as a percent of sales; this appears favorable unless this decline has contributed toward the fall in sales. The level of interest as a percentage of sales has increased significantly; this is verified by the high debt measures in problem 2-15 and suggests that the firm has too much debt.

Further analysis should be directed at the increased cost of goods sold and the high debt level.

2-17 LG 4, 5: The Relationship Between Financial leverage and Profitability

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a. (1)

$$\text{Debt ratio} = \frac{\text{total liabilities}}{\text{total assets}}$$

$$\text{Debt ratio}_{\text{Pelican}} = \frac{\$1,000,000}{\$10,000,000} = .10 = 10\%$$

$$\text{Debt ratio}_{\text{Timberland}} = \frac{\$5,000,000}{\$10,000,000} = .50 = 50\%$$

(2)

$$\text{Times interest earned} = \frac{\text{earning before interest and taxes}}{\text{interest}}$$

$$\text{Times interest earned}_{\text{Pelican}} = \frac{\$6,250,000}{\$100,000} = 62.5$$

$$\text{Times interest earned}_{\text{Timberland}} = \frac{\$6,250,000}{\$500,000} = 12.5$$

Timberland has a much higher degree of financial leverage than does Pelican. As a result Timberland's earnings will be more volatile, causing the common stock owners to face greater risk. This additional risk is supported by the significantly lower times interest earned ratio of Timberland. Pelican can face a very large reduction in net income and still be able to cover its interest expense.

b. (1)

$$\text{Operating profit margin} = \frac{\text{operating profit}}{\text{sales}}$$

$$\text{Operating profit margin}_{\text{Pelican}} = \frac{\$6,250,000}{\$25,000,000} = .25 = 25\%$$

$$\text{Operating profit margin}_{\text{Timberland}} = \frac{\$6,250,000}{\$25,000,000} = .25 = 25\%$$

(2)

$$\text{Net profit margin} = \frac{\text{net income}}{\text{sales}}$$

$$\text{Net profit margin}_{\text{Pelican}} = \frac{\$3,690,000}{\$25,000,000} = .1476 = 14.76\%$$

$$\text{Net profit margin}_{\text{Timberland}} = \frac{\$3,450,000}{\$25,000,000} = .138 = 13.80\%$$

(3)

$$\text{Return on assets} = \frac{\text{net profit after taxes}}{\text{total assets}}$$

$$\text{Return on assets}_{\text{Pelican}} = \frac{\$3,690,000}{\$10,000,000} = .369 = 36.9\%$$

$$\text{Return on assets}_{\text{Timberland}} = \frac{\$3,450,000}{\$10,000,000} = .345 = 34.5\%$$

(4)

$$\text{Return on equity} = \frac{\text{net profit after taxes}}{\text{stockholders equity}}$$

$$\text{Return on equity}_{\text{Pelican}} = \frac{\$3,690,000}{\$9,000,000} = .41 = 41.0\%$$

$$\text{Return on equity}_{\text{Timberland}} = \frac{\$3,450,000}{\$5,000,000} = .69 = 69.0\%$$

Pelican is more profitable than Timberland, as shown by the higher operating profit margin, net profit margin, and return on assets. However, the return on equity for Timberland is higher than that of Pelican.

- (c) Even though Pelican is more profitable, Timberland has a higher ROE than Pelican due to the additional financial leverage risk. The lower profits of Timberland are due to the fact that interest expense is deducted from EBIT. Timberland has \$500,000 of interest expense to Pelican's \$100,000. Even after the tax shield from the interest tax deduction (\$500,000 × .40 = \$200,000) Timberland's profits are less than Pelican's by \$240,000. Since Timberland has a higher relative amount of debt, the stockholders' equity is proportionally reduced resulting in the higher return to equity than that obtained by Pelican. The higher ROE is at the expense of higher levels of financial risk faced by Timberland equity holders.

2-18 LG 6: Ratio Proficiency

- a. Gross profit = sales × gross profit margin
Gross profit = \$40,000,000 × .8 = \$32,000,000
- b. Cost of goods sold = sales - gross profit
Cost of goods sold = \$40,000,000 - \$32,000,000 = \$8,000,000
- c. Operating profit = sales × operating profit margin
Operating profit = \$40,000,000 × .35 = \$14,000,000
- d. Operating expenses = gross profit - operating profit
Operating expenses = \$32,000,000 - \$14,000,000 = \$18,000,000
- e.

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Net profit = sales \times net profit margin = \$40,000,000 \times .08 = \$3,200,000

f.

$$\text{Total assets} = \frac{\text{sales}}{\text{total asset turnover}} = \frac{\$40,000,000}{2} = \$20,000,000$$

g.

$$\text{Total equity} = \frac{\text{net income}}{\text{ROE}} = \frac{\$3,200,000}{.20} = \$16,000,000$$

h.

$$\text{Accounts receivable} = \text{average collection period} \times \frac{\text{sales}}{365}$$

$$\text{Accounts receivable} = 62.2 \text{ days} \times \frac{\$40,000,000}{360} = 62.2 \times \$111,111 = \$6,911,104$$

2-19 LG 6: Cross-Sectional Ratio Analysis

a.

Fox Manufacturing Company Ratio Analysis

	Industry Average 2003	Actual 2003
Current ratio	2.35	1.84
Quick ratio	.87	.75
Inventory turnover	4.55 times	5.61 times
Average collection period	35.3 days	20.5 days
Total asset turnover	1.09	1.47
Debt ratio	.30	.55
Times interest earned	12.3	8.0
Gross profit margin	.202	.233
Operating profit margin	.135	.133
Net profit margin	.091	.072
Return on total assets (ROA)	.099	.105
Return on common equity (ROE)	.167	.234
Earnings per share	\$3.10	\$2.15

Liquidity: The current and quick ratios show a weaker position relative to the industry average.

Activity: All activity ratios indicate a faster turnover of assets compared to the industry. Further analysis is necessary to determine whether the firm is in a weaker or stronger position than the industry. A higher inventory turnover ratio may indicate low inventory, resulting in stockouts and lost sales. A shorter average collection period may indicate extremely efficient receivables management, an overly zealous credit department, or credit terms which prohibit growth in sales.

Debt: The firm uses more debt than the average firm, resulting in higher interest obligations which could reduce its ability to meet other financial obligations.

Profitability: The firm has a higher gross profit margin than the industry, indicating either a higher sales price or a lower cost of goods sold. The operating profit margin is in line with the industry, but the net profit margin is lower than industry, an indication that expenses other than cost of goods sold are higher than the industry. Most likely, the damaging factor is high interest expenses due to a greater than average amount of debt. The increased leverage, however, magnifies the return the owners receive, as evidenced by the superior ROE.

- b. Fox Manufacturing Company needs improvement in its liquidity ratios and possibly a reduction in its total liabilities. The firm is more highly leveraged than the average firm in its industry and, therefore, has more financial risk. The profitability of the firm is lower than average but is enhanced by the use of debt in the capital structure, resulting in a superior ROE.

2-20 LG 6: Financial Statement Analysis

a.

Ratio Analysis Zach Industries

	Industry Average	Actual 2002	Actual 2003
Current ratio	1.80	1.84	1.04
Quick ratio	.70	.78	.38
Inventory turnover	2.50	2.59	2.33
Average collection period	37 days	36 days	56 days
Debt ratio	65%	67%	61.3%
Times interest earned	3.8	4.0	2.8
Gross profit margin	38%	40%	34%
Net profit margin	3.5%	3.6%	4.1%
Return on total assets	4.0%	4.0%	4.4%
Return on common equity	9.5%	8.0%	11.3%
Market/book ratio	1.1	1.2	1.3

b.

- (1) **Liquidity:** Zach Industries' liquidity position has deteriorated from 2002 to 2003 and is inferior to the industry average. The firm may not be able to satisfy short-term obligations as they come due.
- (2) **Activity:** Zach Industries' ability to convert assets into cash has deteriorated from 2002 to 2003. Examination into the cause of the 21-day increase in the average collection period is warranted. Inventory turnover has also decreased for the period under review and is fair compared to industry. The firm may be holding slightly excessive inventory.
- (3) **Debt:** Zach Industries' long-term debt position has improved since 2002 and is below average. Zach Industries' ability to service interest payments has deteriorated and is below industry.
- (4) **Profitability:** Although Zach Industries' gross profit margin is below its industry average, indicating high cost of goods sold, the firm has a superior net profit margin in comparison to average. The firm has

lower than average operating expenses. The firm has a superior return on investment and return on equity in comparison to the industry and shows an upward trend.

- (5) **Market:** Zach Industries' increase in their market price relative to their book value per share indicates that the firm's performance has been interpreted as more positive in 2003 than in 2002 and it is a little higher than the industry.

Overall, the firm maintains superior profitability at the risk of illiquidity. Investigation into the management of accounts receivable and inventory is warranted.

2-21 LG 6: Integrative–Complete Ratio Analysis

Ratio Analysis Sterling Company

<u>Ratio</u>	<u>Actual 2001</u>	<u>Actual 2002</u>	<u>Actual 2003</u>	<u>Industry Average 2003</u>	<u>TS: Time-series</u> <u>CS: Cross-sectional</u>
Current ratio	1.40	1.55	1.67	1.85	TS: Improving CS: Fair
Quick ratio	1.00	.92	.88	1.05	TS: Deteriorating CS: Poor
Inventory turnover	9.52	9.21	7.89	8.60	TS: Deteriorating CS: Fair
Average collection period	45.0 days	36.4 days	28.8 days	35 days	TS: Improving CS: Good

<u>Ratio</u>	<u>Actual 2001</u>	<u>Actual 2002</u>	<u>Actual 2003</u>	<u>Industry Average 2003</u>	<u>TS: Time-series</u> <u>CS: Cross-sectional</u>
Average payment period	58.5 days	60.8 days	52.3 days	45.8 days	TS: Unstable CS: Poor
Total asset turnover	0.74	0.80	.83	0.74	TS: Improving CS: Good
Debt ratio	0.20	0.20	0.35	0.30	TS: Increasing CS: Fair
Times interest earned	8.2	7.3	6.5	8.0	TS: Deteriorating CS: Poor
Fixed payment coverage ratio	4.5	4.2	2.7	4.2	TS: Deteriorating CS: Poor
Gross profit margin	0.30	0.27	0.25	0.25	TS: Deteriorating

CS: Good

Operating profit margin	0.12	0.12	0.13	0.10	TS: Improving CS: Good
Net profit margin	0.067	0.067	0.066	0.058	TS: Stable CS: Good
Return on total assets (ROA)	0.049	0.054	0.055	0.043	TS: Improving CS: Good
Return on common Equity (ROE)	0.066	0.073	0.085	0.072	TS: Improving CS: Good
Earnings per share (EPS)	\$1.75	\$2.20	\$3.05	\$1.50	TS: Improving CS: Good
Price/earnings (P/E)	12.0	10.5	9.0	11.2	TS: Deteriorating CS: Poor
Market/book ratio (M/B)	1.20	1.05	1.16	1.10	TS: Deteriorating CS: Good

Liquidity: Sterling Company's overall liquidity as reflected by the current ratio, net working capital, and acid-test ratio appears to have remained relatively stable but is below the industry average.

Activity: The activity of accounts receivable has improved, but inventory turnover has deteriorated and is currently below the industry average. The firm's average payment period appears to have improved from 2001, although the firm is still paying more slowly than the average company.

Debt: The firm's debt ratios have increased from 2001 and are very close to the industry averages, indicating currently acceptable values but an undesirable trend. The firm's fixed payment coverage has declined and is below the industry average figure, indicating a deterioration in servicing ability.

Profitability: The firm's gross profit margin, while in line with the industry average, has declined, probably due to higher cost of goods sold. The operating and net profit margins have been stable and are also in the range of industry averages. Both the return on total assets and return on equity appear to have improved slightly and are better than the industry averages. Earnings per share made a significant increase in 2002 and 2003. The P/E ratio indicates a decreasing degree of investor confidence in the firm's future earnings potential, perhaps due to the increased debt load and higher servicing requirements.

Market: The firm's price to earnings ratio was good in 2001 but has fallen significantly over 2002 and 2003. The ratio is well below industry average. The market to book ratio initially showed signs of weakness in 2002 but recovered some strength in 2003. The markets interpretation of Sterling's earning ability indicates a lot of uncertainty. The fluctuation in the M/B ratio also shows signs of uncertainty.

In summary, the firm needs to attend to inventory and accounts payable and should not incur added debts until its leverage and fixed-charge coverage ratios are improved. Other than these indicators, the firm appears to be doing well—especially in generating return on sales. The market seems to have some lack of confidence in the stability of Sterling's future.

2-22 LG 6: Dupont System of Analysis

a.

2003	Margin(%)	x	Turnover	=	ROA(%)	x	FL Multiple	=	ROE(%)
Johnson	4.9	x	2.34	=	11.47	x	1.85	=	21.21
Industry	4.1	x	2.15	=	8.82	x	1.64	=	14.46

2002

Johnson	5.8	x	2.18	=	12.64	x	1.75	=	22.13
Industry	4.7	x	2.13	=	10.01	x	1.69	=	16.92

2001

Johnson	5.9	x	2.11	=	12.45	x	1.75	=	21.79
Industry	5.4	x	2.05	=	11.07	x	1.67	=	18.49

b. **Profitability:** Industry net profit margins are decreasing; Johnson's net profit margins have fallen less.

Efficiency: Both industry's and Johnson's asset turnover have increased.

Leverage: Only Johnson shows an increase in leverage from 2002 to 2003, while the industry has had less stability. Between 2001 and 2002, leverage for the industry increased, while it decreased between 2002 and 2003.

As a result of these changes, the ROE has fallen for both Johnson and the industry, but Johnson has experienced a much smaller decline in its ROE.

c. Areas which require further analysis are profitability and debt. Since the total asset turnover is increasing and is superior to that of the industry, Johnson is generating an appropriate sales level for the given level of assets. But why is the net profit margin falling for both industry and Johnson? Has there been increased competition causing downward pressure on prices? Is the cost of raw materials, labor, or other expenses rising? A common-size income statement could be useful in determining the cause of the falling net profit margin.

Note: Some management teams attempt to magnify returns through the use of leverage to offset declining margins. This strategy is effective only within a narrow range. A high leverage strategy may actually result in a decline in stock price due to the increased risk.

2-23 LG 6: Complete Ratio Analysis, Recognizing Significant Differences

a.

Home Health, Inc.				
Ratio	2002	2003	Difference	Proportional Difference
Current ratio	3.25	3.00	.25	7.69%
Quick ratio	2.50	2.20	.30	12.00%
Inventory turnover	12.80	10.30	2.50	19.53%
Average collection period	42 days	31 days	11 days	26.19%
Total asset turnover	1.40	2.00	-.60	-42.86%
Debt ratio	.45	.62	-.17	-37.78%
Times interest earned	4.00	3.85	.15	3.75%

Chapter 2 Financial Statements and Analysis

Gross profit margin	68%	65%	3%	4.41%
Operating profit margin	14%	16%	-2%	-14.29%
Net profit margin	8.3%	8.1%	.2%	2.41%
Return on total assets	11.6%	16.2%	-4.6%	-39.65%
Return on common equity	21.1%	42.6%	-21.5%	-101.90%
Price/earnings ratio	10.7	9.8	0.9	8.41%
Market/book ratio	1.40	1.25	0.15	10.71%

b.

Ratio	Proportional Difference	Company's favor
Quick ratio	12.00%	Yes
Inventory turnover	19.53%	No
Average collection period	26.19%	Yes
Total asset turnover	-42.86%	Yes
Debt ratio	-37.78%	No
Operating profit margin	-14.29%	Yes
Return on total assets	-39.65%	Yes
Return on equity	-101.90%	Yes
Market/book ratio	10.71	Yes

- c.** The most obvious relationship is associated with the increase in the Return on equity value. The increase in this ratio is connected with the increase in the Return on assets. The higher return on assets is partially attributed to the higher Total asset turnover (as reflected in the DuPont model). The Return on equity increase is also associated with the slightly higher level of debt as captured by the higher debt ratio.

Chapter 2 Case**Assessing Martin Manufacturing's Current Financial Position**

Martin Manufacturing Company is an integrative case study addressing financial analysis techniques. The company is a capital-intensive firm which has poor management of accounts receivable and inventory. The industry average inventory turnover can fluctuate from 10 to 100 depending on the market.

a. Ratio Calculations

Financial Ratio	2003
Current ratio	$\$1,531,181 \div \$616,000 = 2.5$
Quick ratio	$(\$1,531,181 - \$700,625) \div \$616,000 = 1.3$
Inventory turnover (times)	$\$3,704,000 \div \$700,625 = 5.3$
Average collection period (days)	$\$805,556 \div (\$5,075,000 \div 360) = 57$
Total asset turnover (times)	$\$5,075,000 \div \$3,125,000 = 1.6$
Debt ratio	$\$1,781,250 \div \$3,125,000 = 57\%$
Times interest earned	$\$153,000 \div \$93,000 = 1.6$
Gross profit margin	$\$1,371,000 \div \$5,075,000 = 27\%$
Net profit margin	$\$36,000 \div \$5,075,000 = 0.71\%$
Return on total assets	$\$36,000 \div \$3,125,000 = 1.2\%$
Return on equity	$\$36,000 \div \$1,343,750 = 2.7\%$

Historical Ratios
Martin Manufacturing Company

Ratio	Actual 2001	Actual 2002	Actual 2003	Industry Average
Current ratio	1.7	1.8	2.5	1.5
Quick ratio	1.0	0.9	1.3	1.2
Inventory turnover (times)	5.2	5.0	5.3	10.2
Average collection period (days)	50	55	57	46
Total asset turnover (times)	1.5	1.5	1.6	2.0
Debt ratio	45.8%	54.3%	57%	24.5%
Times interest earned	2.2	1.9	1.6	2.5
Gross profit margin	27.5%	28.0%	27.0%	26.0%
Net profit margin	1.1%	1.0%	0.71%	1.2%
Return on total assets	1.7%	1.5%	1.2%	2.4%
Return on equity	3.1%	3.3%	2.7%	3.2%
Price/earnings ratio	33.5	38.7	34.48	43.4
Market/book	1.0	1.1	0.89	1.2

- b. Liquidity:** The firm has sufficient current assets to cover current liabilities. The trend is upward and is much higher than the industry average. This is an unfavorable position, since it indicates too much inventory.

Activity: The inventory turnover is stable but much lower than the industry average. This indicates the firm is holding too much inventory. The average collection period is increasing and much higher than the industry average. These are both indicators of a problem in collecting payment.

The fixed asset turnover ratio and the total asset turnover ratios are stable but significantly lower than the industry average. This indicates that the sales volume is not sufficient for the amount of committed assets.

Debt: The debt ratio has increased and is substantially higher than the industry average. This places the company at high risk. Typically industries with heavy capital investment and higher operating risk try to minimize financial risk. Martin Manufacturing has positioned itself with both heavy operating and financial risk. The times-interest-earned ratio also indicates a potential debt service problem. The ratio is decreasing and is far below the industry average.

Profitability: The gross profit margin is stable and quite favorable when compared to the industry average. The net profit margin, however, is deteriorating and far below the industry average. When the gross profit margin is within expectations but the net profit margin is too low, high interest payments may be to blame. The high financial leverage has caused the low profitability.

Market: The market price of the firm's common stock shows weakness relative to both earnings and book value. This result indicates a belief by the market that Martin's ability to earn future profits faces more and increasing uncertainty as perceived by the market.

- c.** Martin Manufacturing clearly has a problem with its inventory level, and sales are not at an appropriate level for its capital investment. As a consequence, the firm has acquired a substantial amount of debt which, due to the high interest payments associated with the large debt burden, is depressing profitability. These problems are being picked up by investors as shown in their weak market ratios.

Principles of Managerial Finance Solution

Lawrence J. Gitman

CHAPTER 3

Cash Flow and Financial Planning

INSTRUCTOR'S RESOURCES

Overview

This chapter introduces the student to the financial planning process, with the emphasis on short-term (operating) financial planning and its two key components: cash planning and profit planning. Cash planning requires preparation of the cash budget, while profit planning involves preparation of a pro forma income statement and balance sheet. The text illustrates through example how these budgets and statements are developed. The weaknesses of the simplified approaches (judgmental and percent-of-sales methods) of pro forma statement preparation are outlined. The distinction between Operating cash flow and Free cash flow is presented and discussed. Current tax law regarding the depreciation of assets and the effect on cash flow are also described. The firm's cash flow is analyzed through classification of sources and uses of cash. The student is guided in a step-by-step preparation of the statement of cash flows and the interpretation of this statement.

PMF DISK

This chapter's topics are not covered on the *PMF Tutor*, *PMF Problem-Solver*, or the *PMF Templates*.

Study Guide

Suggested *Study Guide* examples for classroom presentation:

<u>Example</u>	<u>Topic</u>
1	Cash budgets
3	Pro forma financial statements

ANSWERS TO REVIEW QUESTIONS

- 3-1** The first four classes of property specified by the MACRS system are categorized by the length of the depreciation (recovery) period are called 3-, 5-, 7-, and 10-year property:

Recovery

Period	Definition
3 years	Research and experiment equipment and certain special tools.
5 years	Computers, typewriters, copiers, duplicating equipment, cars, light duty trucks, qualified technological equipment, and similar assets.
7 years	Office furniture, fixtures, most manufacturing equipment, railroad track, and single-purpose agricultural and horticultural structures.
10 years	Equipment used in petroleum refining or in the manufacture of tobacco products and certain food products.

The depreciation percentages are determined by the double-declining balance (200%) method using the half-year convention and switching to straight-line depreciation when advantageous.

- 3-2** *Operating flows* relate to the firm's production cycle—from the purchase of raw materials to the finished product. Any expenses incurred directly related to this process are considered operating flows.

Investment flows result from the purchases and sales of fixed assets and business interests.

Financing flows result from borrowing and repayment of debt obligations and from equity transactions such as the sale or purchase of stock and dividend payments.

- 3-3** A decrease in the cash balance is a *source* of cash flow because cash flow must have been released for some purpose, such as an increase in inventory. Similarly, an increase in the cash balance is a *use* of cash flow, since the cash must have been drawn from some source of cash flow. The increase in cash is an investment (use) of cash in an asset.

- 3-4** Depreciation (and amortization and depletion) is a cash inflow to the firm since it is treated as a non-cash expenditure from the income statement. This reduces the firm's cash outflows for tax purposes. Cash flow from operations can be found by adding depreciation and other non-cash charges back to profits after taxes. Since depreciation is deducted for tax purposes but does not actually require any cash outlay, it must be added back in order to get a true picture of operating cash flows.

- 3-5** Cash flows shown in the statement of cash flows are divided into three categories and presented in the order of: 1. cash flow from operations, 2. cash flow from investments, and 3. cash flow from financing. Traditionally cash outflows are shown in brackets to distinguish them from cash inflows.

- 3-6** *Operating cash flow* is the cash flow generated from a firm's normal operations of producing and selling its output of goods and services. *Free cash flow* is the amount of cash flow available to both debt and equity investors after the firm has met its operating and asset investment needs.

- 3-7** The *financial planning process* is the development of long-term strategic financial plans that guide the preparation of short-term operating plans and budgets. *Long-term (strategic) financial plans* anticipate the financial impact of planned long-term actions (periods ranging from two to ten years). *Short-term*

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(operating) financial plans anticipate the financial impact of short-term actions (periods generally less than two years).

- 3-8** Three key statements resulting from short-term financial planning are 1) the cash budget, 2) the pro forma income statement, and 3) the pro forma balance sheet.
- 3-9** The *cash budget* is a statement of the firm's planned cash inflows and outflows. It is used to estimate its short-term cash requirements. The sales forecast is the key variable in preparation of the cash budget. Significant effort should be expended in deriving a sales figure.
- 3-10** The basic format of the cash budget is presented in the table below.

Cash Budget Format

	Jan.	Feb.	...	Nov.	Dec.
Cash receipts	\$xx	\$xx		\$xx	\$xx
Less: Cash disbursements	<u>xx</u>	<u>xx</u>	...	<u>xx</u>	<u>xx</u>
Net cash flow	xx	xx		xx	xx
Add: Beginning cash	<u>xx</u>	<u>xx</u>	...	<u>xx</u>	<u>xx</u>
Ending cash	xx	xx		xx	xx
Less: Minimum cash balance	<u>xx</u>	<u>xx</u>	...	<u>xx</u>	<u>xx</u>
Required total financing (Notes payable)	\$xx				
Excess cash balance (Marketable securities)		\$xx			

The components of the cash budget are defined as follows:

Cash receipts - the total of all items from which cash inflows result in any given month. The most common components of cash receipts are cash sales, collections of accounts receivable, and other cash received from sources other than sales (dividends and interest received, asset sales, etc.).

Cash disbursements - all outlays of cash in the periods covered. The most common cash disbursements are cash purchases, payments of accounts payable, payments of cash dividends, rent and lease payments, wages and salaries, tax payments, fixed asset outlays, interest payments, principal payments (loans), and repurchases or retirement of stock.

Net cash flow - found by subtracting the cash disbursements from cash receipts in each month.

Ending cash - the sum of beginning cash and net cash flow.

Required total financing - the result of subtracting the minimum cash balance from ending cash and obtaining a negative balance. Usually financed with notes payable.

Excess cash - the result of subtracting the minimum cash balance from ending cash and obtaining a positive balance. Usually invested in marketable securities.

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- 3-11** The ending cash without financing, along with any required minimum cash balance, can be used to determine if additional cash is needed or excess cash will result. If the ending cash is less than the minimum cash balance, additional financing must be arranged; if the ending cash is greater than the minimum cash balance, investment of the surplus should be planned.
- 3-12** Uncertainty in the cash budget is due to the uncertainty of ending cash values, which are based on forecasted values. This may cause a manager to request or arrange to borrow more than the maximum financing indicated. One technique used to cope with this uncertainty is *sensitivity analysis*. This involves preparing several cash budgets, based on different assumptions: a pessimistic forecast, a most likely forecast, and an optimistic forecast. A more sophisticated technique is to use *computer simulation*.
- 3-13** *Pro forma statements* are used to provide a basis for analyzing future profitability and overall financial performance as well as predict external financing requirements. The *sales forecast* is the first statement prepared, since projected sales figures are the driving force behind the development of all other statements. The firm's latest actual balance sheet and income statement are needed as the base year for preparing pro forma statements.
- 3-14** In the *percent-of-sales method* for preparing a pro forma income statement, the financial manager begins with sales forecasts and uses values for cost of goods sold, operating expenses, and interest expense that are expressed as a percentage of projected sales. This technique assumes all costs to be variable. The weakness of this approach is that net profit may be overstated for firms with high fixed costs and understated for firms with low fixed costs. The strength of this approach is ease of calculation.
- 3-15** Due to the effect of leverage, ignoring fixed costs tends to understate profits when sales are rising and overstate them when sales are falling. To avoid this problem, the analyst should divide the expense portion of the pro forma income statement into fixed and variable components.
- 3-16** The *judgmental approach* is used to develop the pro forma balance sheet by estimating some balance sheet accounts while calculating others. This method assumes that values of variables such as cash, accounts receivable, and inventory can be forced to take on certain values rather than occur as a natural flow of business transactions.
- 3-17** The balancing, or "plug," figure used in the pro forma balance sheet prepared with the judgmental approach is the amount of financing necessary to bring this statement into balance. Sometimes an analyst wishing to estimate a firm's long-term borrowing requirement will forecast the balance sheet and let this "plug" figure represent the firm's estimated external funds required.
- A positive external funds required figure means the firm must raise funds externally to meet its operating needs. Once it determines whether to use debt or equity, its pro forma balance sheet can be adjusted to reflect the planned financing strategy. If the figure is negative, the firm's forecast shows that its financing is greater than its requirements. Surplus funds can be used to repay debt, repurchase stock, or increase dividends. The pro forma balance sheet would be modified to show the planned changes.
- 3-18** Simplified approaches to preparing pro forma statements have two basic weaknesses: 1) the assumption that the firm's past financial condition is an accurate predictor of its future and 2) the assumption that the values of certain variables can be forced to take on desired values. The approaches remain popular due to ease of calculation.

- 3-19** The financial manager may perform ratio analysis and may possibly prepare source and use statements from pro forma statements. He treats the pro forma statements as if they were actual statements in order to evaluate various aspects of the firm's financial health—liquidity, activity, debt, and profitability—expected at the end of the future period. The resulting information is used to adjust planned operations to achieve short-term financial goals. Of course, the manager reviews and may question various assumptions and values used in forecasting these statements.

SOLUTIONS TO PROBLEMS**3-1 LG 1: Depreciation**

Depreciation Schedule			
Year	Cost (1)	Percentages from Table 3.2 (2)	Depreciation [(1) x (2)] (3)
Asset A			
1	\$17,000	33%	\$5,610
2	\$17,000	45	7,650
3	\$17,000	15	2,550
4	\$17,000	7	1,190

Depreciation Schedule			
Year	Cost (1)	Percentages from Table 3.2 (2)	Depreciation [(1) x (2)] (3)
Asset B			
1	\$45,000	20%	\$ 9,000
2	\$45,000	32	14,400
3	\$45,000	19	8,550
4	\$45,000	12	5,400
5	\$45,000	12	5,400
6	\$45,000	5	2,250

3-2 LG 2: Accounting Cash flow

Earnings after taxes	\$50,000
Plus: Depreciation	28,000
Plus: Amortization	<u>2,000</u>
Cash flow from operations	<u>\$80,000</u>

3-3 LG 1, 2: MACRS Depreciation Expense, Taxes, and Cash Flow

- a. From table 3.2
Depreciation expense = $\$80,000 \times .20 = \$16,000$
- b. New taxable income = $\$430,000 - \$16,000 = \$414,000$
Tax liability = $\$113,900 + [(\$414,000 - \$335,000) \times .34] = \$113,900 + \$26,860$
= $\$140,760$

Original tax liability before depreciation expense:

$$\text{Tax liability} = \$113,900 + [(\$430,000 - \$335,000) \times .34] = \$113,900 + \$32,300 = \$146,200$$

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Tax savings = \$146,200 - \$140,760 = \$5,440

c.	After-tax net income	\$289,240 (\$430,000 - \$140,760)
	Plus depreciation expense	<u>16,000</u>
	Net cash flow	<u>\$305,240</u>

3-4 LG 1, 2: Depreciation and Accounting Cash Flow

a.	Cash flow from operations:	
	Sales revenue	\$400,000
	Less: Total costs before depreciation,	
	interest, and taxes	290,000
	Depreciation expense	34,200
	Interest expense	<u>15,000</u>
	Net profits before taxes	\$ 60,800
	Less: Taxes at 40%	<u>24,320</u>
	Net profits after taxes	\$ 36,480
	Plus: Depreciation	<u>34,200</u>
	Cash flow from operations	<u>\$ 70,680</u>
b.	Depreciation and other no cash charges serve as a tax shield against income, increasing annual cash flow.	

3-5 LG 2: Classifying Inflows and Outflows of Cash

Item	Change (\$)	I/O	Item	Change (\$)	I/O
Cash	+ 100	<u>O</u>	Accounts receivable	-700	<u>I</u>
Accounts payable	-1,000	<u>O</u>	Net profits	+ 600	<u>I</u>
Notes payable	+ 500	<u>I</u>	Depreciation	+ 100	<u>I</u>
Long-term debt	-2,000	<u>O</u>	Repurchase of stock	+ 600	<u>O</u>
Inventory	+ 200	<u>O</u>	Cash dividends	+ 800	<u>O</u>
Fixed assets	+ 400	<u>O</u>	Sale of stock	+1,000	<u>I</u>

3-6 LG 2: Finding Operating and Free Cash Flows

- a. Cash flow from operations = Net profits after taxes + Depreciation
Cash flow from operations = \$1,400 + 11,600
Cash flow from operations = \$13,000
- b. OCF = EBIT – Taxes + Depreciation
OCF = \$2,700 – \$933 + \$11,600
OCF = \$13,367
- c. FCF = OCF – Net fixed asset investment* – Net current asset investment**
FCF = \$13,367 - \$1,400 - \$1,400
FCF = \$10,567

* Net fixed asset investment = Change in net fixed assets + Depreciation
Net fixed asset investment = (\$14,800 - \$15,000) + (\$14,700 - \$13,100)

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Net fixed asset investment = $-\$200 + \$1,600 = \$1,400$

** Net current asset investment = Change in current assets – change in (accounts payable and accruals)

Net current asset investment = $(\$8,200 - \$6,800) - (\$1,800 - \$1,800)$

Net current asset investment = $\$1,400 - 0 = \$1,400$

- d. Keith Corporation has significant positive cash flows from operating activities. The accounting cash flows are a little less than the operating and free cash flows. The FCF value is very meaningful since it shows that the cash flows from operations are adequate to cover both operating expense plus investment in fixed and current assets.

3-7 LG 4: Cash Receipts

	April	May	June	July	August
Sales	\$ 65,000	\$ 60,000	\$ 70,000	\$100,000	\$100,000
Cash sales (.50)	\$ 32,500	\$ 30,000	\$ 35,000	\$ 50,000	\$ 50,000
Collections:					
Lag 1 month (.25)		16,250	15,000	17,500	25,000
Lag 2 months (.25)			<u>16,250</u>	<u>15,000</u>	<u>17,500</u>
Total cash receipts			\$ 66,250	\$ 82,500	\$ 92,500

3-8 LG 4: Cash Disbursement Schedule

	February	March	April	May	June	July
Sales	\$500,000	\$500,000	\$560,000	\$610,000	\$650,000	\$650,000
Disbursements						
Purchases (.60)	\$300,000	\$336,000	\$366,000	\$390,000	\$390,000	
Cash			36,600	39,000	39,000	
1 month delay						
(.50)			168,000	183,000	195,000	
2 month delay						
(.40)			120,000	134,400	146,400	
Rent			8,000	8,000	8,000	
Wages & salary						
Fixed			6,000	6,000	6,000	
Variable			39,200	42,700	45,500	
Taxes					54,500	
Fixed assets			75,000			
Interest					30,000	
Cash dividends			12,500			
Total						
Disbursements			\$465,300	\$413,100	\$524,400	

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3-9 LG 4: Cash Budget–Basic

	March	April	May	June	July
Sales	\$50,000	\$60,000	\$70,000	\$80,000	\$100,000
Cash sales (.20)	\$10,000	\$12,000	\$14,000	\$16,000	\$ 20,000
Lag 1 month (.60)			36,000	42,000	48,000
Lag 2 months (.20)			10,000	12,000	14,000
Other income			<u>2,000</u>	<u>2,000</u>	<u>2,000</u>
Total cash receipts			\$62,000	\$72,000	\$ 84,000
<u>Disbursements</u>					
Purchases			\$50,000	\$70,000	\$80,000
Rent			3,000	3,000	3,000
Wages & salaries			6,000	7,000	8,000
Dividends				3,000	
Principal & interest				4,000	
Purchase of new equipment					6,000
Taxes due				<u>6,000</u>	
Total cash disbursements			\$59,000	\$93,000	\$97,000
Total cash receipts			\$62,000	\$72,000	\$84,000
Total cash disbursements			<u>59,000</u>	<u>93,000</u>	<u>97,000</u>
Net cash flow			\$ 3,000	(\$21,000)	(\$13,000)
Add: Beginning cash			<u>5,000</u>	<u>8,000</u>	<u>(13,000)</u>
Ending cash			\$ 8,000	(\$13,000)	(\$26,000)
Minimum cash			<u>5,000</u>	<u>5,000</u>	<u>5,000</u>
Required total financing (Notes Payable)				\$18,000	\$31,000
Excess cash balance (Marketable Securities)			\$ 3,000	-0-	-0-

The firm should establish a credit line of at least \$31,000.

3-10 LG 4: Cash Budget–Advanced

a. Xenocore, Inc.
(\$000)

Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.
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Chapter 3 Cash Flow and Financial Planning

Forecast Sales	\$210	\$250	\$170	\$160	\$140	\$180	\$200	\$250
Cash sales (.20)			\$ 34	\$ 32	\$ 28	\$ 36	\$ 40	\$ 50
Collections								
Lag 1 month (.40)			100	68	64	56	72	80
Lag 2 months (.40)			84	100	68	64	56	72
Other cash receipts					15	27	15	12
Total cash receipts			\$218	\$200	\$175	\$183	\$183	\$214

Forecast Purchases	\$120	\$150	\$140	\$100	\$ 80	\$110	\$100	\$ 90
Cash purchases			\$ 14	\$ 10	\$ 8	\$ 11	\$ 10	\$ 9
Payments								
Lag 1 month (.50)			75	70	50	40	55	50
Lag 2 months (.40)			48	60	56	40	32	44
Salaries & wages			50	34	32	28	36	40
Rent			20	20	20	20	20	20
Interest payments					10			10
Principal payments								30
Dividends					20			20
Taxes								80
Purchases of fixed assets				25				
Total cash disbursements			\$207	\$219	\$196	\$139	\$153	\$303

Total cash receipts	\$218	\$200	\$175	\$183	\$183	\$214
Less: Total cash disbursements	207	219	196	139	153	303
Net cash flow	11	(19)	(21)	44	30	(89)
Add: Beginning cash	22	33	14	(7)	37	67
Ending cash	33	14	(7)	37	67	(22)
Less: Minimum cash balance	15	15	15	15	15	15

b. Required total financing (Notes payable)		1	22			37
Excess cash balance (Marketable securities)	18			22	52	

- c.** The line of credit should be at least \$37,000 to cover the maximum borrowing needs for the month of April.

3-11 LG 4: Cash Flow Concepts

Note to instructor: There are a variety of possible answers to this problem, depending on the assumptions the student might make. The purpose of this question is to have a chance to discuss the difference between cash flows, income, and assets.

Transaction	Cash Budget	Pro Forma Income Statement	Pro Forma Balance Sheet
Cash sale	x	x	x

Chapter 3 Cash Flow and Financial Planning

Credit sale	x	x	x
Accounts receivable are collected	x		x
Asset with a five-year life is purchased	x		x
Depreciation is taken		x	x
Amortization of goodwill is taken		x	x
Sale of common stock	x		x
Retirement of outstanding bonds	x		x
Fire insurance premium is paid for the next three years	x		x

3-12 LG 4: Cash Budget–Sensitivity Analysis

a.

Trotter Enterprises, Inc. Multiple Cash Budgets (\$000)

	October			November			December		
	Pessi- mistic	Most Likely	Opti- mistic	Pessi- mistic	Most Likely	Opti- mistic	Pessi- mistic	Most Likely	Opti- mistic
Total cash receipts	\$260	\$342	\$462	\$200	\$287	\$366	\$191	\$294	\$353
Total cash disbursements	285	326	421	203	261	313	287	332	315
Net cash flow	(15)	16	41	(3)	26	53	(96)	(38)	38
Add:									
Beginning cash	(20)	(20)	(20)	(35)	(4)	21	(38)	22	74
Ending cash:	(35)	(4)	21	(38)	22	74	(134)	(16)	112
Financing	53	22		56			152	34	
	\$18	\$18	\$21	\$18	\$22	\$74	\$18	\$18	\$112

- b. Under the pessimistic scenario Trotter will definitely have to borrow funds, up to \$152,000 in December. Their needs are much smaller under their most likely outcome. If events turn out to be consistent with their optimistic forecast, the firm should have excess funds and will not need to access the financial markets.

3-13 LG 4: Multiple Cash Budgets–Sensitivity Analysis

a. and b.

Chapter 3 Cash Flow and Financial Planning

Brownstein, Inc. Multiple Cash Budgets (\$000)

	<u>1st Month</u>			<u>2nd Month</u>			<u>3rd Month</u>		
	Pessi- mistic	Most Likely	Opti- mistic	Pessi- mistic	Most Likely	Opti- mistic	Pessi- mistic	Most Likely	Opti- mistic
Sales	\$ 80	\$ 100	\$ 120	\$ 80	\$ 100	\$ 120	\$ 80	\$ 100	\$ 120
Sale of asset							8	8	8
Purchases	(60)	(60)	(60)	(60)	(60)	(60)	(60)	(60)	(60)
Wages	(14)	(15)	(16)	(14)	(15)	(16)	(14)	(15)	(16)
Taxes	(20)	(20)	(20)						
Purchase of fixed asset				(15)	(15)	(15)			
Net cash flow	\$(14)	\$ 5	\$ 24	\$(9)	\$ 10	\$ 29	\$ 14	\$ 33	\$ 52
Add:									
Beginning cash	0	0	0	(14)	5	24	(23)	15	53
Ending cash:	\$(14)	\$ 5	\$ 24	\$(23)	\$ 15	\$ 53	\$ (9)	\$ 48	\$ 105

- c. Considering the extreme values reflected in the pessimistic and optimistic outcomes allows Brownstein, Inc. to better plan its borrowing or investment requirements by preparing for the worst case scenario.

3-14 LG 5: Pro Forma Income Statement

a.

Pro Forma Income Statement Metro line Manufacturing, Inc. For the Year Ended December 31, 2004 (percent-of-sales method)

Sales	\$1,500,000
Less: Cost of goods sold (.65 x sales)	<u>975,000</u>
Gross profits	\$ 525,000
Less: Operating expenses (.086 x sales)	<u>129,000</u>
Operating profits	\$ 396,000
Less: Interest expense	<u>35,000</u>

Chapter 3 Cash Flow and Financial Planning

Net profits before taxes	\$ 361,000
Less: Taxes (.40 x NPBT)	<u>144,400</u>
Net profits after taxes	\$ 216,600
Less: Cash dividends	<u>70,000</u>
To retained earnings	<u>\$ 146,600</u>

b.

Pro Forma Income Statement
 Metroline Manufacturing, Inc.
 for the Year Ended December 31, 2004
 (based on fixed and variable cost data)

Sales	\$1,500,000
Less: Cost of goods sold	
Fixed cost	210,000
Variable cost (.50 x sales)	<u>750,000</u>
Gross profits	\$ 540,000
Less: Operating expense:	
Fixed expense	36,000
Variable expense (.06 x sales)	<u>90,000</u>
Operating profits	\$ 414,000
Less: Interest expense	<u>35,000</u>
Net profits before taxes	\$ 379,000
Less: Taxes (.40 x NPBT)	<u>151,600</u>
Net profits after taxes	\$ 227,400
Less: Cash dividends	<u>70,000</u>
To retained earnings	<u>\$ 157,400</u>

- c.** The pro forma income statement developed using the fixed and variable cost data projects a higher net profit after taxes due to lower cost of goods sold and operating expenses. Although the percent-of-sales method projects a more conservative estimate of net profit after taxes, the pro forma income statement which classifies fixed and variable cost is more accurate.

3-15 LG 5: Pro Forma Income Statement–Sensitivity Analysis**a.**

Pro Forma Income Statement
 Allen Products, Inc.
 for the Year Ended December 31, 2004

	<u>Pessimistic</u>	<u>Most Likely</u>	<u>Optimistic</u>
Sales	\$900,000	\$1,125,000	\$1,280,000
Less cost of goods sold (45%)	<u>405,000</u>	<u>506,250</u>	<u>576,000</u>
Gross profits	\$495,000	\$ 618,750	\$ 704,000
Less operating expense (25%)	<u>225,000</u>	<u>281,250</u>	<u>320,000</u>
Operating profits	\$270,000	\$ 337,500	\$ 384,000
Less interest expense (3.2%)	<u>28,800</u>	<u>36,000</u>	<u>40,960</u>
Net profit before taxes	\$241,200	\$ 301,500	\$ 343,040
Taxes (25%)	<u>60,300</u>	<u>75,375</u>	<u>85,760</u>
Net profits after taxes	<u>\$180,900</u>	<u>\$ 226,125</u>	<u>\$ 257,280</u>

Chapter 3 Cash Flow and Financial Planning

- b.** The simple percent-of-sales method assumes that all cost are variable. In reality some of the expenses will be fixed. In the pessimistic case this assumption causes all costs to decrease with the lower level of sales when in reality the fixed portion of the costs will not decrease. The opposite occurs for the optimistic forecast since the percent-of-sales assumes all costs increase when in reality only the variable portion will increase. This pattern results in an understatement of costs in the pessimistic case and an overstatement of profits. The opposite occurs in the optimistic scenario.

c.

Pro Forma Income Statement
Allen Products, Inc.
for the Year Ended December 31, 2004

	<u>Pessimistic</u>	<u>Most Likely</u>	<u>Optimistic</u>
Sales	\$900,000	\$1,125,000	\$1,280,000
Less cost of goods sold:			
Fixed	250,000	250,000	250,000
Variable (18.3%)	<u>164,700</u>	<u>205,875</u>	<u>234,240</u>
Gross profits	\$485,300	\$ 669,125	\$ 795,760
Less operating expense			
Fixed	180,000	180,000	180,000
Variable (5.8%)	<u>52,200</u>	<u>65,250</u>	<u>74,240</u>
Operating profits	\$253,100	\$ 423,875	\$ 541,520
Less interest expense	<u>30,000</u>	<u>30,000</u>	<u>30,000</u>
Net profit before taxes	\$223,100	\$ 393,875	\$ 511,520
Taxes (25%)	<u>55,775</u>	<u>98,469</u>	<u>127,880</u>
Net profits after taxes	<u>\$167,325</u>	<u>\$ 295,406</u>	<u>\$ 383,640</u>

- d.** The profits for the pessimistic case are larger in part a than in part c. For the optimistic case, the profits are lower in part a than in part c. This outcome confirms the results as stated in part b.

3-16 LG 5: Pro Forma Balance Sheet–Basic**a.**

Pro Forma Balance Sheet

Leonard Industries

December 31, 2004

Assets

Current assets

Cash	\$ 50,000
Marketable securities	15,000
Accounts receivable	300,000
Inventories	<u>360,000</u>
Total current assets	\$ 725,000
Net fixed assets	<u>658,000</u> ¹
Total assets	<u>\$1,383,000</u>

Liabilities and stockholders' equity

Current liabilities

Accounts payable	\$ 420,000
Accruals	60,000
Other current liabilities	<u>30,000</u>
Total current liabilities	\$ 510,000
Long-term debts	<u>350,000</u>
Total liabilities	\$ 860,000
Common stock	200,000
Retained earnings	<u>270,000</u> ²
Total stockholders' equity	\$ 470,000
External funds required	<u>53,000</u> ³
Total liabilities and stockholders' equity	<u>\$1,383,000</u>

¹	Beginning gross fixed assets	\$ 600,000
	Plus: Fixed asset outlays	90,000
	Less: Depreciation expense	<u>(32,000)</u>
	Ending net fixed assets	\$ 658,000

²	Beginning retained earnings (Jan. 1, 2004)	\$ 220,000
	Plus: Net profit after taxes (\$3,000,000 x .04)	120,000
	Less: Dividends paid	<u>(70,000)</u>
	Ending retained earnings (Dec. 31, 2004)	\$ 270,000

³	Total assets	\$1,383,000
	Less: Total liabilities and equity	<u>1,330,000</u>
	External funds required	\$ 53,000

- b.** Based on the forecast and desired level of certain accounts, the financial manager should arrange for credit of \$53,000. Of course, if financing cannot be obtained, one or more of the constraints may be changed.

- c. If Leonard Industries reduced its 2004 dividend to \$17,000 or less, the firm would not need any additional financing. By reducing the dividend, more cash is retained by the firm to cover the growth in other asset accounts.

3-17 LG 5: Pro Forma Balance Sheet

a.

Pro Forma Balance Sheet
Peabody & Peabody
December 31, 2005

Assets

Current assets

Cash	\$ 480,000
Marketable securities	200,000
Accounts receivable	1,440,000
Inventories	<u>2,160,000</u>
Total current assets	\$4,280,000
Net fixed assets	<u>4,820,000</u> ¹
Total assets	<u><u>\$9,100,000</u></u>

Liabilities and stockholders' equity

Current liabilities

Accounts payable	\$1,680,000
Accruals	500,000
Other current liabilities	<u>80,000</u>
Total current liabilities	\$2,260,000
Long-term debts	<u>2,000,000</u>
Total liabilities	\$4,260,000
Common equity	4,065,000 ²
External funds required	<u>775,000</u>
Total liabilities and stockholders' equity	<u><u>\$9,100,000</u></u>

¹ Beginning gross fixed assets (January 1, 2005)	\$4,000,000
Plus: Fixed asset outlays	1,500,000
Less: Depreciation expense	<u>(680,000)</u>
Ending net fixed assets (December 31, 2005)	\$4,820,000

² Note: Common equity is the sum of common stock and retained earnings.

Beginning common equity (January 1, 2004)	\$3,720,000
Plus: Net profits after taxes (2004)	330,000
Net profits after taxes (2005)	360,000
Less: Dividends paid (2004)	(165,000)
Dividends paid (2005)	<u>(180,000)</u>
Ending common equity (December 31, 2005)	\$4,065,000

- b. Peabody & Peabody must arrange for additional financing of at least \$775,000 over the next two years based on the given constraints and projections.

3-18 LG 5: Integrative–Pro Forma Statements

a.

Pro Forma Income Statement
Red Queen Restaurants
for the Year Ended December 31, 2004
(percent-of-sales method)

Sales	\$ 900,000
Less: Cost of goods sold (.75 x sales)	<u>675,000</u>
Gross profits	\$ 225,000
Less: Operating expenses (.125 x sales)	<u>112,500</u>
Net profits before taxes	\$ 112,500
Less: Taxes (.40 x NPBT)	<u>45,000</u>
Net profits after taxes	\$ 67,500
Less: Cash dividends	<u>35,000</u>
To Retained earnings	<u>\$ 32,500</u>

b.

Pro Forma Balance Sheet
Red Queen Restaurants
December 31, 2004
(Judgmental Method)

<u>Assets</u>		<u>Liabilities and Equity</u>	
Cash	\$ 30,000	Accounts payable	\$ 112,500
Marketable securities	18,000	Taxes payable	11,250
Accounts receivable	162,000	other current liabilities	<u>5,000</u>
Inventories	<u>112,500</u>	Current liabilities	\$ 128,750
Current assets	\$ 322,500	Long-term debt	200,000
Net fixed assets	<u>375,000</u>	Common stock	150,000
		Retained earnings	207,500 *
		External funds required	<u>11,250</u>
		Total liabilities and	
Total assets	\$ <u>697,500</u>	stockholders' equity	<u>\$ 697,500</u>

*	Beginning retained earnings (January 1, 2004)	\$ 175,000
	Plus: Net profit after taxes	67,500
	Less: Dividends paid	<u>(35,000)</u>
	Ending retained earnings (December 31, 2004)	<u>\$ 207,500</u>

c. Using the judgmental approach, the external funds requirement is \$11,250.

3-19 LG 5: Integrative–Pro Forma Statements

a.

Pro Forma Income Statement
Provincial Imports, Inc.
For the Year Ended December 31, 2004
(Percent-of-sales method)

Sales	\$ 6,000,000
Less: Cost of goods sold (.35 x sales + \$1,000,000)	<u>3,100,000</u>
Gross profits	\$ 2,900,000
Less: Operating expenses (.12 x sales + \$250,000)	<u>970,000</u>
Operating profits	\$ 1,930,000
Less: Interest Expense	<u>200,000</u>
Net profits before taxes	\$1,730,000
Less: Taxes (.40 x NPBT)	<u>692,000</u>
Net profits after taxes	\$ 1,038,000
Less: Cash dividends (.40 x NPAT)	<u>415,200</u>
To Retained earnings	<u>\$ 622,800</u>

b.

Pro Forma Balance Sheet
Provincial Imports, Inc.
December 31, 2004
(Judgmental Method)

Chapter 3 Cash Flow and Financial Planning

Assets		Liabilities and Equity	
Cash	\$ 400,000	Accounts payable	\$ 840,000
Marketable securities	275,000	Taxes payable	138,400 ¹
		Notes payable	200,000
Accounts receivable	750,000	Other current liabilities	6,000
Inventories	<u>1,000,000</u>	Current liabilities	\$1,184,400
Current assets	\$2,425,000	Long-term debt	550,000
Net fixed assets	<u>1,646,000</u>	Common stock	75,000
		Retained earnings	1,651,800 ²
		External funds required	<u>609,800</u>
		Total liabilities and	
Total assets	<u>\$4,071,000</u>	stockholders' equity	<u>\$4,071,000</u>

- 1 Taxes payable for 2000 are nearly 20% of the 2000 taxes on the income statement. The pro forma value is obtained by taking 20% of the 2001 taxes ($.2 \times \$692,000 = \$138,400$).
- 2
- | | |
|---|---------------------|
| Beginning retained earnings (January 1, 2004) | \$ 1,375,000 |
| Plus: Net profit after taxes | 692,000 |
| Less: Dividends paid | <u>(415,200)</u> |
| Ending retained earnings (December 31, 2004) | <u>\$ 1,651,800</u> |
- c. Using the judgmental approach, the external funds requirement is \$609,800.

CHAPTER 3 CASE

Preparing Martin Manufacturing's 2004 Pro Forma Financial Statement

In this case, the student prepares pro forma financial statements, using them to determine whether Martin Manufacturing will require external funding in order to embark on a major expansion program.

a.

Martin Manufacturing Company
Pro Forma Income Statement
for the Year Ended December 31, 2004

Sales revenue	\$6,500,000	(100%)
Less: Cost of goods sold	<u>4,745,000</u>	(.73 x sales)
Gross profits	\$1,755,000	(.27 x sales)
Less: Operating expenses		
Selling expense and general and administrative expense	\$1,365,000	(.21 x sales)
Depreciation expense	<u>185,000</u>	
Total operating expenses	<u>\$1,550,000</u>	
Operating profits	\$ 205,000	
Less: Interest expense	<u>97,000</u>	
Net profits before taxes	\$ 108,000	
Less: Taxes (40%)	<u>43,200</u>	
Total profits after taxes	<u>\$ 64,800</u>	

Note: Calculations "driven" by cost of goods sold and operating expense (excluding depreciation, which is given) percentages.

b.

Martin Manufacturing Company
Pro Forma Balance Sheet
December 31, 2004

Assets

Current assets

Cash	\$ 25,000
Accounts receivable	902,778
Inventories	<u>677,857</u>
Total current assets	\$1,605,635

Gross fixed assets	\$2,493,819
Less: Accumulated depreciation	<u>685,000</u>
Net fixed assets	<u>\$1,808,819</u>
Total assets	<u><u>\$3,414,454</u></u>

Liabilities and stockholders' equity

Current liabilities

Accounts payable	\$ 276,000
Notes payable	311,000
Accruals	<u>75,000</u>
Total current liabilities	\$ 662,000
Long-term debts	<u>1,165,250</u>
Total liabilities	\$1,827,250

Stockholders' equity

Preferred stock	\$ 50,000
Common stock (at par)	100,000
Paid-in capital in excess of par	193,750
Retained earnings	<u>1,044,800</u> ¹
Total stockholders' equity	<u>\$1,388,550</u>
Total	\$3,215,800
External funds required	<u>198,654</u>
Total liabilities and stockholders' equity	<u><u>\$3,414,454</u></u>

¹ Beginning retained earnings (January 1, 2004)	\$1,000,000
Plus: Net profits	64,800
Less: Dividends paid	<u>(20,000)</u>
Ending retained earnings (December 31, 2004)	<u>\$1,044,800</u>

- c. Based on the pro forma financial statements prepared above, Martin Manufacturing will need to raise about \$200,000 (\$198,654) in external financing in order to undertake its construction program.

INTEGRATIVE CASE 1

TRACK SOFTWARE, INC.

Integrative Case 1, Track Software, Inc., places the student in the role of financial decision maker to introduce the basic concepts of financial goal-setting, measurement of the firm's performance, and analysis of the firm's financial condition. Since this seven-year-old software company has cash flow problems, the student must prepare and analyze the statement of cash flows. Interest expense is increasing, and the firm's financing strategy should be evaluated in view of current yields on loans of different maturities. A ratio analysis of Track's financial statements is used to provide additional information about the firm's financial condition. The student is then faced with a cost/benefit trade-off: Is the additional expense of a new software developer, which will decrease short-term profitability, a good investment for the firm's long-term potential? In considering these situations, the student becomes familiar with the importance of financial decisions to the firm's day-to-day operations and long-term profitability.

- a. (1) Stanley is focusing on maximizing profit, as shown by the increase in net profits over the period 1997 to 2003. His dilemma about adding the software designer, which would depress earnings for the near term, also demonstrates his emphasis on this goal. Maximizing wealth should be the correct goal for a financial manager. Wealth maximization takes a long-term perspective and also considers risk and cash flows. Profits maximization does not integrate these three factors (cash flow, timing, risk) in the decision process
- (2) An agency problem exists when managers place personal goals ahead of corporate goals. Since Stanley owns 40% of the outstanding equity, it is unlikely that an agency problem would arise at Track Software.

b. **Earnings per share (EPS) calculation:**

<u>Year</u>	<u>Net Profits after Taxes</u>	<u>EPS</u> (NPAT ÷ 100,000 shares)
1997	(\$50,000)	\$0
1998	(20,000)	0
1999	15,000	.15
2000	35,000	.35
2001	40,000	.40
2002	43,000	.43
2003	48,000	.48

Earnings per share has increased steadily, confirming that Stanley is concentrating his efforts on profit maximization.

c. **Calculation of Operating and Free Cash Flows**

$$\text{OCF} = \text{EBIT} - \text{Taxes} + \text{Depreciation}$$

$$\text{OCF} = \$89 - 12 + 11 = \$88$$

$$\text{FCF} = \text{OCF} - \text{Net fixed asset investment}^* - \text{Net current asset investment}^{**}$$

$$\text{FCF} = \$88 - 15 - 47 = 26$$

$$^* \text{NFAI} = \text{Change in net fixed assets} + \text{depreciation}$$

$$\text{NFAI} = (132 - 128) + 11 = 15$$

NCAI = Change in current assets - change in (accounts payable + accruals)

$$\text{NCAI} = 59 - (10 + 2) = 47$$

Track Software is providing a good positive cash flow from its operating activities. The OCF is large enough to provide the cash needed for the needed investment in both fixed assets and the increase in net working capital. The firm still has \$26,000 available to pay investors (creditors and equity holders).

d.

Ratio Analysis
Track Software, Inc.

Ratio	Actual		Industry Average 2003	TS: Time-series CS: Cross-sectional
	2002	2003		
Net working capital	\$21,000	\$58,000	\$96,000	TS: Improving CS: Poor
Current ratio	1.06	1.16	1.82	TS: Improving CS: Poor
Quick ratio	0.63	0.63	1.10	TS: Stable CS: Poor
Inventory turnover	10.40	5.39	12.45	TS: Deteriorating CS: Poor
Average collection period	29.6 days	35.3 days	20.2 days	TS: Deteriorating CS: Poor
Total asset turnover	2.66	2.80	3.92	TS: Improving CS: Poor

Ratio	Actual		Industry Average 2003	TS: Time-series CS: Cross-sectional
	2002	2003		
Debt ratio	0.78	0.73	0.55	TS: Decreasing CS: Poor
Times interest earned	3.0	3.1	5.6	TS: Stable CS: Poor
Gross profit margin	32.1%	33.5%	42.3%	TS: Improving CS: Fair
Operating profit margin	5.5%	5.7%	12.4%	TS: Improving CS: Poor
Net profit margin	3.0%	3.1%	4.0%	TS: Stable

CS: Fair

Return on total Assets (ROA)	80%	8.7%	15.6%	TS: Improving CS: Poor
Return on Equity (ROE)	36.4%	31.6%	34.7%	TS: Deteriorating CS: Fair

Analysis of Track Software based on ratio data:

- (1) **Liquidity:** Track Software's liquidity as reflected by the current ratio, net working capital, and acid-test ratio has improved slightly or remained stable, but overall is significantly below the industry average.
- (2) **Activity:** Inventory turnover has deteriorated considerably and is much worse than the industry average. The average collection period has also deteriorated and is also substantially worse than the industry average. Total asset turnover improved slightly but is still well below the industry norm.
- (3) **Debt:** The firm's debt ratio improved slightly from 2002 but is higher than the industry averages. The times interest earned ratio is stable and, although it provides a reasonable cushion for the company, is below the industry average.
- (4) **Profitability:** The firm's gross, operating, and net profit margins have improved slightly in 2003 but remain low compared to the industry. Return on total assets has improved slightly but is about half the industry average. Return on equity declined slightly and is now below the industry average.

Track Software, while showing improvement in most liquidity, debt, and profitability ratios, should take steps to improve activity ratios, particularly inventory turnover and accounts receivable collection. It does not compare favorably to its peer group.

- e. Stanley should make every effort to find the cash to hire the software developer. Since the major goal is profit maximization, the ability to add a new product would increase sales and lead to greater profits for Track Software over the long-term.

PART 2

Important Financial Concepts

CHAPTERS IN THIS PART

- 4 Time Value of Money**
- 5 Risk and Return**
- 6 Interest Rates and Bond Valuation**
- 7 Stock Valuation**

INTEGRATIVE CASE 2: ENCORE INTERNATIONAL

CHAPTER 4

*Time Value
of Money***INSTRUCTOR'S RESOURCES****Overview**

This chapter introduces an important financial concept: the time value of money. The present value and future value of a sum, as well as the present and future values of an annuity, are explained. Special applications of the concepts include intra-year compounding, mixed cash flow streams, mixed cash flows with an embedded annuity, perpetuities, deposits to accumulate a future sum, and loan amortization. Numerous business and personal financial applications are used as examples.

PMF DISK***PMF Tutor: Time Value of Money***

Time value of money problems included in the *PMF Tutor* are future value (single amount), present value (single amount and mixed stream), present and future value annuities, loan amortization, and deposits to accumulate a sum.

PMF Problem-Solver: Time Value of Money

This module will allow the student to compute the worth of money under three scenarios: 1) single payment, 2) annuities, 3) mixed stream. These routines may also be used to amortize a loan or estimate growth rates.

PMF Templates

Spreadsheet templates are provided for the following problems:

<u>Problem</u>	<u>Topic</u>
Self-Test 1	Future values for various compounding frequencies
Self-Test 2	Future value of annuities
Self-Test 3	Present value of lump sums and streams
Self-Test 4	Deposits needed to accumulate a future sum

Study Guide

The following *Study Guide* examples are suggested for classroom presentation:

<u>Example</u>	<u>Topic</u>
5	More on annuities
6	Loan amortization
10	Effective rate

ANSWERS TO REVIEW QUESTIONS

4-1 *Future value (FV)*, the value of a present amount at a future date, is calculated by applying compound interest over a specific time period. *Present value (PV)*, represents the dollar value today of a future amount, or the amount you would invest today at a given interest rate for a specified time period to equal the future amount. Financial managers prefer present value to future value because they typically make decisions at time zero, before the start of a project.

4-2 A *single amount* cash flow refers to an individual, stand alone, value occurring at one point in time. An *annuity* consists of an unbroken series of cash flows of equal dollar amount occurring over more than one period. A *mixed stream* is a pattern of cash flows over more than one time period and the amount of cash associated with each period will vary.

4-3 *Compounding* of interest occurs when an amount is deposited into a savings account and the interest paid after the specified time period remains in the account, thereby becoming part of the principal for the following period. The general equation for future value in year n (FV_n) can be expressed using the specified notation as follows:

$$FV_n = PV \times (1+i)^n$$

4-4 A decrease in the interest rate lowers the future amount of a deposit for a given holding period, since the deposit earns less at the lower rate. An increase in the holding period for a given interest rate would increase the future value. The increased holding period increases the future value since the deposit earns interest over a longer period of time.

4-5 The present value, PV, of a future amount indicates how much money today would be equivalent to the future amount if one could invest that amount at a specified rate of interest. Using the given notation, the present value (PV) of a future amount (FV_n) can be defined as follows:

$$PV = FV \left(\frac{1}{(1+i)^n} \right)$$

4-6 An increasing required rate of return would reduce the present value of a future amount, since future dollars would be worth less today. Looking at the formula for present value in question 5, it should be clear that by increasing the i value, which is the required return, the present value interest factor would decrease, thereby reducing the present value of the future sum.

4-7 Present value calculations are the exact inverse of compound interest calculations. Using compound interest, one attempts to find the future value of a present amount; using present value, one attempts to find the present value of an amount to be received in the future.

4-8 An *ordinary annuity* is one for which payments occur at the end of each period. An *annuity due* is one for which payments occur at the beginning of each period.

The ordinary annuity is the more common. For otherwise identical annuities and interest rates, the annuity due results in a higher future value because cash flows occur earlier and have more time to compound.

4-9 The present value of an ordinary annuity, PVA_n , can be determined using the formula:

$$PVA_n = PMT \times (PVIFA_{i\%,n})$$

Where:

PMT = the end of period cash inflows

PVIFA_{i%,n} = the present value interest factor of an annuity for interest rate i and n periods.

The PVIFA is related to the PVIF in that the annuity factor is the sum of the PVIFs over the number of periods for the annuity. For example, the PVIFA for 5% and 3 periods is 2.723, and the sum of the 5% PVIF for periods one through three is 2.723 (.952 + .907 + .864).

- 4-10** The FVIFA factors for an ordinary annuity can be converted for use in calculating an annuity due by multiplying the FVIFA_{i%,n} by $1 + i$.
- 4-11** The PVIFA factors for an ordinary annuity can be converted for use in calculating an annuity due by multiplying the PVIFA_{i%,n} by $1 + i$.
- 4-12** A *perpetuity* is an infinite-lived annuity. The factor for finding the present value of a perpetuity can be found by dividing the discount rate into 1.0. The resulting quotient represents the factor for finding the present value of an infinite-lived stream of equal annual cash flows.
- 4-13** The future value of a mixed stream of cash flows is calculated by multiplying each year's cash flow by the appropriate future value interest factor. To find the present value of a mixed stream of cash flows multiply each year's cash flow by the appropriate present value interest factor. There will be at least as many calculations as the number of cash flow.
- 4-14** As interest is compounded more frequently than once a year, both (a) the future value for a given holding period and (b) the *effective annual rate* of interest will increase. This is due to the fact that the more frequently interest is compounded, the greater the future value. In situations of intra-year compounding, the actual rate of interest is greater than the stated rate of interest.
- 4-15** *Continuous compounding* assumes interest will be compounded an infinite number of times per year, at intervals of microseconds. Continuous compounding of a given deposit at a given rate of interest results in the largest value when compared to any other compounding period.
- 4-16** The *nominal annual rate* is the contractual rate that is quoted to the borrower by the lender. The *effective annual rate*, sometimes called the *true rate*, is the actual rate that is paid by the borrower to the lender. The difference between the two rates is due to the compounding of interest at a frequency greater than once per year.

APR is the *Annual Percentage Rate* and is required by “truth in lending laws” to be disclosed to consumers. This rate is calculated by multiplying the periodic rate by the number of periods in one year. The periodic rate is the nominal rate over the shortest time period in which interest is compounded. The APY, or *Annual Percentage Yield*, is the effective rate of interest that must be disclosed to consumers by banks on their savings products as a result of the “truth in savings laws.” These laws result in both favorable and unfavorable information to consumers. The good news is that rate quotes on both loans and savings are standardized among financial institutions. The negative is that the APR, or lending rate, is a nominal rate, while the APY, or saving rate, is an effective rate. These rates are the same when compounding occurs only once per year.

- 4-17** The size of the equal annual end-of-year deposits needed to accumulate a given amount over a certain time period at a specified rate can be found by dividing the interest factor for the future value of an annuity for the given interest rate and the number of years (FVIFA_{i%,n}) into the desired future amount. The resulting

quotient would be the amount of the equal annual end-of-year deposits required. The future value interest factor for an annuity is used in this calculation:

$$PMT = \frac{FV_n}{FVIFA_{i\%, n}}$$

- 4-18** Amortizing a loan into equal annual payments involves finding the future payments whose present value at the loan interest rate just equals the amount of the initial principal borrowed. The formula is:

$$PMT = \frac{PV_n}{PVIFA_{i\%, n}}$$

- 4-19 a.** Either the present value interest factor or the future value interest factor can be used to find the growth rate associated with a stream of cash flows.

The growth rate associated with a stream of cash flows may be found by using the following equation, where the growth rate, g , is substituted for k .

$$PV = \frac{FV_n}{(1 + g)}$$

To find the rate at which growth has occurred, the amount received in the earliest year is divided by the amount received in the latest year. This quotient is the $PVIF_{i\%, n}$. The growth rate associated with this factor may be found in the PVIF table.

- b.** To find the interest rate associated with an equal payment loan, the Present Value Interest Factors for a One-Dollar Annuity Table would be used.

To determine the interest rate associated with an equal payment loan, the following equation may be used:

$$PV_n = PMT \times (PVIFA_{i\%, n})$$

Solving the equation for $PVIFA_{i\%, n}$ we get:

$$PVIFA_{i\%, n} = \frac{PV_n}{PMT}$$

Then substitute the values for PV_n and PMT into the formula, using the PVIFA Table to find the interest rate most closely associated with the resulting PVIFA, which is the interest rate on the loan.

- 4-20** To find the number of periods it would take to compound a known present amount into a known future amount you can solve either the present value or future value equation for the interest factor as shown below using the present value:

$$PV = FV \times (PVIF_{i\%, n})$$

Solving the equation for $PVIF_{i\%, n}$ we get:

$$PVIF_{i\%, n} = \frac{PV}{FV}$$

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Then substitute the values for PV and FV into the formula, using the PVIF Table for the known interest rate find the number of periods most closely associated with the resulting PVIF.

The same approach would be used for finding the number of periods for an annuity except that the annuity factor and the PVIFA (or FVIFA) table would be used. This process is shown below.

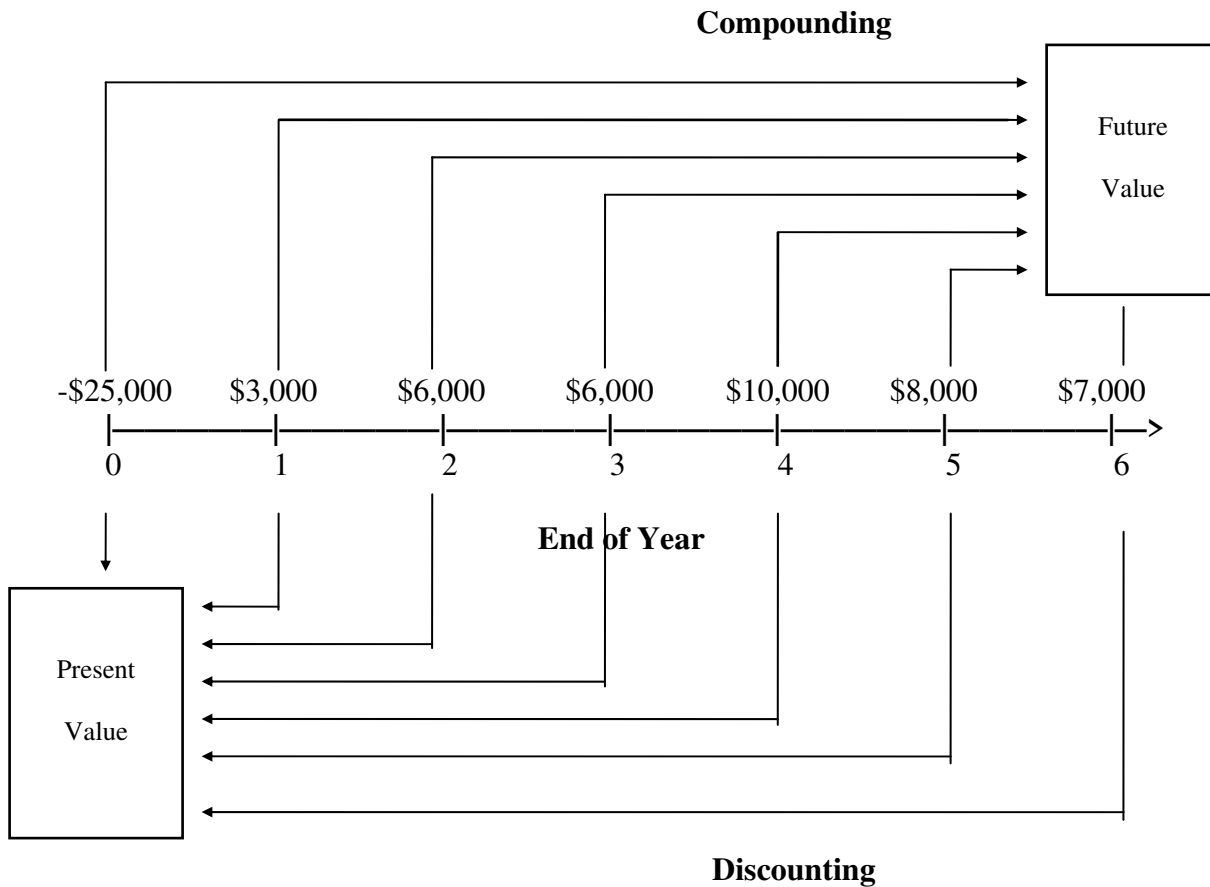
$$PV_n = PMT \times (PVIFA_{i\%,n})$$

Solving the equation for $PVIFA_{i\%,n}$ we get:

$$PVIFA_{i\%,n} = \frac{PV_n}{PMT}$$

SOLUTIONS TO PROBLEMS**4-1 LG 1: Using a Time Line**

a., b., c.



- d. Financial managers rely more on present than future value because they typically make decisions before the start of a project, at time zero, as does the present value calculation.

4-2 LG 2: Future Value Calculation: $FV_n = PV \times (1+i)^n$ **Case**

A $FVIF_{12\%, 2 \text{ periods}} = (1 + .12)^2 = 1.254$

B $FVIF_{6\%, 3 \text{ periods}} = (1 + .06)^3 = 1.191$

C $FVIF_{9\%, 2 \text{ periods}} = (1 + .09)^2 = 1.188$

D $FVIF_{3\%, 4 \text{ periods}} = (1 + .03)^4 = 1.126$

4-3 LG 2: Future Value Tables: $FV_n = PV \times (1+i)^n$ **Case A**

a.	2	=	$1 \times (1 + .07)^n$	b.	4	=	$1 \times (1 + .07)^n$
	2/1	=	$(1.07)^n$		4/1	=	$(1.07)^n$
	2	=	$FVIF_{7\%, n}$		4	=	$FVIF_{7\%, n}$
	10 years < n < 11 years				20 years < n < 21 years		
	Nearest to 10 years				Nearest to 20 years		

Case B

<p>a. 2 = 1 x (1 + .40)ⁿ 2 = FVIF_{40%,n} 2 years < n < 3 years Nearest to 2 years</p>	<p>b. 4 = (1 + .40)ⁿ 4 = FVIF_{40%,n} 4 years < n < 5 years Nearest to 4 years</p>
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Case C

<p>a. 2 = 1 x (1 + .20)ⁿ 2 = FVIF_{20%,n} 3 years < n < 4 years Nearest to 4 years</p>	<p>b. 4 = (1 + .20)ⁿ 4 = FVIF_{20%,n} 7 years < n < 8 years Nearest to 8 years</p>
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Case D

<p>a. 2 = 1 x (1 + .10)ⁿ 2 = FVIF_{10%,n} 7 years < n < 8 years Nearest to 7 years</p>	<p>b. 4 = (1 + .10)ⁿ 4 = FVIF_{40%,n} 14 years < n < 15 years Nearest to 15 years</p>
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4-4 LG 2: Future Values: $FV_n = PV \times (1 + i)^n$ or $FV_n = PV \times (FVIF_{i\%,n})$

Case

A $FV_{20} = PV \times FVIF_{5\%,20 \text{ yrs.}}$
 $FV_{20} = \$200 \times (2.653)$
 $FV_{20} = \$530.60$
 Calculator solution: \$530.66

Case

B $FV_7 = PV \times FVIF_{8\%,7 \text{ yrs.}}$
 $FV_7 = \$4,500 \times (1.714)$
 $FV_7 = \$7,713$
 Calculator solution; \$7,712.21

C $FV_{10} = PV \times FVIF_{9\%,10 \text{ yrs.}}$
 $FV_{10} = \$10,000 \times (2.367)$
 $FV_{10} = \$23,670$
 Calculator solution: \$23,673.64

D $FV_{12} = PV \times FVIF_{10\%,12 \text{ yrs.}}$
 $FV_{12} = \$25,000 \times (3.138)$
 $FV_{12} = \$78,450$
 Calculator solution: \$78,460.71

E $FV_5 = PV \times FVIF_{11\%,5 \text{ yrs.}}$
 $FV_5 = \$37,000 \times (1.685)$
 $FV_5 = \$62,345$
 Calculator solution: \$62,347.15

F $FV_9 = PV \times FVIF_{12\%,9 \text{ yrs.}}$
 $FV_9 = \$40,000 \times (2.773)$
 $FV_9 = \$110,920$
 Calculator solution: \$110,923.15

4-5 LG 2: Future Value: $FV_n = PV \times (1 + i)^n$ or $FV^n = PV \times (FVIF_{i\%,n})$

<p>a 1. $FV_3 = PV \times (FVIF_{7\%,3})$ $FV_3 = \\$1,500 \times (1.225)$ $FV_3 = \\$1,837.50$ Calculator solution: \$1,837.56</p> <p>2. $FV_6 = PV \times (FVIF_{7\%,6})$ $FV_6 = \\$1,500 \times (1.501)$ $FV_6 = \\$2,251.50$ Calculator solution: \$2,251.10</p> <p>3. $FV_9 = PV \times (FVIF_{7\%,9})$ $FV_9 = \\$1,500 \times (1.838)$ $FV_9 = \\$2,757.00$</p>	<p>b. 1. Interest earned = $FV_3 - PV$ Interest earned = \$1,837.50 <u>-\$1,500.00</u> <u>\$ 337.50</u></p> <p>2. Interest earned = $FV_6 - FV_3$ Interest earned = \$2,251.50 <u>-\$1,837.50</u> <u>\$ 414.00</u></p> <p>3. Interest earned = $FV_9 - FV_6$ Interest earned = \$2,757.00 <u>-\$2,251.50</u></p>
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Calculator solution: \$2,757.69

\$ 505.50

- c. The fact that the longer the investment period is, the larger the total amount of interest collected will be, is not unexpected and is due to the greater length of time that the principal sum of \$1,500 is invested. The most significant point is that the incremental interest earned per 3-year period increases with each subsequent 3 year period. The total interest for the first 3 years is \$337.50; however, for the second 3 years (from year 3 to 6) the additional interest earned is \$414.00. For the third 3-year period, the incremental interest is \$505.50. This increasing change in interest earned is due to compounding, the earning of interest on previous interest earned. The greater the previous interest earned, the greater the impact of compounding.

4-6 LG 2: Inflation and Future Value

- a. 1. $FV_5 = PV \times (FVIF_{2\%,5})$ 2. $FV_5 = PV \times (FVIF_{4\%,5})$
 $FV_5 = \$14,000 \times (1.104)$ $FV_5 = \$14,000 \times (1.217)$
 $FV_5 = \$15,456.00$ $FV_5 = \$17,038.00$
Calculator solution: \$15,457.13 Calculator solution: \$17,033.14
- b. The car will cost \$1,582 more with a 4% inflation rate than an inflation rate of 2%. This increase is 10.2% more ($\$1,582 \div \$15,456$) than would be paid with only a 2% rate of inflation.

4-7 LG 2: Future Value and Time

Deposit now:

$$FV_{40} = PV \times FVIF_{9\%,40}$$

$$FV_{40} = \$10,000 \times (1.09)^{40}$$

$$FV_{40} = \$10,000 \times (31.409)$$

$$FV_{40} = \$314,090.00$$

Calculator solution: \$314,094.20

Deposit in 10 years:

$$FV_{30} = PV_{10} \times (FVIF_{9\%,30})$$

$$FV_{30} = PV_{10} \times (1.09)^{30}$$

$$FV_{30} = \$10,000 \times (13.268)$$

$$FV_{30} = \$132,680.00$$

Calculator solution: \$132,676.79

You would be better off by \$181,410 (\$314,090 - \$132,680) by investing the \$10,000 now instead of waiting for 10 years to make the investment.

4-8 LG 2: Future Value Calculation: $FV_n = PV \times FVIF_{i\%,n}$

a. $\$15,000 = \$10,200 \times FVIF_{i\%,5}$

$$FVIF_{i\%,5} = \$15,000 \div \$10,200 = 1.471$$

$$8\% < i < 9\%$$

Calculator Solution: 8.02%

b. $\$15,000 = \$8,150 \times FVIF_{i\%,5}$

$$FVIF_{i\%,5} = \$15,000 \div \$8,150 = 1.840$$

$$12\% < i < 13\%$$

Calculator Solution: 12.98%

c. $\$15,000 = \$7,150 \times FVIF_{i\%,5}$

$$FVIF_{i\%,5} = \$15,000 \div \$7,150 = 2.098$$

$$15\% < i < 16\%$$

Calculator Solution: 15.97%

4-9 LG 2: Single-payment Loan Repayment: $FV_n = PV \times FVIF_{i\%,n}$

a. $FV_1 = PV \times (FVIF_{14\%,1})$

$$FV_1 = \$200 \times (1.14)$$

$$FV_1 = \$228$$

Calculator Solution: \$228

b. $FV_4 = PV \times (FVIF_{14\%,4})$

$$FV_4 = \$200 \times (1.689)$$

$$FV_4 = \$337.80$$

Calculator solution: \$337.79

c. $FV_8 = PV \times (FVIF_{14\%,8})$

$$FV_8 = \$200 \times (2.853)$$

$$FV_8 = \$570.60$$

Calculator Solution: \$570.52

4-10 LG 2: Present Value Calculation: $PVIF = \frac{1}{(1+i)^n}$

Case

A $PVIF = 1 \div (1 + .02)^4 = .9238$

B $PVIF = 1 \div (1 + .10)^2 = .8264$

C $PVIF = 1 \div (1 + .05)^3 = .8638$

D $PVIF = 1 \div (1 + .13)^2 = .7831$

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4-11 LG 2: Present Values: $PV = FV_n \times (PVIF_{i\%,n})$

Case		Calculator Solution
A	$PV_{12\%,4\text{yrs}} = \$7,000 \times .636 = \$4,452$	\$ 4,448.63
B	$PV_{8\%,20\text{yrs}} = \$28,000 \times .215 = \$6,020$	\$ 6,007.35
C	$PV_{14\%,12\text{yrs}} = \$10,000 \times .208 = \$2,080$	\$ 2,075.59
D	$PV_{11\%,6\text{yrs}} = \$150,000 \times .535 = \$80,250$	\$80,196.13
E	$PV_{20\%,8\text{yrs}} = \$45,000 \times .233 = \$10,485$	\$10,465.56

4-12 LG 2: Present Value Concept: $PV_n = FV_n \times (PVIF_{i\%,n})$

- a. $PV = FV_6 \times (PVIF_{12\%,6})$
 $PV = \$6,000 \times (.507)$
 $PV = \$3,042.00$
 Calculator solution: \$3,039.79
- b. $PV = FV_6 \times (PVIF_{12\%,6})$
 $PV = \$6,000 \times (.507)$
 $PV = \$3,042.00$
 Calculator solution: \$3,039.79
- c. $PV = FV_6 \times (PVIF_{12\%,6})$
 $PV = \$6,000 \times (.507)$
 $PV = \$3,042.00$
 Calculator solution: \$3,039.79
- d. The answer to all three parts are the same. In each case the same questions is being asked but in a different way.

4-13 LG 2: Present Value: $PV = FV_n \times (PVIF_{i\%,n})$

Jim should be willing to pay no more than \$408.00 for this future sum given that his opportunity cost is 7%.

$$PV = \$500 \times (PVIF_{7\%,3})$$

$$PV = \$500 \times (.816)$$

$$PV = \$408.00$$

Calculator solution: \$408.15

4-14 LG 2: Present Value: $PV = FV_n \times (PVIF_{i\%,n})$

$$PV = \$100 \times (PVIF_{8\%,6})$$

$$PV = \$100 \times (.630)$$

$$PV = \$63.00$$

Calculator solution: \$63.02

4-15 LG 2: Present Value and Discount Rates: $PV = FV_n \times (PVIF_{i\%,n})$

- a. (1) $PV = \$1,000,000 \times (PVIF_{6\%,10})$
 $PV = \$1,000,000 \times (.558)$
 $PV = \$558,000.00$
 Calculator solution: \$558,394.78
- (2) $PV = \$1,000,000 \times (PVIF_{9\%,10})$
 $PV = \$1,000,000 \times (.422)$
 $PV = \$422,000.00$
 Calculator solution: \$422,410.81

$$\begin{aligned} (3) \text{ PV} &= \$1,000,000 \times (\text{PVIF}_{12\%,10}) \\ \text{PV} &= \$1,000,000 \times (.322) \\ \text{PV} &= \$322,000.00 \\ \text{Calculator solution: } &\$321,973.24 \end{aligned}$$

<p>b. (1) $\text{PV} = \\$1,000,000 \times (\text{PVIF}_{6\%,15})$ $\text{PV} = \\$1,000,000 \times (.417)$ $\text{PV} = \\$417,000.00$ Calculator solution: \$417,265.06</p> <p>(3) $\text{PV} = \\$1,000,000 \times (\text{PVIF}_{12\%,15})$ $\text{PV} = \\$1,000,000 \times (.183)$ $\text{PV} = \\$183,000.00$ Calculator solution: \$182,696.26</p>	<p>(2) $\text{PV} = \\$1,000,000 \times (\text{PVIF}_{9\%,15})$ $\text{PV} = \\$1,000,000 \times (.275)$ $\text{PV} = \\$275,000.00$ Calculator solution: \$274,538.04</p>
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- c.** As the discount rate increases, the present value becomes smaller. This decrease is due to the higher opportunity cost associated with the higher rate. Also, the longer the time until the lottery payment is collected, the less the present value due to the greater time over which the opportunity cost applies. In other words, the larger the discount rate and the longer the time until the money is received, the smaller will be the present value of a future payment.

4-16 LG 2: Present Value Comparisons of Lump Sums: $\text{PV} = \text{FV}_n \times (\text{PVIF}_{i\%,n})$

<p>a. A. $\text{PV} = \\$28,500 \times (\text{PVIF}_{11\%,3})$ $\text{PV} = \\$28,500 \times (.731)$ $\text{PV} = \\$20,833.50$ Calculator solution: \$20,838.95</p> <p>C. $\text{PV} = \\$160,000 \times (\text{PVIF}_{11\%,20})$ $\text{PV} = \\$160,000 \times (.124)$ $\text{PV} = \\$19,840.00$ Calculator solution: \$19,845.43</p>	<p>B. $\text{PV} = \\$54,000 \times (\text{PVIF}_{11\%,9})$ $\text{PV} = \\$54,000 \times (.391)$ $\text{PV} = \\$21,114.00$ Calculator solution: \$21,109.94</p>
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- b.** Alternatives A and B are both worth greater than \$20,000 in term of the present value.
- c.** The best alternative is B because the present value of B is larger than either A or C and is also greater than the \$20,000 offer.

4-17 LG 2: Cash Flow Investment Decision: $\text{PV} = \text{FV}_n \times (\text{PVIF}_{i\%,n})$

<p>A. $\text{PV} = \\$30,000 \times (\text{PVIF}_{10\%,5})$ $\text{PV} = \\$30,000 \times (.621)$ $\text{PV} = \\$18,630.00$ Calculator solution: \$18,627.64</p> <p>C. $\text{PV} = \\$10,000 \times (\text{PVIF}_{10\%,10})$ $\text{PV} = \\$10,000 \times (.386)$ $\text{PV} = \\$3,860.00$ Calculator solution: \$3,855.43</p>	<p>B. $\text{PV} = \\$3,000 \times (\text{PVIF}_{10\%,20})$ $\text{PV} = \\$3,000 \times (.149)$ $\text{PV} = \\$447.00$ Calculator solution: \$445.93</p> <p>D. $\text{PV} = \\$15,000 \times (\text{PVIF}_{10\%,40})$ $\text{PV} = \\$15,000 \times (.022)$ $\text{PV} = \\$330.00$ Calculator solution: \$331.42</p>
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Purchase

Do Not Purchase

A

B

C

D

4-18 LG 3: Future Value of an Annuity

a. Future Value of an Ordinary Annuity vs. Annuity Due

(1) Ordinary Annuity

$$FVA_{k\%,n} = PMT \times (FVIFA_{k\%,n})$$

A $FVA_{8\%,10} = \$2,500 \times 14.487$
 $FVA_{8\%,10} = \$36,217.50$
 Calculator solution: \$36,216.41

B $FVA_{12\%,6} = \$500 \times 8.115$
 $FVA_{12\%,6} = \$4,057.50$
 Calculator solution: \$4,057.59

C $FVA_{20\%,5} = \$30,000 \times 7.442$
 $FVA_{20\%,5} = \$223,260$
 Calculator solution: \$223,248

(2) Annuity Due

$$FVA_{due} = PMT \times [(FVIFA_{k\%,n} \times (1 + k))]$$

$FVA_{due} = \$2,500 \times (14.487 \times 1.08)$
 $FVA_{due} = \$39,114.90$
 Calculator solution: \$39,113.72

$FVA_{due} = \$500 \times (8.115 \times 1.12)$
 $FVA_{due} = \$4,544.40$
 Calculator solution: \$4,544.51

$FVA_{due} = \$30,000 \times (7.442 \times 1.20)$
 $FVA_{due} = \$267,912$
 Calculator solution: \$267,897.60

(1) Ordinary Annuity

D $FVA_{9\%,8} = \$11,500 \times 11.028$
 $FVA_{9\%,8} = \$126,822$
 Calculator solution: \$126,827.45

(2) Annuity Due

$FVA_{due} = \$11,500 \times (11.028 \times 1.09)$
 $FVA_{due} = \$138,235.98$
 Calculator solution: \$138,241.92

E $FVA_{14\%,30} = \$6,000 \times 356.787$ $FVA_{due} = \$6,000 \times (356.787 \times 1.14)$
 $FVA_{14\%,30} = \$2,140,722$ $FVA_{due} = \$2,440,422.00$
 Calculator solution: \$2,140,721.10 Calculator solution: \$2,440,422.03

b. The annuity due results in a greater future value in each case. By depositing the payment at the beginning rather than at the end of the year, it has one additional year of compounding.

4-19 LG 3: Present Value of an Annuity: $PV_n = PMT \times (PVIFA_{i\%,n})$

a. Present Value of an Ordinary Annuity vs. Annuity Due

(1) Ordinary Annuity

$$PVA_{k\%,n} = PMT \times (PVIFA_{i\%,n})$$

A $PVA_{7\%,3} = \$12,000 \times 2.624$
 $PVA_{7\%,3} = \$31,488$
 Calculator solution: \$31,491.79

B $PVA_{12\%,15} = \$55,000 \times 6.811$
 $PVA_{12\%,15} = \$374,605$
 Calculator solution: \$374,597.55

C $PVA_{20\%,9} = \$700 \times 4.031$
 $PVA_{20\%,9} = \$2,821.70$
 Calculator solution: \$2,821.68

(2) Annuity Due

$$PVA_{due} = PMT \times [(PVIFA_{i\%,n} \times (1 + k))]$$

$PVA_{due} = \$12,000 \times (2.624 \times 1.07)$
 $PVA_{due} = \$33,692$
 Calculator solution: \$33,696.22

$PVA_{due} = \$55,000 \times (6.811 \times 1.12)$
 $PVA_{due} = \$419,557.60$
 Calculator solution: \$419,549.25

$PVA_{due} = \$700 \times (4.031 \times 1.20)$
 $PVA_{due} = \$3,386.04$
 Calculator solution: \$3,386.01

D $PVA_{5\%,7} = \$140,000 \times 5.786$ $PVA_{\text{due}} = \$140,000 \times (5.786 \times 1.05)$
 $PVA_{5\%,7} = \$810,040$ $PVA_{\text{due}} = \$850,542$
 Calculator solution: \$810,092.28 Calculator solution: \$850,596.89

E $PVA_{10\%,5} = \$22,500 \times 3.791$ $PVA_{\text{due}} = \$22,500 \times (2.791 \times 1.10)$
 $PVA_{10\%,5} = \$85,297.50$ $PVA_{\text{due}} = \$93,827.25$
 Calculator solution: \$85,292.70 Calculator solution: \$93,821.97

- b.** The annuity due results in a greater present value in each case. By depositing the payment at the beginning rather than at the end of the year, it has one less year to discount back.

4-20 LG 3: Ordinary Annuity versus Annuity Due

a. **Annuity C (Ordinary)** **Annuity D (Due)**
 $FVA_{i\%,n} = PMT \times (FVIFA_{i\%,n})$ $FVA_{\text{due}} = PMT \times [FVIFA_{i\%,n} \times (1 + i)]$

(1) $FVA_{10\%,10} = \$2,500 \times 15.937$ $FVA_{\text{due}} = \$2,200 \times (15.937 \times 1.10)$
 $FVA_{10\%,10} = \$39,842.50$ $FVA_{\text{due}} = \$38,567.54$
 Calculator solution: \$39,843.56 Calculator solution: \$38,568.57

(2) $FVA_{20\%,10} = \$2,500 \times 25.959$ $FVA_{\text{due}} = \$2,200 \times (25.959 \times 1.20)$
 $FVA_{20\%,10} = \$64,897.50$ $FVA_{\text{due}} = \$68,531.76$
 Calculator solution: \$64,896.71 Calculator solution: \$68,530.92

- b.** (1) At the end of year 10, at a rate of 10%, Annuity C has a greater value (\$39,842.50 vs. \$38,567.54).
 (2) At the end of year 10, at a rate of 20%, Annuity D has a greater value (\$68,531.76 vs. \$64,896.71).

c. **Annuity C (Ordinary)** **Annuity D (Due)**
 $PVA_{i\%,n} = PMT \times (FVIFA_{i\%,n})$ $PVA_{\text{due}} = PMT \times [FVIFA_{i\%,n} \times (1 + i)]$

(1) $PVA_{10\%,10} = \$2,500 \times 6.145$ $PVA_{\text{due}} = \$2,200 \times (6.145 \times 1.10)$
 $PVA_{10\%,10} = \$15,362.50$ $PVA_{\text{due}} = \$14,870.90$
 Calculator solution: \$15,361.42 Calculator solution: \$14,869.85

(2) $PVA_{20\%,10} = \$2,500 \times 4.192$ $PVA_{\text{due}} = \$2,200 \times (4.192 \times 1.20)$
 $PVA_{20\%,10} = \$10,480$ $PVA_{\text{due}} = \$11,066.88$
 Calculator solution: \$10,481.18 Calculator solution: \$11,068.13

- d.** (1) At the beginning of the 10 years, at a rate of 10%, Annuity C has a greater value (\$15,362.50 vs. \$14,870.90).
 (2) At the beginning of the 10 years, at a rate of 20%, Annuity D has a greater value (\$11,066.88 vs. \$10,480.00).

- e.** Annuity C, with an annual payment of \$2,500 made at the end of the year, has a higher present value at 10% than Annuity D with an annual payment of \$2,200 made at the beginning of the year. When the rate is increased to 20%, the shorter period of time to discount at the higher rate results in a larger value for Annuity D, despite the lower payment.

4-21 LG 3: Future Value of a Retirement Annuity

$$\begin{array}{ll} \text{a.} & \text{FVA}_{40} = \$2,000 \times (\text{FVIFA}_{10\%,40}) \\ & \text{FVA}_{40} = \$2,000 \times (442.593) \\ & \text{FVA}_{40} = \$885,186 \\ & \text{Calculator solution: } \$885,185.11 \end{array} \quad \begin{array}{ll} \text{b.} & \text{FVA}_{30} = \$2,000 \times (\text{FVIFA}_{10\%,30}) \\ & \text{FVA}_{30} = \$2,000 \times (164.494) \\ & \text{FVA}_{30} = \$328,988 \\ & \text{Calculator solution: } \$328,988.05 \end{array}$$

c. By delaying the deposits by 10 years the total opportunity cost is \$556,198. This difference is due to both the lost deposits of \$20,000 (\$2,000 x 10yrs.) and the lost compounding of interest on all of the money for 10 years.

d. Annuity Due:

$$\begin{array}{l} \text{FVA}_{40} = \$2,000 \times (\text{FVIFA}_{10\%,40}) \times (1 + .10) \\ \text{FVA}_{40} = \$2,000 \times (486.852) \\ \text{FVA}_{40} = \$973,704 \\ \text{Calculator solution: } \$973,703.62 \end{array}$$

Annuity Due:

$$\begin{array}{l} \text{FVA}_{30} = \$2,000 \times (\text{FVIFA}_{10\%,30}) \times (1.10) \\ \text{FVA}_{30} = \$2,000 \times (180.943) \\ \text{FVA}_{30} = \$361,886 \\ \text{Calculator solution: } \$361,886.85 \end{array}$$

Both deposits increased due to the extra year of compounding from the beginning-of-year deposits instead of the end-of-year deposits. However, the incremental change in the 40 year annuity is much larger than the incremental compounding on the 30 year deposit (\$88,518 versus \$32,898) due to the larger sum on which the last year of compounding occurs.

4-22 LG 3: Present Value of a Retirement Annuity

$$\begin{array}{l} \text{PVA} = \text{PMT} \times (\text{PVIFA}_{9\%,25}) \\ \text{PVA} = \$12,000 \times (9.823) \\ \text{PVA} = \$117,876.00 \\ \text{Calculator solution: } \$117,870.96 \end{array}$$

4-23 LG 3: Funding Your Retirement

$$\begin{array}{ll} \text{a.} & \text{PVA} = \text{PMT} \times (\text{PVIFA}_{11\%,30}) \\ & \text{PVA} = \$20,000 \times (8.694) \\ & \text{PVA} = \$173,880.00 \\ & \text{Calculator solution: } \$173,875.85 \end{array} \quad \begin{array}{ll} \text{b.} & \text{PV} = \text{FV} \times (\text{PVIF}_{9\%,20}) \\ & \text{PV} = \$173,880 \times (.178) \\ & \text{PV} = \$30,950.64 \\ & \text{Calculator solution: } \$31,024.82 \end{array}$$

c. Both values would be lower. In other words, a smaller sum would be needed in 20 years for the annuity and a smaller amount would have to be put away today to accumulate the needed future sum.

4-24 LG 2, 3: Present Value of an Annuity versus a Lump Sum

$$\begin{array}{l} \text{a.} & \text{PVA}_n = \text{PMT} \times (\text{PVIFA}_{i\%,n}) \\ & \text{PVA}_{25} = \$40,000 \times (\text{PVIFA}_{5\%,25}) \\ & \text{PVA}_{25} = \$40,000 \times 14.094 \end{array}$$

$$PVA_{25} = \$563,760$$

Calculator solution: \$563,757.78

At 5%, taking the award as an annuity is better; the present value is \$563,760, compared to receiving \$500,000 as a lump sum.

b. $PVA_n = \$40,000 \times (PVIFA_{7\%, 25})$
 $PVA_{25} = \$40,000 \times (11.654)$
 $PVA_{25} = \$466,160$
 Calculator solution: \$466,143.33

At 7%, taking the award as a lump sum is better; the present value of the annuity is only \$466,160, compared to the \$500,000 lump sum payment.

c. Because the annuity is worth more than the lump sum at 5% and less at 7%, try 6%:

$$PV_{25} = \$40,000 \times (PVIFA_{6\%, 25})$$

$$PV_{25} = \$40,000 \times 12.783$$

$$PV_{25} = \$511,320$$

The rate at which you would be indifferent is greater than 6%; about 6.25% Calculator solution: 6.24%

4-25 LG 3: Perpetuities: $PV_n = PMT \times (PVIFA_{i\%, \infty})$

a. Case	PV Factor	b. $PMT \times (PVIFA_{i\%, \infty}) = PMT \times (1 \div i)$
A	$1 \div .08 = 12.50$	\$20,000 x 12.50 = \$ 250,000
B	$1 \div .10 = 10.00$	\$100,000 x 10.00 = \$1,000,000
C	$1 \div .06 = 16.67$	\$3,000 x 16.67 = \$ 50,000
D	$1 \div .05 = 20.00$	\$60,000 x 20.00 = \$1,200,000

4-26 LG 3: Creating an Endowment

a. $PV = PMT \times (PVIFA_{i\%, \infty})$	b. $PV = PMT \times (PVIFA_{i\%, \infty})$
$PV = (\$600 \times 3) \times (1 \div i)$	$PV = (\$600 \times 3) \times (1 \div i)$
$PV = \$1,800 \times (1 \div .06)$	$PV = \$1,800 \times (1 \div .09)$
$PV = \$1,800 \times (16.67)$	$PV = \$1,800 \times (11.11)$
$PV = \$30,006$	$PV = \$19,998$

4-27 LG 4: Future Value of a Mixed Stream

A.

Cash Flow Stream	Year	Number of Years to Compound	FV = CF x FVIF _{12%, n}	Future Value
A	1	3	\$ 900 x 1.405	= \$1,264.50
	2	2	1,000 x 1.254	= 1,254.00
	3	1	1,200 x 1.120	= 1,344.00
				<u>\$3,862.50</u>
			Calculator Solution:	\$3,862.84
B	1	5	\$ 30,000 x 1.762	= \$52,860.00
	2	4	25,000 x 1.574	= 39,350.00
	3	3	20,000 x 1.405	= 28,100.00

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4	2	10,000 x 1.254	=	12,540.00'
5	1	5,000 x 1.120	=	5,600.00
				<u>\$138,450.00</u>

Calculator Solution: \$138,450.79.

C	1	4	\$ 1,200 x 1.574	=	\$1,888.80
	2	3	1,200 x 1.405	=	1,686.00
	3	2	1,000 x 1.254	=	1,254.00
	4	1	1,900 x 1.120	=	<u>2,128.00</u>
					<u>\$6,956.80</u>

Calculator Solution: \$6,956.53

- b.** If payments are made at the beginning of each period the present value of each of the end-of-period cash flow streams will be multiplied by $(1 + i)$ to get the present value of the beginning-of-period cash flows.

$$A \quad \$3,862.50 (1 + .12) = \$4,326.00$$

$$B \quad \$138,450.00 (1 + .12) = \$155,064.00$$

$$C \quad \$6,956.80 (1 + .12) = \$7,791.62$$

4-28 LG 4: Future Value of Lump Sum versus a Mixed Stream

Lump Sum Deposit

$$FV_5 = PV \times (FVIF_{7\%,5})$$

$$FV_5 = \$24,000 \times (1.403)$$

$$FV_5 = \$33,672.00$$

Calculator solution: \$33,661.24

Mixed Stream of Payments

Beginning of Year	Number of Years to Compound	FV = CF x FVIF _{7%,n}	Future Value
1	5	\$ 2,000 x 1.403	= \$2,806.00
2	4	\$ 4,000 x 1.311	= \$5,244.00
3	3	\$ 6,000 x 1.225	= \$7,350.00
4	2	\$ 8,000 x 1.145	= \$9,160.00
5	1	\$ 10,000 x 1.070	= <u>\$10,700.00</u>
			<u>\$35,260.00</u>

Calculator Solution: \$35,257.74

Gina should select the stream of payments over the front-end lump sum payment. Her future wealth will be higher by \$1,588.

4-29 LG 4: Present Value-Mixed Stream

Cash Flow

Stream	Year	CF	x	PVIF _{12%,n}	=	Present Value
A	1	-\$2000	x	.893	=	- \$ 1,786
	2	3,000	x	.797	=	2,391
	3	4,000	x	.712	=	2,848
	4	6,000	x	.636	=	3,816

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$$5 \quad 8,000 \quad \times \quad .567 \quad = \quad \underline{4,536}$$

$$\underline{\underline{\$ 11,805}}$$

$$\text{Calculator solution} \quad \$ 11,805.51$$

$$\mathbf{B} \quad 1 \quad \$10,000 \quad \times \quad .893 \quad = \quad \$ 8,930$$

$$2-5 \quad 5,000 \quad \times \quad 2.712^* \quad = \quad 13,560$$

$$6 \quad 7,000 \quad \times \quad .507 \quad = \quad \underline{3,549}$$

$$\underline{\underline{\$26,039}}$$

$$\text{Calculator solution:} \quad \$26,034.59$$

* Sum of PV factors for years 2 - 5

$$\mathbf{C} \quad 1-5 \quad - \$10,000 \quad \times \quad 3.605^* \quad \$36,050$$

$$6-10 \quad 8,000 \quad \times \quad 2.045^{**} \quad \underline{16,360}$$

$$\underline{\underline{\$52,410}}$$

$$\text{Calculator Solution} \quad \$52,411.34$$

* PVIFA for 12% 5 years

** (PVIFA for 12%,10 years) - (PVIFA for 12%,5 years)

4-30 LG 4: Present Value-Mixed Stream

a. Cash Flow

Stream	Year	CF	x	PVIF _{15%,n}	=	Present Value
A	1	\$50,000	x	.870	=	\$ 43,500
	2	40,000	x	.756	=	30,240
	3	30,000	x	.658	=	19,740
	4	20,000	x	.572	=	11,440
	5	10,000	x	.497	=	<u>4,970</u>
						<u>\$ 109,890</u>
						Calculator solution \$ 109,856.33

Cash Flow

Stream	Year	CF	x	PVIF _{15%,n}	=	Present Value
B	1	\$10,000	x	.870	=	\$ 8,700
	2	20,000	x	.756	=	15,120
	3	30,000	x	.658	=	19,740
	4	40,000	x	.572	=	22,880
	5	50,000	x	.497	=	<u>24,850</u>
						<u>\$91,290</u>
						Calculator solution \$91,272.98

b. Cash flow stream A, with a present value of \$109,890, is higher than cash flow stream B's present value of \$91,290 because the larger cash inflows occur in A in the early years when their present value is greater, while the smaller cash flows are received further in the future.

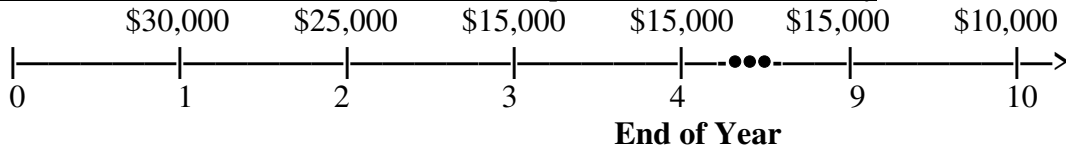
4-31 LG 1, 4: Present Value of a Mixed Stream

a.

Cash Flows

Find out more at www.kawsarbd1.weebly.com

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b.

Cash Flow Stream	Year	CF	x	PVIF _{12%,n}	=	Present Value
A	1	\$30,000	x	.893	=	\$ 26,790
	2	25,000	x	.797	=	19,925
	3-9	15,000	x	3.639*	=	54,585
	10	10,000	x	.322	=	3,220
						<u>\$ 104,520</u>
				Calculator solution		\$ 104,508.28

* The PVIF for this 7-year annuity is obtained by summing together the PVIFs of 12% for periods 3 through 9. This factor can also be calculated by taking the PVIFA_{12%,7} and multiplying by the PVIF_{12%,2}.

c. Harte should accept the series of payments offer. The present value of that mixed stream of payments is greater than the \$100,000 immediate payment.

4-32 LG 5: Funding Budget Shortfalls

a.

Year	Budget Shortfall	x	PVIF _{8%,n}	=	Present Value
1	\$5,000	x	.926	=	\$ 4,630
2	4,000	x	.857	=	3,428
3	6,000	x	.794	=	4,764
4	10,000	x	.735	=	7,350
5	3,000	x	.681	=	2,043
					<u>\$ 22,215</u>
				Calculator solution:	\$22,214.03

A deposit of \$22,215 would be needed to fund the shortfall for the pattern shown in the table.

b. An increase in the earnings rate would reduce the amount calculated in part **a**. The higher rate would lead to a larger interest being earned each year on the investment. The larger interest amounts will permit a decrease in the initial investment to obtain the same future value available for covering the shortfall.

4-33 LG 4: Relationship between Future Value and Present Value-Mixed Stream

a. Present Value

Year	CF	x	PVIF _{5%,n}	=	Present Value
1	\$ 800	x	.952	=	\$ 761.60
2	900	x	.907	=	816.30
3	1,000	x	.864	=	864.00
4	1,500	x	.822	=	1,233.00
5	2,000	x	.784	=	1,568.00
					<u>\$5,242.90</u>
			Calculator Solution:		<u>\$5,243.17</u>

b. The maximum you should pay is \$5,242.90.

c. A higher 7% discount rate will cause the present value of the cash flow stream to be lower than \$5,242.90.

4-34 LG 5: Changing Compounding Frequency

(1) Compounding Frequency: $FV_n = PV \times FVIF_{i\%/m, n \times m}$

a. Annual

12 %, 5 years

$$FV_5 = \$5,000 \times (1.762)$$

$$FV_5 = \$8,810$$

Calculator solution: \$8,811.71

Semiannual

12% ÷ 2 = 6%, 5 x 2 = 10 periods

$$FV_5 = \$5,000 \times (1.791)$$

$$FV_5 = \$8,955$$

Calculator solution: \$8,954.24

Quarterly

12% ÷ 4 = 3%, 5 x 4 = 20 periods

$$FV_5 = \$5,000 (1.806)$$

$$FV_5 = \$9,030$$

Calculator solution: \$9,030.56

b. Annual

16%, 6 years

$$FV_6 = \$5,000 (2.436)$$

$$FV_6 = \$12,180$$

Calculator solution: \$12,181.98

Semiannual

16% ÷ 2 = 8%, 6 x 2 = 12 periods

$$FV_6 = \$5,000 (2.518)$$

$$FV_6 = \$12,590$$

Calculator solution: \$12,590.85

Quarterly

16% ÷ 4 = 4%, 6 x 4 = 24 periods

$$FV_6 = \$5,000 (2.563)$$

$$FV_6 = \$12,815$$

Calculator solution: \$12,816.52

c. Annual

20%, 10 years

Semiannual

20% ÷ 2 = 10%, 10 x 2 = 20 periods

$$FV_{10} = \$5,000 \times (6.192)$$

$$FV_{10} = \$30,960$$

$$\text{Calculator solution: } \$30,958.68$$

$$FV_{10} = \$5,000 \times (6.727)$$

$$FV_{10} = \$33,635$$

$$\text{Calculator solution: } \$33,637.50$$

Quarterly

$$20\% \div 4 = 5\%, 10 \times 4 = 40 \text{ periods}$$

$$FV_{10} = \$5,000 \times (7.040)$$

$$FV_{10} = \$35,200$$

$$\text{Calculator solution: } \$35,199.94$$

(2) Effective Interest Rate: $i_{\text{eff}} = (1 + i/m)^m - 1$

a. Annual

$$i_{\text{eff}} = (1 + .12/1)^1 - 1$$

$$i_{\text{eff}} = (1.12)^1 - 1$$

$$i_{\text{eff}} = (1.12) - 1$$

$$i_{\text{eff}} = .12 = 12\%$$

Semiannual

$$i_{\text{eff}} = (1 + .12/2)^2 - 1$$

$$i_{\text{eff}} = (1.06)^2 - 1$$

$$i_{\text{eff}} = (1.124) - 1$$

$$i_{\text{eff}} = .124 = 12.4\%$$

Quarterly

$$i_{\text{eff}} = (1 + .12/4)^4 - 1$$

$$i_{\text{eff}} = (1.03)^4 - 1$$

$$i_{\text{eff}} = (1.126) - 1$$

$$i_{\text{eff}} = .126 = 12.6\%$$

b. Annual

$$i_{\text{eff}} = (1 + .16/1)^1 - 1$$

$$i_{\text{eff}} = (1.16)^1 - 1$$

$$i_{\text{eff}} = (1.16) - 1$$

$$i_{\text{eff}} = .16 = 16\%$$

Semiannual

$$i_{\text{eff}} = (1 + .16/2)^2 - 1$$

$$i_{\text{eff}} = (1.08)^2 - 1$$

$$i_{\text{eff}} = (1.166) - 1$$

$$i_{\text{eff}} = .166 = 16.6\%$$

Quarterly

$$i_{\text{eff}} = (1 + .16/4)^4 - 1$$

$$i_{\text{eff}} = (1.04)^4 - 1$$

$$i_{\text{eff}} = (1.170) - 1$$

$$i_{\text{eff}} = .170 = 17\%$$

c. Annual

$$i_{\text{eff}} = (1 + .20/1)^1 - 1$$

$$i_{\text{eff}} = (1.20)^1 - 1$$

$$i_{\text{eff}} = (1.20) - 1$$

$$i_{\text{eff}} = .20 = 20\%$$

Semiannual

$$i_{\text{eff}} = (1 + .20/2)^2 - 1$$

$$i_{\text{eff}} = (1.10)^2 - 1$$

$$i_{\text{eff}} = (1.210) - 1$$

$$i_{\text{eff}} = .210 = 21\%$$

Quarterly

$$i_{\text{eff}} = (1 + .20/4)^4 - 1$$

$$i_{\text{eff}} = (1.05)^4 - 1$$

$$i_{\text{eff}} = (1.216) - 1$$

$$i_{\text{eff}} = .216 = 21.6\%$$

4-35 LG 5: Compounding Frequency, Future Value, and Effective Annual Rates

a. Compounding Frequency: $FV_n = PV \times FVIF_{i\%,n}$

- | | |
|--|---|
| <p>A $FV_5 = \\$2,500 \times (FVIF_{3\%,10})$
 $FV_5 = \\$2,500 \times (1.344)$
 $FV_5 = \\$3,360$
 Calculator solution: \$3,359.79</p> | <p>B $FV_3 = \\$50,000 \times (FVIF_{2\%,18})$
 $FV_3 = \\$50,000 \times (1.428)$
 $FV_3 = \\$71,400$
 Calculator solution: \$71,412.31</p> |
| <p>C $FV_{10} = \\$1,000 \times (FVIF_{5\%,10})$
 $FV_{10} = \\$1,000 \times (1.629)$
 $FV_{10} = \\$1,629$
 Calculator solution: \$1,628.89</p> | <p>D $FV_6 = \\$20,000 \times (FVIF_{4\%,24})$
 $FV_6 = \\$20,000 \times (2.563)$
 $FV_6 = \\$51,260$
 Calculator solution: \$51,266.08</p> |

b. Effective Interest Rate: $i_{\text{eff}} = (1 + i\%/m)^m - 1$

- | | |
|---|--|
| <p>A $i_{\text{eff}} = (1 + .06/2)^2 - 1$
 $i_{\text{eff}} = (1 + .03)^2 - 1$
 $i_{\text{eff}} = (1.061) - 1$
 $i_{\text{eff}} = .061 = 6.1\%$</p> | <p>B $i_{\text{eff}} = (1 + .12/6)^6 - 1$
 $i_{\text{eff}} = (1 + .02)^6 - 1$
 $i_{\text{eff}} = (1.126) - 1$
 $i_{\text{eff}} = .126 = 12.6\%$</p> |
| <p>C $i_{\text{eff}} = (1 + .05/1)^1 - 1$
 $i_{\text{eff}} = (1 + .05)^1 - 1$
 $i_{\text{eff}} = (1.05) - 1$
 $i_{\text{eff}} = .05 = 5\%$</p> | <p>D $i_{\text{eff}} = (1 + .16/4)^4 - 1$
 $i_{\text{eff}} = (1 + .04)^4 - 1$
 $i_{\text{eff}} = (1.170) - 1$
 $i_{\text{eff}} = .17 = 17\%$</p> |

c. The effective rates of interest rise relative to the stated nominal rate with increasing compounding frequency.

4-36 LG 2: Continuous Compounding: $FV_{\text{cont.}} = PV \times e^x$ ($e = 2.7183$)

- A** $FV_{\text{cont.}} = \$1,000 \times e^{.18} = \$1,197.22$
- B** $FV_{\text{cont.}} = \$600 \times e^1 = \$1,630.97$
- C** $FV_{\text{cont.}} = \$4,000 \times e^{.56} = \$7,002.69$
- D** $FV_{\text{cont.}} = \$2,500 \times e^{.48} = \$4,040.19$

Note: If calculator doesn't have e^x key, use y^x key, substituting 2.7183 for y .

4-37 LG 5: Compounding Frequency and Future Value

- | | |
|--|--|
| <p>a. (1) $FV_{10} = \\$2,000 \times (FVIF_{8\%,10})$
 $FV_{10} = \\$2,000 \times (2.159)$
 $FV_{10} = \\$4,318$
 Calculator solution: \$4,317.85</p> | <p>(2) $FV_{10} = \\$2,000 \times (FVIF_{4\%,20})$
 $FV_{10} = \\$2,000 \times (2.191)$
 $FV_{10} = \\$4,382$
 Calculator solution: \$4,382.25</p> |
| <p>(3) $FV_{10} = \\$2,000 \times (FVIF_{.022\%,3,600})$
 $FV_{10} = \\$2,000 \times (2.208)$
 $FV_{10} = \\$4,416$
 Calculator solution: \$4,415.23</p> | <p>(4) $FV_{10} = \\$2,000 \times (e^8)$
 $FV_{10} = \\$2,000 \times (2.226)$
 $FV_{10} = \\$4,452$
 Calculator solution: \$4,451.08</p> |
-
- | | |
|--|---|
| <p>b. (1) $i_{\text{eff}} = (1 + .08/1)^1 - 1$
 $i_{\text{eff}} = (1 + .08)^1 - 1$
 $i_{\text{eff}} = (1.08) - 1$
 $i_{\text{eff}} = .08 = 8\%$</p> | <p>(2) $i_{\text{eff}} = (1 + .08/2)^2 - 1$
 $i_{\text{eff}} = (1 + .04)^2 - 1$
 $i_{\text{eff}} = (1.082) - 1$
 $i_{\text{eff}} = .082 = 8.2\%$</p> |
|--|---|

$$\begin{aligned} (3) \quad i_{\text{eff}} &= (1 + .08/360)^{360} - 1 \\ i_{\text{eff}} &= (1 + .00022)^{360} - 1 \\ i_{\text{eff}} &= (1.0824) - 1 \\ i_{\text{eff}} &= .0824 = 8.24\% \end{aligned}$$

$$\begin{aligned} (4) \quad i_{\text{eff}} &= (e^k - 1) \\ i_{\text{eff}} &= (e^{.08} - 1) \\ i_{\text{eff}} &= (1.0833 - 1) \\ i_{\text{eff}} &= .0833 = 8.33\% \end{aligned}$$

- c. Compounding continuously will result in \$134 more dollars at the end of the 10 year period than compounding annually.
- d. The more frequent the compounding the larger the future value. This result is shown in part a by the fact that the future value becomes larger as the compounding period moves from annually to continuously. Since the future value is larger for a given fixed amount invested, the effective return also increases directly with the frequency of compounding. In part b we see this fact as the effective rate moved from 8% to 8.33% as compounding frequency moved from annually to continuously.

4-38 LG 5: Comparing Compounding Periods

a. $FV_n = PV \times FVIF_{i\%,n}$

(1) **Annually:** $FV = PV \times FVIF_{12\%,2} = \$15,000 \times (1.254) = \$18,810$
 Calculator solution: \$18,816

(2) **Quarterly:** $FV = PV \times FVIF_{3\%,8} = \$15,000 \times (1.267) = \$19,005$
 Calculator solution: \$19,001.55

(3) **Monthly:** $FV = PV \times FVIF_{1\%,24} = \$15,000 \times (1.270) = \$19,050$
 Calculator solution: \$19,046.02

(4) **Continuously:** $FV_{\text{cont.}} = PV \times e^{xt}$
 $FV = PV \times 2.7183^{.24} = \$15,000 \times 1.27125 = \$19,068.77$
 Calculator solution: \$19,068.74

- b. The future value of the deposit increases from \$18,810 with annual compounding to \$19,068.77 with continuous compounding, demonstrating that future value increases as compounding frequency increases.
- c. The maximum future value for this deposit is \$19,068.77, resulting from continuous compounding, which assumes compounding at every possible interval.

4-39 LG 3, 5: Annuities and Compounding: $FVA_n = PMT \times (FVIFA_{i\%,n})$

a.

(1) **Annual**

$$\begin{aligned} FVA_{10} &= \$300 \times (FVIFA_{8\%,10}) \\ FVA_{10} &= \$300 \times (14.487) \\ FVA_{10} &= \$4,346.10 \\ \text{Calculator solution:} &= \$4,345.97 \end{aligned}$$

(2) **Semiannual**

$$\begin{aligned} FVA_{10} &= \$150 \times (FVIFA_{4\%,20}) \\ FVA_{10} &= \$150 \times (29.778) \\ FVA_{10} &= \$4,466.70 \\ \text{Calculator Solution:} &= \$4,466.71 \end{aligned}$$

(3) **Quarterly**

$$\begin{aligned} FVA_{10} &= \$75 \times (FVIFA_{2\%,40}) \\ FVA_{10} &= \$75 \times (60.402) \\ FVA_{10} &= \$4,530.15 \\ \text{Calculator solution:} &= \$4,530.15 \end{aligned}$$

- b. The sooner a deposit is made the sooner the funds will be available to earn interest and contribute to compounding. Thus, the sooner the deposit and the more frequent the compounding, the larger the future sum will be.

4-40 LG 6: Deposits to Accumulate Growing Future Sum: $PMT = \frac{FVA_n}{FVIFA_{i\%, n}}$

Case	Terms	Calculation	Payment
A	12%, 3 yrs.	$PMT = \$5,000 \div 3.374$ Calculator solution:	$= \$1,481.92$ $\$1,481.74$
B	7%, 20 yrs.	$PMT = \$100,000 \div 40.995$ Calculator solution:	$= \$2,439.32$ $\$2,439.29$
C	10%, 8 yrs.	$PMT = \$30,000 \div 11.436$ Calculator solution:	$= \$2,623.29$ $\$2,623.32$
D	8%, 12 yrs.	$PMT = \$15,000 \div 18.977$ Calculator solution:	$= \$790.43$ $\$790.43$

4-41 LG 6: Creating a Retirement Fund

- a. $PMT = FVA_{42} \div (FVIFA_{8\%, 42})$
 $PMT = \$220,000 \div (304.244)$
 $PMT = \$723.10$
- b. $FVA_{42} = PMT \times (FVIFA_{8\%, 42})$
 $FVA_{42} = \$600 \times (304.244)$
 $FVA_{42} = \$182,546.40$

4-42 LG 6: Accumulating a Growing Future Sum

$FV_n = PV \times (FVIF_{i\%, n})$
 $FV_{20} = \$85,000 \times (FVIF_{6\%, 20})$
 $FV_{20} = \$85,000 \times (3.207)$
 $FV_{20} = \$272,595 = \text{Future value of retirement home in 20 years.}$
 Calculator solution: \$ 272,606.52

$PMT = FV \div (FVIFA_{i\%, n})$
 $PMT = \$272,595 \div (FVIFA_{10\%, 20})$
 $PMT = \$272,595 \div (57.274)$
 $PMT = \$4,759.49$
 Calculator solution: \$4,759.61 = annual payment required.

4-43 LG 3, 5: Deposits to Create a Perpetuity

- a. Present value of a perpetuity = $PMT \times (1 \div i)$
 $= \$6,000 \times (1 \div .10)$
 $= \$6,000 \times 10$
 $= \$60,000$
- b. $PMT = FVA \div (FVIFA_{10\%, 10})$
 $PMT = \$60,000 \div (15.937)$
 $PMT = \$3,764.82$
 Calculator solution: \$ 3,764.72

4-44 LG 2, 3, 6: Inflation, Future Value, and Annual Deposits

- a. $FV_n = PV \times (FVIF_{i\%, n})$
 $FV_{20} = \$200,000 \times (FVIF_{5\%, 25})$
 $FV_{20} = \$200,000 \times (3.386)$

$FV_{20} = \$677,200$ = Future value of retirement home in 25 years.

Calculator solution: \$ 677,270.99

b. $PMT = FV \div (FVIFA_{i\%,n})$
 $PMT = \$677,200 \div (FVIFA_{9\%,25})$
 $PMT = \$677,200 \div (84.699)$
 $PMT = \$7,995.37$

Calculator solution: \$7,995.19 = annual payment required.

- c.** Since John will have an additional year on which to earn interest at the end of the 25 years his annuity deposit will be smaller each year. To determine the annuity amount John will first discount back the \$677,200 one period.

$$PV_{24} = \$677,200 \times .9174 = \$621,263.28$$

John can solve for his annuity amount using the same calculation as in part b.

$$PMT = FV \div (FVIFA_{i\%,n})$$

$$PMT = \$621,263.78 \div (FVIFA_{9\%,25})$$

$$PMT = \$621,263.78 \div (84.699)$$

$$PMT = \$7,334.95$$

Calculator solution: \$7,334.78 = annual payment required.

4-45 LG 6: Loan Payment: $PMT = \frac{PVA}{PVIFA_{i\%,n}}$

Loan

A $PMT = \$12,000 \div (PVIFA_{8\%,3})$
 $PMT = \$12,000 \div 2.577$
 $PMT = \$4,656.58$
 Calculator solution: \$4,656.40

B $PMT = \$60,000 \div (PVIFA_{12\%,10})$
 $PMT = \$60,000 \div 5.650$
 $PMT = \$10,619.47$
 Calculator solution: \$10,619.05

C $PMT = \$75,000 \div (PVIFA_{10\%,30})$
 $PMT = \$75,000 \div 9.427$
 $PMT = \$7,955.87$
 Calculator Solution: \$7,955.94

D $PMT = \$4,000 \div (PVIFA_{15\%,5})$
 $PMT = \$4,000 \div 3.352$
 $PMT = \$1,193.32$
 Calculator solution: \$1,193.26

4-46 LG 6: Loan Amortization Schedule

a. $PMT = \$15,000 \div (PVIFA_{14\%,3})$
 $PMT = \$15,000 \div 2.322$
 $PMT = \$6,459.95$
 Calculator solution: \$6,460.97

b.	End of Year	Loan Payment	Beginning of Year Principal	Payments		End of Year Principal
				Interest	Principal	
	1	\$ 6,459.95	\$15,000.00	\$2,100.00	\$4,359.95	\$10,640.05
	2	\$ 6,459.95	10,640.05	1,489.61	4,970.34	5,669.71
	3	\$ 6,459.95	5,669.71	793.76	5,666.19	0

(The difference in the last year's beginning and ending principal is due to rounding.)

- c. Through annual end-of-the-year payments, the principal balance of the loan is declining, causing less interest to be accrued on the balance.

4-47 LG 6: Loan Interest Deductions

- a. $PMT = \$10,000 \div (PVIFA_{13\%,3})$
 $PMT = \$10,000 \div (2.361)$
 $PMT = \$4,235.49$
 Calculator solution: \$4,235.22

b.	End of Year	Loan Payment	Beginning of Year Principal	c.	Payments		End of Year Principal
					Interest	Principal	
	1	\$ 4,235.49	\$ 10,000.00	\$ 1,300.00	\$ 2,935.49		\$ 7,064.51
	2	4,235.49	7,064.51	918.39	3,317.10		3,747.41
	3	4,235.49	3,747.41	487.16	3,748.33		0

(The difference in the last year's beginning and ending principal is due to rounding.)

4-48 LG 6: Monthly Loan Payments

- a. $PMT = \$4,000 \div (PVIFA_{1\%,24})$
 $PMT = \$4,000 \div (21.243)$
 $PMT = \$188.28$
 Calculator solution: \$188.29
- b. $PMT = \$4,000 \div (PVIFA_{75\%,24})$
 $PMT = \$4,000 \div (21.889)$
 $PMT = \$182.74$
 Calculator solution: \$182.74

4-49 LG 6: Growth Rates

- | | |
|--|--|
| <p>a. $PV = FV_n \times PVIF_{i\%,n}$</p> <p>Case A</p> <p>$PV = FV_4 \times PVIF_{k\%,4\text{yrs.}}$
 $\\$500 = \\$800 \times PVIF_{k\%,4\text{yrs.}}$
 $.625 = PVIF_{k\%,4\text{yrs.}}$
 $12\% < k < 13\%$
 Calculator Solution: 12.47%</p> <p>B</p> <p>$PV = FV_9 \times PVIF_{i\%,9\text{yrs.}}$
 $\\$1,500 = \\$2,280 \times PVIF_{k\%,9\text{yrs.}}$
 $.658 = PVIF_{k\%,9\text{yrs.}}$
 $4\% < k < 5\%$
 Calculator solution: 4.76%</p> <p>C</p> <p>$PV = FV_6 \times PVIF_{i\%,6}$</p> | <p>b.</p> <p>Case A Same</p> <p>B Same</p> <p>C Same</p> |
|--|--|

$$\begin{aligned} \$2,500 &= \$2,900 \times \text{PVIF}_{k\%, 6 \text{ yrs.}} \\ .862 &= \text{PVIF}_{k\%, 6 \text{ yrs.}} \\ 2\% < k < 3\% \\ \text{Calculator solution: } 2.50\% \end{aligned}$$

- c. The growth rate and the interest rate should be equal, since they represent the same thing.

4-50 LG 6: Rate of Return: $PV_n = FV_n \times (\text{PVIF}_{i\%, n})$

a.

$$\begin{aligned} PV &= \$2,000 \times (\text{PVIF}_{i\%, 3 \text{ yrs.}}) \\ \$1,500 &= \$2,000 \times (\text{PVIF}_{i\%, 3 \text{ yrs.}}) \\ .75 &= \text{PVIF}_{i\%, 3 \text{ yrs.}} \\ 10\% < i < 11\% \\ \text{Calculator solution: } 10.06\% \end{aligned}$$

- b. Mr. Singh should accept the investment that will return \$2,000 because it has a higher return for the same amount of risk.

4-51 LG 6: Rate of Return and Investment Choice

<p>a. A</p> $\begin{aligned} PV &= \$8,400 \times (\text{PVIF}_{i\%, 6 \text{ yrs.}}) \\ \$5,000 &= \$8,400 \times (\text{PVIF}_{i\%, 6 \text{ yrs.}}) \\ .595 &= \text{PVIF}_{i\%, 6 \text{ yrs.}} \\ 9\% < i < 10\% \\ \text{Calculator solution: } 9.03\% \end{aligned}$	<p>B</p> $\begin{aligned} PV &= \$15,900 \times (\text{PVIF}_{i\%, 15 \text{ yrs.}}) \\ \$5,000 &= \$15,900 \times (\text{PVIF}_{i\%, 15 \text{ yrs.}}) \\ .314 &= \text{PVIF}_{i\%, 15 \text{ yrs.}} \\ 8\% < i < 9\% \\ \text{Calculator solution: } 8.02\% \end{aligned}$
<p>C</p> $\begin{aligned} PV &= \$7,600 \times (\text{PVIF}_{i\%, 4 \text{ yrs.}}) \\ \$5,000 &= \$7,600 \times (\text{PVIF}_{i\%, 4 \text{ yrs.}}) \\ .658 &= \text{PVIF}_{i\%, 4 \text{ yrs.}} \\ 11\% < i < 12\% \\ \text{Calculator solution: } 11.04\% \end{aligned}$	<p>D</p> $\begin{aligned} PV &= \$13,000 \times (\text{PVIF}_{i\%, 10 \text{ yrs.}}) \\ \$5,000 &= \$13,000 \times (\text{PVIF}_{i\%, 10 \text{ yrs.}}) \\ .385 &= \text{PVIF}_{i\%, 10 \text{ yrs.}} \\ 10\% < i < 11\% \\ \text{Calculator solution: } 10.03\% \end{aligned}$

- b. Investment C provides the highest return of the 4 alternatives. Assuming equal risk for the alternatives, Clare should choose C.

4-52 LG 6: Rate of Return-Annuity: $PVA_n = \text{PMT} \times (\text{PVIFA}_{i\%, n})$

$$\begin{aligned} \$10,606 &= \$2,000 \times (\text{PVIFA}_{i\%, 10 \text{ yrs.}}) \\ 5.303 &= \text{PVIFA}_{i\%, 10 \text{ yrs.}} \\ 13\% < i < 14\% \\ \text{Calculator solution: } 13.58\% \end{aligned}$$

4-53 LG 6: Choosing the Best Annuity: $PVA_n = \text{PMT} \times (\text{PVIFA}_{i\%, n})$

<p>a. Annuity A</p> $\begin{aligned} \$30,000 &= \$3,100 \times (\text{PVIFA}_{i\%, 20 \text{ yrs.}}) \\ 9.677 &= \text{PVIFA}_{i\%, 20 \text{ yrs.}} \\ 8\% < i < 9\% \\ \text{Calculator solution: } 8.19\% \end{aligned}$	<p>Annuity B</p> $\begin{aligned} \$25,000 &= \$3,900 \times (\text{PVIFA}_{i\%, 10 \text{ yrs.}}) \\ 6.410 &= \text{PVIFA}_{i\%, 10 \text{ yrs.}} \\ 9\% < i < 10\% \\ \text{Calculator solution: } 9.03\% \end{aligned}$
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Annuity C

Annuity D

Chapter 4 Time Value of Money

$$\begin{aligned} \$40,000 &= \$4,200 \times (\text{PVIFA}_{i\%,15 \text{ yrs.}}) & \$35,000 &= \$4,000 \times (\text{PVIFA}_{i\%,12 \text{ yrs.}}) \\ 9.524 &= \text{PVIFA}_{i\%,15 \text{ yrs.}} & 8.75 &= \text{PVIFA}_{i\%,12 \text{ yrs.}} \\ 6\% < i < 7\% & & 5\% < i < 6\% & \\ \text{Calculator solution: } 6.3\% & & \text{Calculator solution: } 5.23\% & \end{aligned}$$

- b. Loan B gives the highest rate of return at 9% and would be the one selected based upon Raina's criteria.

4-54 LG 6: Interest Rate for an Annuity

a. **Defendants interest rate assumption**

$$\begin{aligned} \$2,000,000 &= \$156,000 \times (\text{PVIFA}_{i\%,25 \text{ yrs.}}) \\ 12.821 &= \text{PVIFA}_{i\%,25 \text{ yrs.}} \\ 5\% < i < 6\% \\ \text{Calculator solution: } 5.97\% \end{aligned}$$

b. **Prosecution interest rate assumption**

$$\begin{aligned} \$2,000,000 &= \$255,000 \times (\text{PVIFA}_{i\%,25 \text{ yrs.}}) \\ 7.843 &= \text{PVIFA}_{i\%,25 \text{ yrs.}} \\ i &= 12\% \\ \text{Calculator solution: } 12.0\% \end{aligned}$$

- c. $\$2,000,000 = \text{PMT} \times (\text{PVIFA}_{9\%,25 \text{ yrs.}})$
 $\$2,000,000 = \text{PMT} (9.823)$
 $\text{PMT} = \$203,603.79$

4-55 LG 6: Loan Rates of Interest: $\text{PVA}_n = \text{PMT} \times (\text{PVIFA}_{i\%,n})$

a. **Loan A**

$$\begin{aligned} \$5,000 &= \$1,352.81 \times (\text{PVIFA}_{i\%,5 \text{ yrs.}}) \\ 3.696 &= \text{PVIFA}_{i\%,5 \text{ yrs.}} \\ i &= 11\% \end{aligned}$$

Loan B

$$\begin{aligned} \$5,000 &= \$1,543.21 \times (\text{PVIFA}_{i\%,4 \text{ yrs.}}) \\ 3.24 &= \text{PVIFA}_{i\%,4 \text{ yrs.}} \\ i &= 9\% \end{aligned}$$

Loan C

$$\begin{aligned} \$5,000 &= \$2,010.45 \times (\text{PVIFA}_{i\%,3 \text{ yrs.}}) \\ 2.487 &= \text{PVIFA}_{i\%,3 \text{ yrs.}} \\ i &= 10\% \end{aligned}$$

- b. Mr. Fleming should choose Loan B, which has the lowest interest rate.

4-56 LG 6: Number of Years – Single Amounts

A

$$\begin{aligned} \text{FV} &= \text{PV} \times (\text{FVIF}_{7\%,n \text{ yrs.}}) \\ \$1,000 &= \$300 \times (\text{FVIF}_{7\%,n \text{ yrs.}}) \\ 3.333 &= \text{FVIF}_{7\%,n \text{ yrs.}} \\ 17 < n < 18 \\ \text{Calculator solution: } 17.79 \end{aligned}$$

B

$$\begin{aligned} \text{FV} &= \$12,000 \times (\text{FVIF}_{5\%,n \text{ yrs.}}) \\ \$15,000 &= \$12,000 \times (\text{FVIF}_{5\%,n \text{ yrs.}}) \\ 1.250 &= \text{FVIF}_{5\%,n \text{ yrs.}} \\ 4 < n < 5 \\ \text{Calculator solutions: } 4.573 \end{aligned}$$

C

$$\begin{aligned} \text{FV} &= \text{PV} \times (\text{FVIF}_{10\%,n \text{ yrs.}}) \\ \$20,000 &= \$12,000 \times (\text{FVIF}_{10\%,n \text{ yrs.}}) \\ 1.667 &= \text{FVIF}_{10\%,n \text{ yrs.}} \\ 5 < n < 6 \end{aligned}$$

D

$$\begin{aligned} \text{FV} &= \$100 \times (\text{FVIF}_{9\%,n \text{ yrs.}}) \\ \$500 &= \$100 \times (\text{FVIF}_{9\%,n \text{ yrs.}}) \\ 5.00 &= \text{FVIF}_{9\%,n \text{ yrs.}} \\ 18 < n < 19 \end{aligned}$$

Calculator solution: 5.36

Calculator solution: 18.68

E

$$FV = PV \times (FVIF_{15\%,n \text{ yrs.}})$$

$$\$30,000 = \$7,500 \times (FVIF_{15\%,n \text{ yrs.}})$$

$$4.000 = FVIF_{15\%,n \text{ yrs.}}$$

$$9 < n < 10$$

Calculator solution: 9.92

4-57 LG 6: Time to Accumulate a Given Sum

a. $20,000 = \$10,000 \times (FVIF_{10\%,n \text{ yrs.}})$

$$2.000 = FVIF_{10\%,n \text{ yrs.}}$$

$$7 < n < 8$$

Calculator solution: 7.27

b. $20,000 = \$10,000 \times (FVIF_{7\%,n \text{ yrs.}})$

$$2.000 = FVIF_{7\%,n \text{ yrs.}}$$

$$10 < n < 11$$

Calculator solution: 10.24

c. $20,000 = \$10,000 \times (FVIF_{12\%,n \text{ yrs.}})$

$$2.000 = FVIF_{12\%,n \text{ yrs.}}$$

$$6 < n < 7$$

Calculator solution: 6.12

d. The higher the rate of interest the less time is required to accumulate a given future sum.

4-58 LG 6: Number of Years – Annuities

A

$$PVA = PMT \times (PVIFA_{11\%,n \text{ yrs.}})$$

$$\$1,000 = \$250 \times (PVIFA_{11\%,n \text{ yrs.}})$$

$$4.000 = PVIFA_{11\%,n \text{ yrs.}}$$

$$5 < n < 6$$

Calculator solution: 5.56

B

$$PVA = PMT \times (PVIFA_{15\%,n \text{ yrs.}})$$

$$\$150,000 = \$30,000 \times (PVIFA_{15\%,n \text{ yrs.}})$$

$$5.000 = PVIFA_{15\%,n \text{ yrs.}}$$

$$9 < n < 10$$

Calculator solution: 9.92

C

$$PVA = PMT \times (PVIFA_{10\%,n \text{ yrs.}})$$

$$\$80,000 = \$30,000 \times (PVIFA_{10\%,n \text{ yrs.}})$$

$$2.667 = PVIFA_{10\%,n \text{ yrs.}}$$

$$3 < n < 4$$

Calculator solution: 3.25

D

$$PVA = PMT \times (PVIFA_{9\%,n \text{ yrs.}})$$

$$\$600 = \$275 \times (PVIFA_{9\%,n \text{ yrs.}})$$

$$2.182 = PVIFA_{9\%,n \text{ yrs.}}$$

$$2 < n < 3$$

Calculator solutions: 2.54

E

$$PVA = PMT \times (PVIFA_{6\%,n \text{ yrs.}})$$

$$\$17,000 = \$3,500 \times (PVIFA_{6\%,n \text{ yrs.}})$$

$$4.857 = PVIFA_{6\%,n \text{ yrs.}}$$

$$5 < n < 6$$

Calculator solution: 5.91

4-59 LG 6: Time to Repay Installment Loan

- a.** $\$14,000 = \$2,450 \times (\text{PVIFA}_{12\%,n \text{ yrs.}})$
 $5.714 = \text{PVIFA}_{12\%,n \text{ yrs.}}$
 $10 < n < 11$
 Calculator solution: 10.21
- b.** $\$14,000 = \$2,450 \times (\text{PVIFA}_{9\%,n \text{ yrs.}})$
 $5.714 = \text{PVIFA}_{9\%,n \text{ yrs.}}$
 $8 < n < 9$
 Calculator solution: 8.37
- c.** $\$14,000 = \$2,450 \times (\text{PVIFA}_{15\%,n \text{ yrs.}})$
 $5.714 = \text{PVIFA}_{15\%,n \text{ yrs.}}$
 $13 < n < 14$
 Calculator solution: 13.92
- d.** The higher the interest rate the greater the number of time periods needed to repay the loan fully.

Chapter 4 Case**Finding Jill Moran's Retirement Annuity**

Chapter 4's case challenges the student to apply present and future value techniques to a real-world situation. The first step in solving this case is to determine the total amount Sunrise Industries needs to accumulate until Ms. Moran retires, remembering to take into account the interest that will be earned during the 20-year payout period. Once that is calculated, the annual amount to be deposited can be determined.

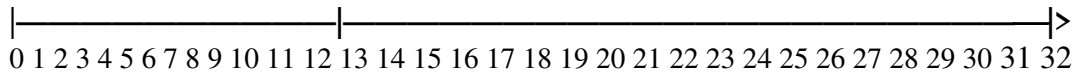
a.

Cash inflow:**Accumulation Period**

12 end-of-year deposits;
Earns interest at 9%

Cash outflow: Distribution Period

20 end-of-year payments of \$42,000
balance earns interest at 12%

**End of Year**b. **Total amount to accumulate by end of year 12**

$$PV_n = PMT \times (PVIFA_{i\%,n})$$

$$PV_{20} = \$42,000 \times (PVIFA_{12\%,20})$$

$$PV_{20} = \$42,000 \times 7.469$$

$$PV_{20} = \$313,698$$

Calculator solution: \$313,716.63

c. **End-of-year deposits, 9% interest:** $PMT = \frac{FVA_n}{FVIFA_{i\%,n}}$

$$PMT = \$313,698 \div (FVIFA_{9\%,12 \text{ yrs.}})$$

$$PMT = \$313,698 \div 20.141$$

$$PMT = \$15,575.10$$

Calculator solution: \$15,575.31

Sunrise Industries must make a \$15,575.10 annual end-of-year deposit in years 1-12 in order to provide Ms. Moran a retirement annuity of \$42,000 per year in years 13 to 32.

d. **End-of-year deposits, 10% interest**

$$PMT = \$313,698 \div (FVIFA_{10\%,12 \text{ yrs.}})$$

$$PMT = \$313,698 \div 21.384$$

$$PMT = \$14,669.75$$

Calculator solution: \$14,669.56

The corporation must make a \$14,669.75 annual end-of-year deposit in years 1-12 in order to provide Ms. Moran a retirement annuity of \$42,000 per year in years 13 to 32.

e. **Initial deposit if annuity is a perpetuity and initial deposit earns 9%:**

$$PV_{\text{perp}} = PMT \times (1 \div i)$$

$$PV_{\text{perp}} = \$42,000 \times (1 \div .12)$$

$$PV_{\text{perp}} = \$42,000 \times 8.333$$

$$PV_{\text{perp}} = \$349,986$$

End-of-year deposit:

$$PMT = FVA_n \div (FVIFA_{i\%,n})$$

$$\text{PMT} = \$349,986 \div (\text{FVIFA}_{9\%, 12 \text{ yrs.}})$$

$$\text{PMT} = \$349,986 \div 20.141$$

$$\text{PMT} = \$17,376.79$$

Calculator solution: 17,377.04

CHAPTER 5

Risk and Return

INSTRUCTOR'S RESOURCES

Overview

This chapter focuses on the fundamentals of the risk and return relationship of assets and their valuation. For the single asset held in isolation, risk is measured with the probability distribution and its associated statistics: the mean, the standard deviation, and the coefficient of variation. The concept of diversification is examined by measuring the risk of a portfolio of assets that are perfectly positively correlated, perfectly negatively correlated, and those that are uncorrelated. Next, the chapter looks at international diversification and its effect on risk. The Capital Asset Pricing Model (CAPM) is then presented as a valuation tool for securities and as a general explanation of the risk-return trade-off involved in all types of financial transactions.

PMF DISK

This chapter's topics are not covered on the *PMF Tutor* or *PMF Problem-Solver*.

PMF Templates

Spreadsheet templates are provided for the following problems:

<u>Problem</u>	<u>Topic</u>
Self-Test 1	Portfolio analysis
Self-Test 2	Beta and CAPM
Problem 5-7	Coefficient of variation
Problem 5-26	Security market line, SML

Study Guide

The following *Study Guide* examples are suggested for classroom presentation:

<u>Example</u>	<u>Topic</u>
4	Risk attitudes
6	Graphic determination of beta
12	Impact of market changes on return

ANSWERS TO REVIEW QUESTIONS

5-1 *Risk* is defined as the chance of financial loss, as measured by the variability of expected returns associated with a given asset. A decision maker should evaluate an investment by measuring the chance of loss, or risk, and comparing the expected risk to the expected return. Some assets are considered risk-free; the most common examples are U. S. Treasury issues.

5-2 The *return on an investment* (total gain or loss) is the change in value plus any cash distributions over a defined time period. It is expressed as a percent of the beginning-of-the-period investment. The formula is:

$$\text{Return} = \frac{[(\text{ending value} - \text{initial value}) + \text{cash distribution}]}{\text{initial value}}$$

Realized return requires the asset to be purchased and sold during the time periods the return is measured. *Unrealized return* is the return that could have been realized if the asset had been purchased and sold during the time period the return was measured.

- 5-3**
- a. The *risk-averse* financial manager requires an increase in return for a given increase in risk.
 - b. The *risk-indifferent* manager requires no change in return for an increase in risk.
 - c. The *risk-seeking* manager accepts a decrease in return for a given increase in risk.

Most financial managers are risk-averse.

5-4 *Sensitivity analysis* evaluates asset risk by using more than one possible set of returns to obtain a sense of the variability of outcomes. The range is found by subtracting the pessimistic outcome from the optimistic outcome. The larger the range, the more variability of risk associated with the asset.

5-5 The decision maker can get an estimate of project risk by viewing a plot of the probability distribution, which relates probabilities to expected returns and shows the degree of dispersion of returns. The more spread out the distribution, the greater the variability or risk associated with the return stream.

5-6 The *standard deviation* of a distribution of asset returns is an absolute measure of dispersion of risk about the mean or expected value. A higher standard deviation indicates a greater project risk. With a larger standard deviation, the distribution is more dispersed and the outcomes have a higher variability, resulting in higher risk.

5-7 The *coefficient of variation* is another indicator of asset risk, measuring relative dispersion. It is calculated by dividing the standard deviation by the expected value. The coefficient of variation may be a better basis than the standard deviation for comparing risk of assets with differing expected returns.

5-8 An *efficient portfolio* is one that maximizes return for a given risk level or minimizes risk for a given level of return. *Return of a portfolio* is the weighted average of returns on the individual component assets:

$$\hat{k}_p = \sum_{j=1}^n w_j \times \hat{k}_j$$

Where n = number of assets, w_j = weight of individual assets, and \hat{k}_j = expected Returns.

The *standard deviation of a portfolio* is not the weighted average of component standard deviations; the risk of the portfolio as measured by the standard deviation will be smaller. It is calculated by applying the standard deviation formula to the portfolio assets:

$$\sigma_{kp} = \sqrt{\sum_{i=1}^n \frac{(k_i - k)^2}{(n-1)}}$$

- 5-9** The *correlation* between asset returns is important when evaluating the effect of a new asset on the portfolio's overall risk. Returns on different assets moving in the same direction are *positively correlated*, while those moving in opposite directions are *negatively correlated*. Assets with high positive correlation increase the variability of portfolio returns; assets with high negative correlation reduce the variability of portfolio returns. When negatively correlated assets are brought together through diversification, the variability of the expected return from the resulting combination can be less than the variability or risk of the individual assets. When one asset has high returns, the other's returns are low and vice versa. Therefore, the result of diversification is to reduce risk by providing a pattern of stable returns.

Diversification of risk in the asset selection process allows the investor to reduce overall risk by combining negatively correlated assets so that the risk of the portfolio is less than the risk of the individual assets in it. Even if assets are not negatively correlated, the lower the positive correlation between them, the lower the resulting risks.

- 5-10** The inclusion of foreign assets in a domestic company's portfolio reduces risk for two reasons. When returns from foreign-currency-denominated assets are translated into dollars, the correlation of returns of the portfolio's assets is reduced. Also, if the foreign assets are in countries that are less sensitive to the U.S. business cycle, the portfolio's response to market movements is reduced.

When the dollar *appreciates* relative to other currencies, the dollar value of a foreign-currency-denominated portfolio *declines* and results in lower returns in dollar terms. If this appreciation is due to better performance of the U.S. economy, foreign-currency-denominated portfolios generally have lower returns in local currency as well, further contributing to reduced returns.

Political risks result from possible actions by the host government that are harmful to foreign investors or possible political instability that could endanger foreign assets. This form of risk is particularly high in developing countries. Companies diversifying internationally may have assets seized or the return of profits blocked.

- 5-11** The *total risk* of a security is the combination of nondiversifiable risk and diversifiable risk. *Diversifiable risk* refers to the portion of an asset's risk attributable to firm-specific, random events (strikes, litigation, loss of key contracts, etc.) that can be eliminated by diversification. *Nondiversifiable risk* is attributable to market factors affecting all firms (war, inflation, political events, etc.). Some argue that nondiversifiable risk is the only relevant risk because diversifiable risk can be eliminated by creating a portfolio of assets which are not perfectly positively correlated.

- 5-12** *Beta* measures nondiversifiable risk. It is an index of the degree of movement of an asset's return in response to a change in the market return. The beta coefficient for an asset can be found by plotting the

asset's historical returns relative to the returns for the market. By using statistical techniques, the "*characteristic line*" is fit to the data points. The slope of this line is beta. Beta coefficients for actively traded stocks are published in Value Line Investment Survey and in brokerage reports. The beta of a portfolio is calculated by finding the weighted average of the betas of the individual component assets.

5-13 The equation for the Capital Asset Pricing Model is: $k_i = R_F + [b_i \times (k_m - R_F)]$,

Where:

k_j = the required (or expected) return on asset j .

R_F = the rate of return required on a risk-free security (a U.S. Treasury bill)

b_j = the beta coefficient or index of nondiversifiable (relevant) risk for asset j

k_m = the required return on the market portfolio of assets (the market return)

The security market line (SML) is a graphical presentation of the relationship between the amount of systematic risk associated with an asset and the required return. Systematic risk is measured by beta and is on the horizontal axis while the required return is on the vertical axis.

5-14 a. If there is an increase in inflationary expectations, the security market line will show a parallel shift upward in an amount equal to the expected increase in inflation. The required return for a given level of risk will also rise.

b. The slope of the SML (the beta coefficient) will be less steep if investors become less risk-averse, and a lower level of return will be required for each level of risk.

5-15 The CAPM provides financial managers with a link between risk and return. Because it was developed to explain the behavior of securities prices in efficient markets and uses historical data to estimate required returns, it may not reflect future variability of returns. While studies have supported the CAPM when applied in active securities markets, it has not been found to be generally applicable to real corporate assets. However, the CAPM can be used as a conceptual framework to evaluate the relationship between risk and return.

SOLUTIONS TO PROBLEMS

5-1 LG 1: Rate of Return: $k_t = \frac{(P_t - P_{t-1} + C_t)}{P_{t-1}}$

a.

Investment X: $\text{Return} = \frac{(\$21,000 - \$20,000 + \$1,500)}{\$20,000} = 12.50\%$

Investment Y: $\text{Return} = \frac{(\$55,000 - \$55,000 + \$6,800)}{\$55,000} = 12.36\%$

b. Investment X should be selected because it has a higher rate of return for the same level of risk.

5-2 LG 1: Return Calculations: $k_t = \frac{(P_t - P_{t-1} + C_t)}{P_{t-1}}$

Investment	Calculation	k_t (%)
A	$(\$1,100 - \$800 - \$100) \div \800	25.00
B	$(\$118,000 - \$120,000 + \$15,000) \div \$120,000$	10.83
C	$(\$48,000 - \$45,000 + \$7,000) \div \$45,000$	22.22
D	$(\$500 - \$600 + \$80) \div \600	-3.33
E	$(\$12,400 - \$12,500 + \$1,500) \div \$12,500$	11.20

5-3 LG 1: Risk Preferences

- a.** The risk-indifferent manager would accept Investments X and Y because these have higher returns than the 12% required return and the risk doesn't matter.
- b.** The risk-averse manager would accept Investment X because it provides the highest return and has the lowest amount of risk. Investment X offers an increase in return for taking on more risk than what the firm currently earns.
- c.** The risk-seeking manager would accept Investments Y and Z because he or she is willing to take greater risk without an increase in return.
- d.** Traditionally, financial managers are risk-averse and would choose Investment X, since it provides the required increase in return for an increase in risk.

5-4 LG 2: Risk Analysis

a.	<u>Expansion</u>	<u>Range</u>
	A	$24\% - 16\% = 8\%$
	B	$30\% - 10\% = 20\%$

- b.** Project A is less risky, since the range of outcomes for A is smaller than the range for Project B.

Chapter 5 Risk and Return

- c. Since the most likely return for both projects is 20% and the initial investments are equal, the answer depends on your risk preference.
- d. The answer is no longer clear, since it now involves a risk-return trade-off. Project B has a slightly higher return but more risk, while A has both lower return and lower risk.

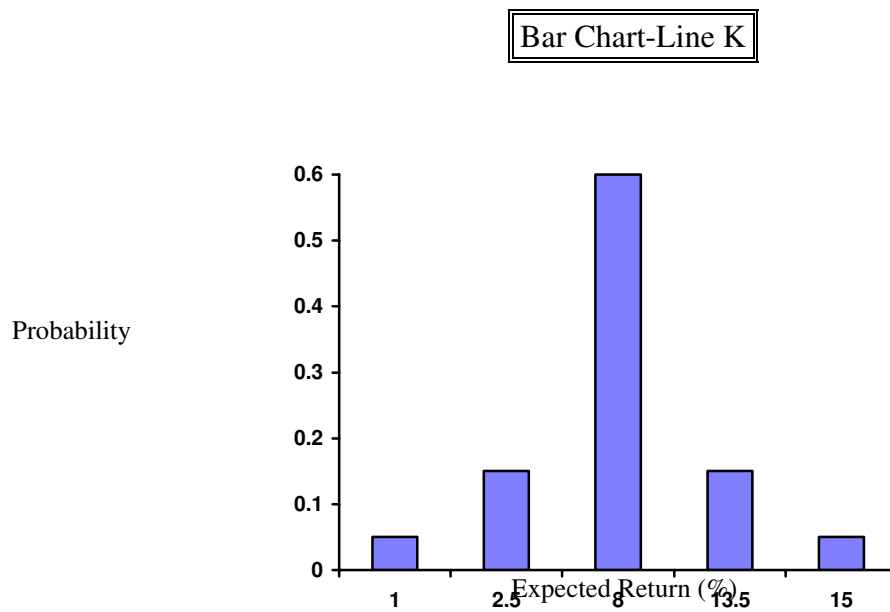
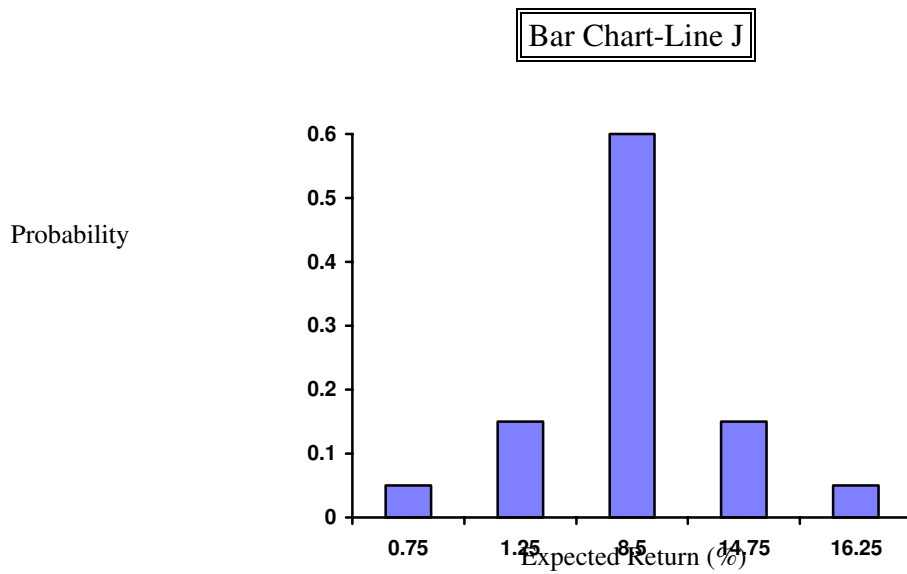
5-5 LG 2: Risk and Probability

a.	<u>Camera</u>	<u>Range</u>
	R	30% - 20% = 10%
	S	35% - 15% = 20%

b.	Possible Outcomes	Probability P_{ri}	Expected Return k_i	Weighted Value (%) ($k_i \times P_{ri}$)
Camera R	Pessimistic	0.25	20	5.00
	Most likely	0.50	25	12.50
	Optimistic	<u>0.25</u>	30	<u>7.50</u>
		1.00	Expected Return	<u>25.00</u>
Camera S	Pessimistic	0.20	15	3.00
	Most likely	0.55	25	13.75
	Optimistic	<u>0.25</u>	35	<u>8.75</u>
		1.00	Expected Return	<u>25.50</u>

- c. Camera S is considered more risky than Camera R because it has a much broader range of outcomes. The risk-return trade-off is present because Camera S is more risky and also provides a higher return than Camera R.

a.



b.

	Market Acceptance	Probability P_{ri}	Expected Return k_i	Weighted Value ($k_i \times P_{ri}$)
Line J	Very Poor	0.05	.0075	.000375
	Poor	0.15	.0125	.001875
	Average	0.60	.0850	.051000
	Good	0.15	.1475	.022125
	Excellent	<u>0.05</u>	.1625	<u>.008125</u>
		1.00	Expected Return	<u>.083500</u>

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Line K	Very Poor	0.05	.010	.000500
	Poor	0.15	.025	.003750
	Average	0.60	.080	.048000
	Good	0.15	.135	.020250
	Excellent	<u>0.05</u>	.150	<u>.007500</u>
		1.00	Expected Return	<u>.080000</u>

- c. Line K appears less risky due to a slightly tighter distribution than line J, indicating a lower range of outcomes.

5-7 LG 2: Coefficient of Variation: $CV = \frac{\sigma_k}{k}$

- a. **A** $CV_A = \frac{7\%}{20\%} = .3500$
- B** $CV_B = \frac{9.5\%}{22\%} = .4318$
- C** $CV_C = \frac{6\%}{19\%} = .3158$
- D** $CV_D = \frac{5.5\%}{16\%} = .3438$

- b. Asset C has the lowest coefficient of variation and is the least risky relative to the other choices.

5-8 LG 2: Standard Deviation versus Coefficient of Variation as Measures of Risk

- a. Project A is least risky based on range with a value of .04.
- b. Project A is least risky based on standard deviation with a value of .029. Standard deviation is not the appropriate measure of risk since the projects have different returns.
- c. **A** $CV_A = \frac{.029}{.12} = .2417$
- B** $CV_B = \frac{.032}{.125} = .2560$
- C** $CV_C = \frac{.035}{.13} = .2692$
- D** $CV_D = \frac{.030}{.128} = .2344$

In this case project A is the best alternative since it provides the least amount of risk for each percent of return earned. Coefficient of variation is probably the best measure in this instance since it provides a standardized method of measuring the risk/return trade-off for investments with differing returns.

5-9 LG 2: Assessing Return and Risk**a. Project 257**

1. **Range:** $1.00 - (-.10) = 1.10$

2. **Expected return:** $\bar{k} = \sum_{i=1}^n k_i \times P_{ri}$

Rate of Return k_i	Probability P_{ri}	Weighted Value $k_i \times P_{ri}$	Expected Return $\bar{k} = \sum_{i=1}^n k_i \times P_{ri}$
-.10	.01	-.001	
.10	.04	.004	
.20	.05	.010	
.30	.10	.030	
.40	.15	.060	
.45	.30	.135	
.50	.15	.075	
.60	.10	.060	
.70	.05	.035	
.80	.04	.032	
1.00	.01	.010	
	<u>1.00</u>		<u>.450</u>

3. **Standard Deviation:** $\sigma = \sqrt{\sum_{i=1}^n (k_i - \bar{k})^2 \times P_{ri}}$

k_i	\bar{k}	$k_i - \bar{k}$	$(k_i - \bar{k})^2$	P_{ri}	$(k_i - \bar{k})^2 \times P_{ri}$
-.10	.450	-.550	.3025	.01	.003025
.10	.450	-.350	.1225	.04	.004900
.20	.450	-.250	.0625	.05	.003125
.30	.450	-.150	.0225	.10	.002250
.40	.450	-.050	.0025	.15	.000375
.45	.450	.000	.0000	.30	.000000
.50	.450	.050	.0025	.15	.000375
.60	.450	.150	.0225	.10	.002250
.70	.450	.250	.0625	.05	.003125
.80	.450	.350	.1225	.04	.004900
1.00	.450	.550	.3025	.01	.003025
					<u>.027350</u>

$$\sigma_{\text{Project 257}} = \sqrt{.027350} = .165378$$

4. $CV = \frac{.165378}{.450} = .3675$

Project 432

1. **Range:** $.50 - .10 = .40$

2. **Expected return:** $\bar{k} = \sum_{i=1}^n k_i \times P_{ri}$

Rate of Return	Probability	Weighted Value	Expected Return
----------------	-------------	----------------	-----------------

k_i	P_{ri}	$k_i \times P_{ri}$	$\bar{k} = \sum_{i=1}^n k_i \times P_{ri}$
.10	.05	.0050	
.15	.10	.0150	
.20	.10	.0200	
.25	.15	.0375	
.30	.20	.0600	
.35	.15	.0525	
.40	.10	.0400	
.45	.10	.0450	
.50	.05	.0250	
	<u>1.00</u>		<u>.300</u>

3. Standard Deviation: $\sigma = \sqrt{\sum_{i=1}^n (k_i - \bar{k})^2 \times P_{ri}}$

k_i	\bar{k}	$k_i - \bar{k}$	$(k_i - \bar{k})^2$	P_{ri}	$(k_i - \bar{k})^2 \times P_{ri}$
.10	.300	-.20	.0400	.05	.002000
.15	.300	-.15	.0225	.10	.002250
.20	.300	-.10	.0100	.10	.001000
.25	.300	-.05	.0025	.15	.000375
.30	.300	.00	.0000	.20	.000000
.35	.300	.05	.0025	.15	.000375
.40	.300	.10	.0100	.10	.001000
.45	.300	.15	.0225	.10	.002250
.50	.300	.20	.0400	.05	.002000
					<u>.011250</u>

$$\sigma_{\text{Project 432}} = \sqrt{.011250} = .106066$$

4. $CV = \frac{.106066}{.300} = .3536$

b. Bar Charts

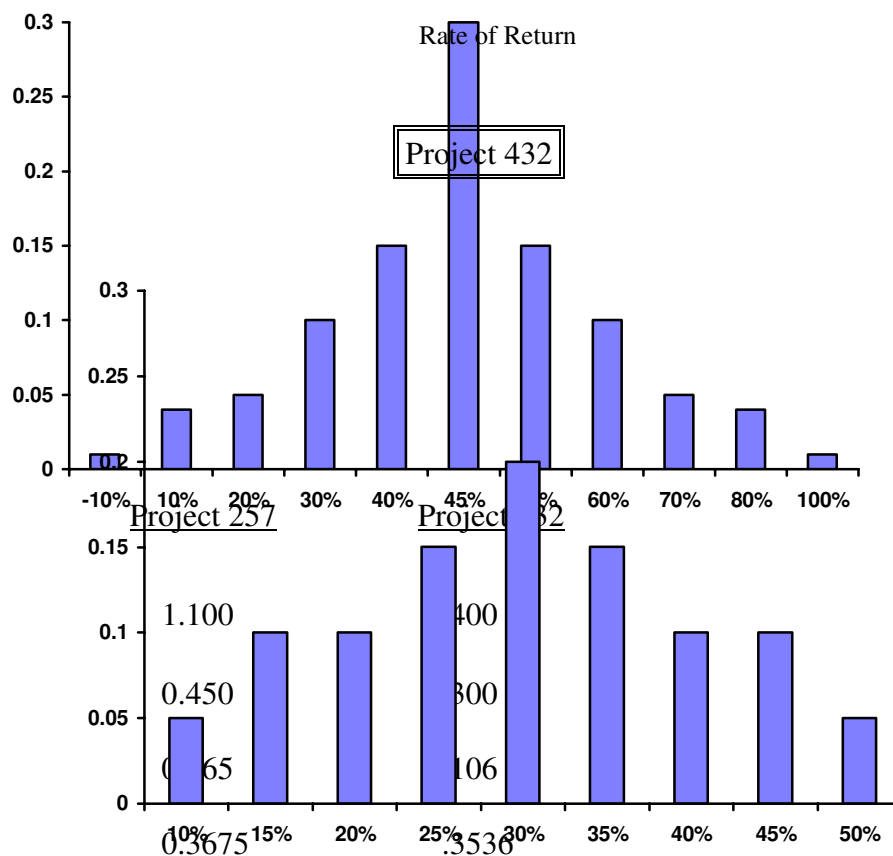
Project 257

Probability

c.

Summary Statistics

Probability
Range
Expected
Return (\bar{k})
Standard
Deviation (σ_k)
Coefficient of
Variation (CV)



Since Projects 257 and 432 have differing expected values, the coefficient of variation should be the criterion by which the risk of the asset is judged. Since Project 432 has a smaller CV, it is the opportunity with lower risk.

Rate of Return

5-10 LG 2: Integrative–Expected Return, Standard Deviation, and Coefficient of Variation

a. Expected return: $\bar{k} = \sum_{i=1}^n k_i \times P_{ri}$

	Rate of Return	Probability	Weighted Value	Expected Return
	k_i	P_{ri}	$k_i \times P_{ri}$	$\bar{k} = \sum_{i=1}^n k_i \times P_{ri}$
Asset F	.40	.10	.04	<u>.04</u>
	.10	.20	.02	
	.00	.40	.00	
	-.05	.20	-.01	
	-.10	.10	-.01	

Asset G	.35	.40	.14	
	.10	.30	.03	
	-.20	.30	-.06	
				<u>.11</u>
Asset H	.40	.10	.04	
	.20	.20	.04	
	.10	.40	.04	
	.00	.20	.00	
	-.20	.10	-.02	
				<u>.10</u>

Asset G provides the largest expected return.

b. **Standard Deviation:** $\sigma_k = \sqrt{\sum_{i=1}^n (k_i - \bar{k})^2 \times P_{ri}}$

	$(k_i - \bar{k})$	$(k_i - \bar{k})^2$	P_{ri}	σ^2	σ_k
Asset F	.40 - .04 = .36	.1296	.10	.01296	
	.10 - .04 = .06	.0036	.20	.00072	
	.00 - .04 = -.04	.0016	.40	.00064	
	-.05 - .04 = -.09	.0081	.20	.00162	
	-.10 - .04 = -.14	.0196	.10	.00196	
				.01790	<u>.1338</u>

	$(k_i - \bar{k})$	$(k_i - \bar{k})^2$	P_{ri}	σ^2	σ_k
Asset G	.35 - .11 = .24	.0576	.40	.02304	
	.10 - .11 = -.01	.0001	.30	.00003	
	-.20 - .11 = -.31	.0961	.30	.02883	
				.05190	<u>.2278</u>
Asset H	.40 - .10 = .30	.0900	.10	.009	
	.20 - .10 = .10	.0100	.20	.002	
	.10 - .10 = .00	.0000	.40	.000	
	.00 - .10 = -.10	.0100	.20	.002	
	-.20 - .10 = -.30	.0900	.10	.009	
				.022	<u>.1483</u>

Based on standard deviation, Asset G appears to have the greatest risk, but it must be measured against its expected return with the statistical measure coefficient of variation, since the three assets have differing expected values. An incorrect conclusion about the risk of the assets could be drawn using only the standard deviation.

c. **Coefficient of Variation** = $\frac{\text{standard deviation } (\sigma)}{\text{expected value}}$

$$\text{Asset F:} \quad CV = \frac{.1338}{.04} = 3.345$$

$$\text{Asset G:} \quad CV = \frac{.2278}{.11} = 2.071$$

$$\text{Asset H:} \quad CV = \frac{.1483}{.10} = 1.483$$

As measured by the coefficient of variation, Asset F has the largest relative risk.

5-11 LG 2: Normal Probability Distribution

a. Coefficient of variation: $CV = \sigma_k \div \bar{k}$

$$\begin{aligned} \text{Solving for standard deviation:} \quad .75 &= \sigma_k \div .189 \\ \sigma_k &= .75 \times .189 = .14175 \end{aligned}$$

b. 1. 58% of the outcomes will lie between ± 1 standard deviation from the expected value:

$$+1\sigma = .189 + .14175 = .33075$$

$$-1\sigma = .189 - .14175 = .04725$$

2. 95% of the outcomes will lie between ± 2 standard deviations from the expected value:

$$+2\sigma = .189 + (2 \times .14175) = .4725$$

$$-2\sigma = .189 - (2 \times .14175) = -.0945$$

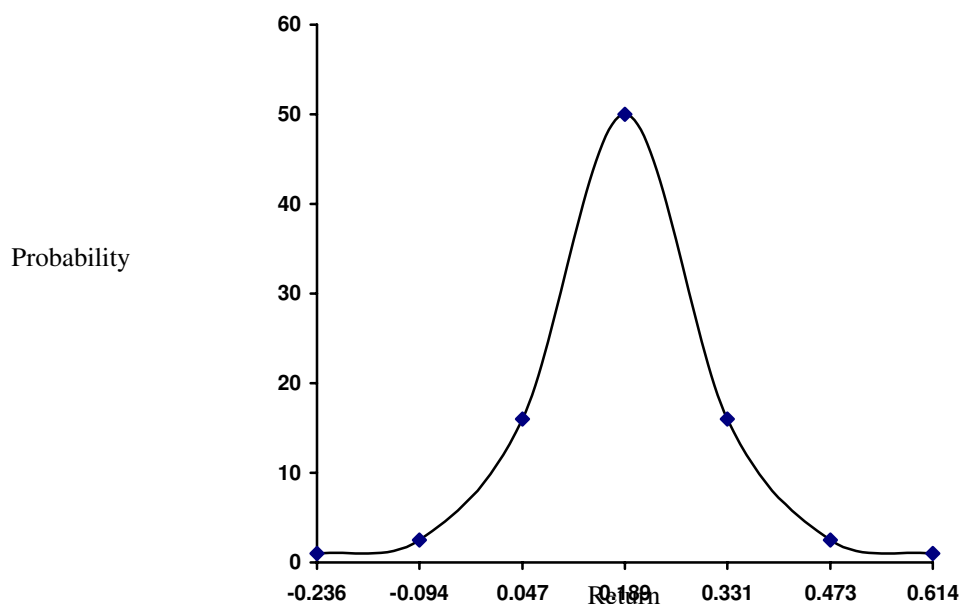
3. 99% of the outcomes will lie between ± 3 standard deviations from the expected value:

$$+3\sigma = .189 + (3 \times .14175) = .61425$$

$$-3\sigma = .189 - (3 \times .14175) = -.23625$$

c.

Probability Distribution



5-12 LG 3: Portfolio Return and Standard Deviation

a. **Expected Portfolio Return for Each Year:** $k_p = (w_L \times k_L) + (w_M \times k_M)$

Year	Asset L ($w_L \times k_L$)	+	Asset M ($w_M \times k_M$)	Expected Portfolio Return k_p
2004	(14% x .40 = 5.6%)	+	(20% x .60 = 12.0%)	= 17.6%
2005	(14% x .40 = 5.6%)	+	(18% x .60 = 10.8%)	= 16.4%
2006	(16% x .40 = 6.4%)	+	(16% x .60 = 9.6%)	= 16.0%
2007	(17% x .40 = 6.8%)	+	(14% x .60 = 8.4%)	= 15.2%
2008	(17% x .40 = 6.8%)	+	(12% x .60 = 7.2%)	= 14.0%
2009	(19% x .40 = 7.6%)	+	(10% x .60 = 6.0%)	= 13.6%

b. **Portfolio Return:** $k_p = \frac{\sum_{j=1}^n w_j \times k_j}{n}$

$$k_p = \frac{17.6 + 16.4 + 16.0 + 15.2 + 14.0 + 13.6}{6} = 15.467 = 15.5\%$$

c. **Standard Deviation:** $\sigma_{k_p} = \sqrt{\frac{\sum_{i=1}^n (k_i - \bar{k})^2}{(n-1)}}$

$$\sigma_{kp} = \sqrt{\frac{(17.6\% - 15.5\%)^2 + (16.4\% - 15.5\%)^2 + (16.0\% - 15.5\%)^2 + (15.2\% - 15.5\%)^2 + (14.0\% - 15.5\%)^2 + (13.6\% - 15.5\%)^2}{6-1}}$$

$$\sigma_{kp} = \sqrt{\frac{(2.1\%)^2 + (.9\%)^2 + (0.5\%)^2 + (-0.3\%)^2 + (-1.5\%)^2 + (-1.9\%)^2}{5}}$$

$$\sigma_{kp} = \sqrt{\frac{(4.41\% + 0.81\% + 0.25\% + 0.09\% + 2.25\% + 3.61\%)^2}{5}}$$

$$\sigma_{kp} = \sqrt{\frac{11.42}{5}} = \sqrt{2.284} = 1.51129$$

- d. The assets are negatively correlated.
- e. Combining these two negatively correlated assets reduces overall portfolio risk.

5-13 LG 3: Portfolio Analysis

a. Expected portfolio return:

Alternative 1: 100% Asset F

$$k_p = \frac{16\% + 17\% + 18\% + 19\%}{4} = 17.5\%$$

Alternative 2: 50% Asset F + 50% Asset G

Year	Asset F ($w_F \times k_F$)	+	Asset G ($w_G \times k_G$)	=	Portfolio Return k_p
2001	(16% x .50 = 8.0%)	+	(17% x .50 = 8.5%)	=	16.5%
2002	(17% x .50 = 8.5%)	+	(16% x .50 = 8.0%)	=	16.5%
2003	(18% x .50 = 9.0%)	+	(15% x .50 = 7.5%)	=	16.5%
2004	(19% x .50 = 9.5%)	+	(14% x .50 = 7.0%)	=	16.5%

$$k_p = \frac{66}{4} = 16.5\%$$

Alternative 3: 50% Asset F + 50% Asset H

Year	Asset F ($w_F \times k_F$)	+	Asset H ($w_H \times k_H$)	=	Portfolio Return k_p
2001	(16% x .50 = 8.0%)	+	(14% x .50 = 7.0%)	=	15.0%
2002	(17% x .50 = 8.5%)	+	(15% x .50 = 7.5%)	=	16.0%
2003	(18% x .50 = 9.0%)	+	(16% x .50 = 8.0%)	=	17.0%
2004	(19% x .50 = 9.5%)	+	(17% x .50 = 8.5%)	=	18.0%

$$k_p = \frac{66}{4} = 16.5\%$$

b. Standard Deviation: $\sigma_{kp} = \sqrt{\sum_{i=1}^n \frac{(k_i - \bar{k})^2}{(n-1)}}$

(1)

$$\sigma_F = \sqrt{\frac{[(16.0\% - 17.5\%)^2 + (17.0\% - 17.5\%)^2 + (18.0\% - 17.5\%)^2 + (19.0\% - 17.5\%)^2]}{4-1}}$$

$$\sigma_F = \sqrt{\frac{[(-1.5\%)^2 + (-0.5\%)^2 + (0.5\%)^2 + (1.5\%)^2]}{3}}$$

$$\sigma_F = \sqrt{\frac{(2.25\% + 0.25\% + 0.25\% + 2.25\%)}{3}}$$

$$\sigma_F = \sqrt{\frac{5}{3}} = \sqrt{1.667} = 1.291$$

(2)

$$\sigma_{FG} = \sqrt{\frac{[(16.5\% - 16.5\%)^2 + (16.5\% - 16.5\%)^2 + (16.5\% - 16.5\%)^2 + (16.5\% - 16.5\%)^2]}{4-1}}$$

$$\sigma_{FG} = \sqrt{\frac{[(0)^2 + (0)^2 + (0)^2 + (0)^2]}{3}}$$

$$\sigma_{FG} = 0$$

(3)

$$\sigma_{FH} = \sqrt{\frac{[(15.0\% - 16.5\%)^2 + (16.0\% - 16.5\%)^2 + (17.0\% - 16.5\%)^2 + (18.0\% - 16.5\%)^2]}{4-1}}$$

$$\sigma_{FH} = \sqrt{\frac{[(-1.5\%)^2 + (-0.5\%)^2 + (0.5\%)^2 + (1.5\%)^2]}{3}}$$

$$\sigma_{FH} = \sqrt{\frac{[(2.25 + .25 + .25 + 2.25)]}{3}}$$

$$\sigma_{FH} = \sqrt{\frac{5}{3}} = \sqrt{1.667} = 1.291$$

c. **Coefficient of variation: CV** = $\sigma_k \div \bar{k}$

$$CV_F = \frac{1.291}{17.5\%} = .0738$$

$$CV_{FG} = \frac{0}{16.5\%} = 0$$

$$CV_{FH} = \frac{1.291}{16.5\%} = .0782$$

d. **Summary:**

	k_p : Expected Value of Portfolio	σ_{kp}	CV_p
Alternative 1 (F)	17.5%	1.291	.0738
Alternative 2 (FG)	16.5%	0	.0
Alternative 3 (FH)	16.5%	1.291	.0782

Since the assets have different expected returns, the coefficient of variation should be used to determine the best portfolio. Alternative 3, with positively correlated assets, has the highest coefficient of variation and therefore is the riskiest. Alternative 2 is the best choice; it is perfectly negatively correlated and therefore has the lowest coefficient of variation.

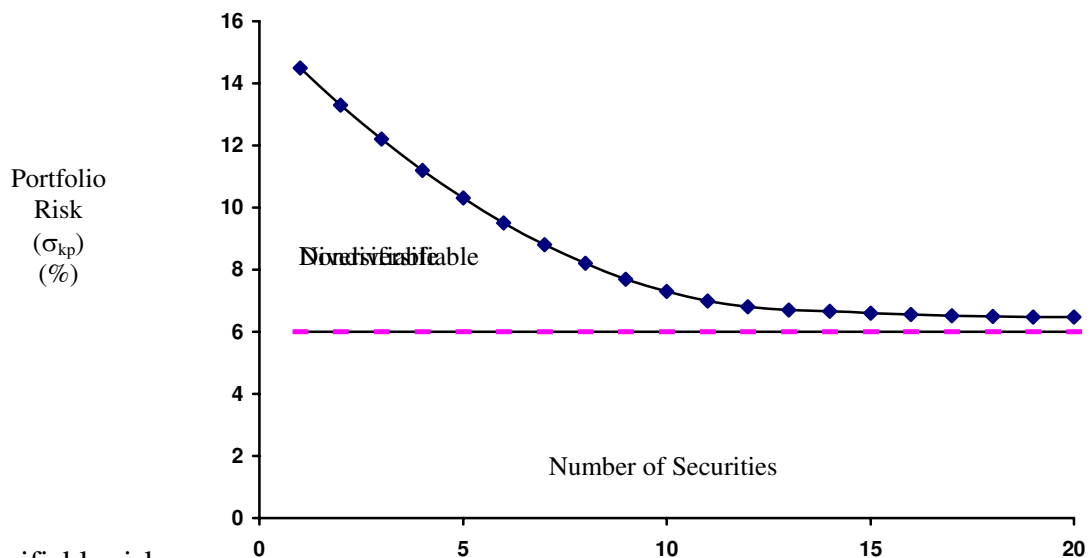
5-14 LG 4: Correlation, Risk, and Return

- a.
 1. Range of expected return: between 8% and 13%
 2. Range of the risk: between 5% and 10%
- b.
 1. Range of expected return: between 8% and 13%
 2. Range of the risk: $0 < \text{risk} < 10\%$
- c.
 1. Range of expected return: between 8% and 13%
 2. Range of the risk: $0 < \text{risk} < 10\%$

5-15 LG 1, 4: International Investment Returns

a. $\text{Return}_{\text{pesos}} = \frac{24,750 - 20,500}{20,500} = \frac{4,250}{20,500} = .20732 = 20.73\%$

b. $\text{Purchase price} = \frac{\text{Price in pesos}}{\text{Pesos per dollar}} = \frac{20.50}{9.21} = \$2.22584 \times 1,000 \text{ shares} = \$2,225.84$



a.

b. To estimate beta, the "rise over run" method can be used:

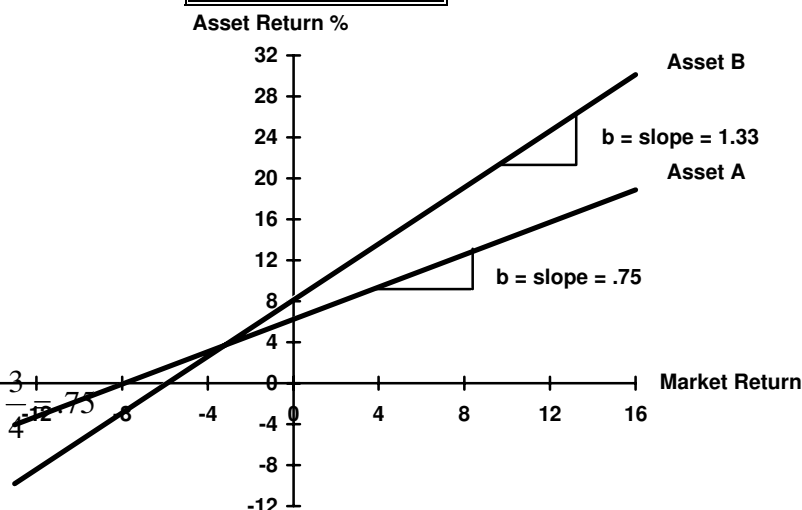
$$\text{Beta} = \frac{\text{Rise}}{\text{Run}} = \frac{\Delta Y}{\Delta X}$$

Taking the points shown on the graph:

$$\text{Beta A} = \frac{\Delta Y}{\Delta X} = \frac{12 - 9}{8 - 4} = \frac{3}{4} = .75$$

$$\text{Beta B} = \frac{\Delta Y}{\Delta X} = \frac{26 - 22}{13 - 10} = \frac{4}{3} = 1.33$$

Derivation of Beta



A financial calculator with statistical functions can be used to perform linear regression analysis. The beta (slope) of line A is .79; of line B, 1.379.

- c. With a higher beta of 1.33, Asset B is more risky. Its return will move 1.33 times for each one point the market moves. Asset A's return will move at a lower rate, as indicated by its beta coefficient of .75.

5-18 LG 5: Interpreting Beta

Effect of change in market return on asset with beta of 1.20:

- 1.20 x (15%) = 18.0% increase
- 1.20 x (-8%) = 9.6% decrease
- 1.20 x (0%) = no change
- The asset is more risky than the market portfolio, which has a beta of 1. The higher beta makes the return move more than the market.

5-19 LG 5: Betas

a. and b.

Asset	Beta	Increase in Market Return	Expected Impact on Asset Return	Decrease in Market Return	Impact on Asset Return
A	0.50	.10	.05	-.10	-.05
B	1.60	.10	.16	-.10	-.16
C	-0.20	.10	-.02	-.10	.02
D	0.90	.10	.09	-.10	-.09

- c. Asset B should be chosen because it will have the highest increase in return.
- d. Asset C would be the appropriate choice because it is a defensive asset, moving in opposition to the market. In an economic downturn, Asset C's return is increasing.

5-20 LG 5: Betas and Risk Rankings

a.	Stock	Beta
Most risky	B	1.40
	A	0.80

Least risky	C	-0.30
-------------	---	-------

b. and c.	Asset	Beta	Increase in Market Return	Expected Impact on Asset Return	Decrease in Market Return	Impact on Asset Return
	A	0.80	.12	.096	-.05	-.04
	B	1.40	.12	.168	-.05	-.07
	C	-0.30	.12	-.036	-.05	.015

- d. In a declining market, an investor would choose the defensive stock, stock C. While the market declines, the return on C increases.
- e. In a rising market, an investor would choose stock B, the aggressive stock. As the market rises one point, stock B rises 1.40 points.

5-21 LG 5: Portfolio Betas: $b_p = \sum_{j=1}^n w_j \times b_j$

a.

Asset	Beta	Portfolio A		Portfolio B	
		w_A	$w_A \times b_A$	w_B	$w_B \times b_B$
1	1.30	.10	.130	.30	.39
2	0.70	.30	.210	.10	.07
3	1.25	.10	.125	.20	.25
4	1.10	.10	.110	.20	.22
5	.90	.40	.360	.20	.18
		$b_A = .935$		$b_B = 1.11$	

- b. Portfolio A is slightly less risky than the market (average risk), while Portfolio B is more risky than the market. Portfolio B's return will move more than Portfolio A's for a given increase or decrease in market return. Portfolio B is the more risky.

5-22 LG 6: Capital Asset Pricing Model (CAPM): $k_j = R_F + [b_j \times (k_m - R_F)]$

Case	k_j	=	$R_F + [b_j \times (k_m - R_F)]$
A	8.9%	=	$5\% + [1.30 \times (8\% - 5\%)]$
B	12.5%	=	$8\% + [0.90 \times (13\% - 8\%)]$
C	8.4%	=	$9\% + [-0.20 \times (12\% - 9\%)]$
D	15.0%	=	$10\% + [1.00 \times (15\% - 10\%)]$
E	8.4%	=	$6\% + [0.60 \times (10\% - 6\%)]$

5-23 LG 6: Beta Coefficients and the Capital Asset Pricing Model

To solve this problem you must take the CAPM and solve for beta. The resulting model is:

$$\text{Beta} = \frac{k - R_F}{k_m - R_F}$$

a. $\text{Beta} = \frac{10\% - 5\%}{16\% - 5\%} = \frac{5\%}{11\%} = .4545$

b. $\text{Beta} = \frac{15\% - 5\%}{16\% - 5\%} = \frac{10\%}{11\%} = .9091$

c.
$$\text{Beta} = \frac{18\% - 5\%}{16\% - 5\%} = \frac{13\%}{11\%} = 1.1818$$

d.
$$\text{Beta} = \frac{20\% - 5\%}{16\% - 5\%} = \frac{15\%}{11\%} = 1.3636$$

e. If Katherine is willing to take a maximum of average risk then she will be able to have an expected return of only 16%. ($k = 5\% + 1.0(16\% - 5\%) = 16\%$.)

5-24 LG 6: Manipulating CAPM: $k_j = R_F + [b_j \times (k_m - R_F)]$

a.
$$\begin{aligned} k_j &= 8\% + [0.90 \times (12\% - 8\%)] \\ k_j &= 11.6\% \end{aligned}$$

b.
$$\begin{aligned} 15\% &= R_F + [1.25 \times (14\% - R_F)] \\ R_F &= 10\% \end{aligned}$$

c.
$$\begin{aligned} 16\% &= 9\% + [1.10 \times (k_m - 9\%)] \\ k_m &= 15.36\% \end{aligned}$$

d.
$$\begin{aligned} 15\% &= 10\% + [b_j \times (12.5\% - 10\%)] \\ b_j &= 2 \end{aligned}$$

5-25 LG 1, 3, 5, 6: Portfolio Return and Beta

a.
$$b_p = (.20)(.80) + (.35)(.95) + (.30)(1.50) + (.15)(1.25) = .16 + .3325 + .45 + .1875 = 1.13$$

b.
$$k_A = \frac{(\$20,000 - \$20,000) + \$1,600}{\$20,000} = \frac{\$1,600}{\$20,000} = 8\%$$

$$k_B = \frac{(\$36,000 - \$35,000) + \$1,400}{\$35,000} = \frac{\$2,400}{\$35,000} = 6.86\%$$

$$k_C = \frac{(\$34,500 - \$30,000) + 0}{\$30,000} = \frac{\$4,500}{\$30,000} = 15\%$$

$$k_D = \frac{(\$16,500 - \$15,000) + \$375}{\$15,000} = \frac{\$1,875}{\$15,000} = 12.5\%$$

c.
$$k_P = \frac{(\$107,000 - \$100,000) + \$3,375}{\$100,000} = \frac{\$10,375}{\$100,000} = 10.375\%$$

d.
$$k_A = 4\% + [0.80 \times (10\% - 4\%)] = 8.8\%$$

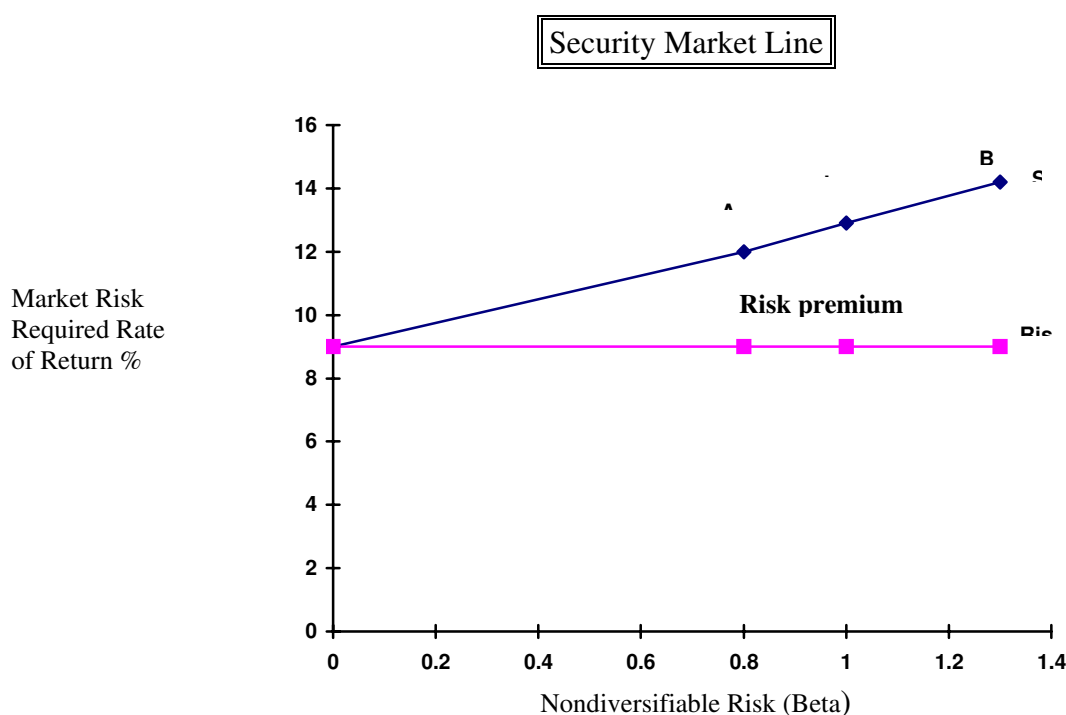
$$k_B = 4\% + [0.95 \times (10\% - 4\%)] = 9.7\%$$

$$k_C = 4\% + [1.50 \times (10\% - 4\%)] = 13.0\%$$

$$k_D = 4\% + [1.25 \times (10\% - 4\%)] = 11.5\%$$

- e. Of the four investments, only C had an actual return which exceeded the CAPM expected return (15% versus 13%). The underperformance could be due to any unsystematic factor which would have caused the firm not to do as well as expected. Another possibility is that the firm's characteristics may have changed such that the beta at the time of the purchase overstated the true value of beta that existed during that year. A third explanation is that beta, as a single measure, may not capture all of the systematic factors that cause the expected return. In other words, there is error in the beta estimate.

5-26 LG 6: Security Market Line, SML a., b., and d.



c. $k_j = R_F + [b_j \times (k_m - R_F)]$

Asset A

$$k_j = .09 + [0.80 \times (.13 - .09)]$$

$$k_j = .122$$

Asset B

$$k_j = .09 + [1.30 \times (.13 - .09)]$$

$$k_j = .142$$

- d. Asset A has a smaller required return than Asset B because it is less risky, based on the beta of 0.80 for Asset A versus 1.30 for Asset B. The market risk premium for Asset A is 3.2% (12.2% - 9%), which is lower than Asset B's (14.2% - 9% = 5.2%).

5-27 LG 6: Shifts in the Security Market Line

a., b., c., d.

$$b. \quad k_j = R_F + [b_j \times$$

$$k_A = 8\% +$$

Required
Return
(%)

$$12.4\%$$

$$c. \quad k_A = 6\% +$$

$$k_A = 6\% +$$

$$k_A = 10.4\%$$

$$d. \quad k_A = 8\% +$$

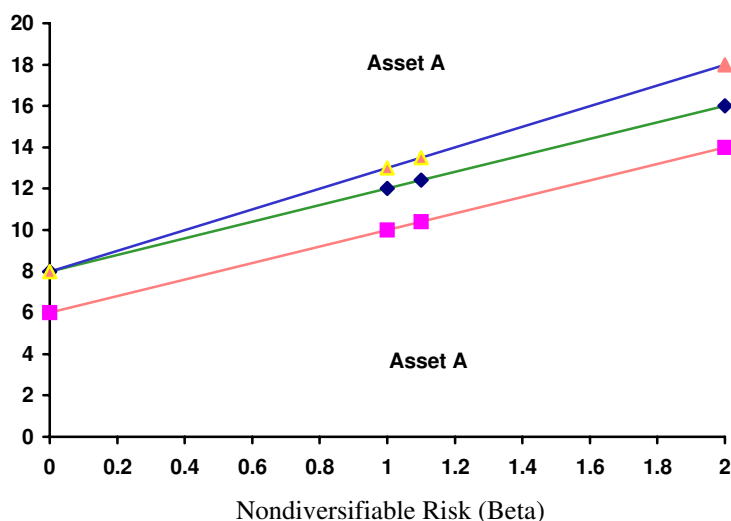
$$k_A = 8\% + 5.5\%$$

$$k_A = 13.5\%$$

e. 1. A decrease in inflationary expectations reduces the required return as shown in the parallel downward shift of the SML.

2. Increased risk aversion results in a steeper slope, since a higher return would be required for each level of risk as measured by beta.

Security Market Lines



$$(k_m - R_F)]$$

$$SML_d \quad [1.1 \times (12\% -$$

$$SML_a$$

$$SML_c \quad k_A =$$

$$8\%$$

$$+ 4.4\%$$

$$k_A =$$

$$[1.1 \times (10\% - 6\%)]$$

$$4.4\%$$

$$[1.1 \times (13\% - 8\%)]$$

5-28 LG 5, 6: Integrative-Risk, Return, and CAPM

$$a. \quad \text{Project} \quad k_j = R_F + [b_j \times (k_m - R_F)]$$

$$A \quad k_j = 9\% + [1.5 \times (14\% - 9\%)] = 16.5\%$$

$$B \quad k_j = 9\% + [.75 \times (14\% - 9\%)] = 12.75\%$$

$$C \quad k_j = 9\% + [2.0 \times (14\% - 9\%)] = 19.0\%$$

$$D \quad k_j = 9\% + [0 \times (14\% - 9\%)] = 9.0\%$$

$$E \quad k_j = 9\% + [(-.5) \times (14\% - 9\%)] = 6.5\%$$

b. and d.

Security Market Line

$$SML_b$$

$$SML_d$$

Chapter 5 Risk and Return

c. Project A is as the market.

Project B is the market.

Project C is as the market.

Project D is movement.

Project E is responsive as moves in the the market.

d. See graph for

$$k_A = 9\%$$

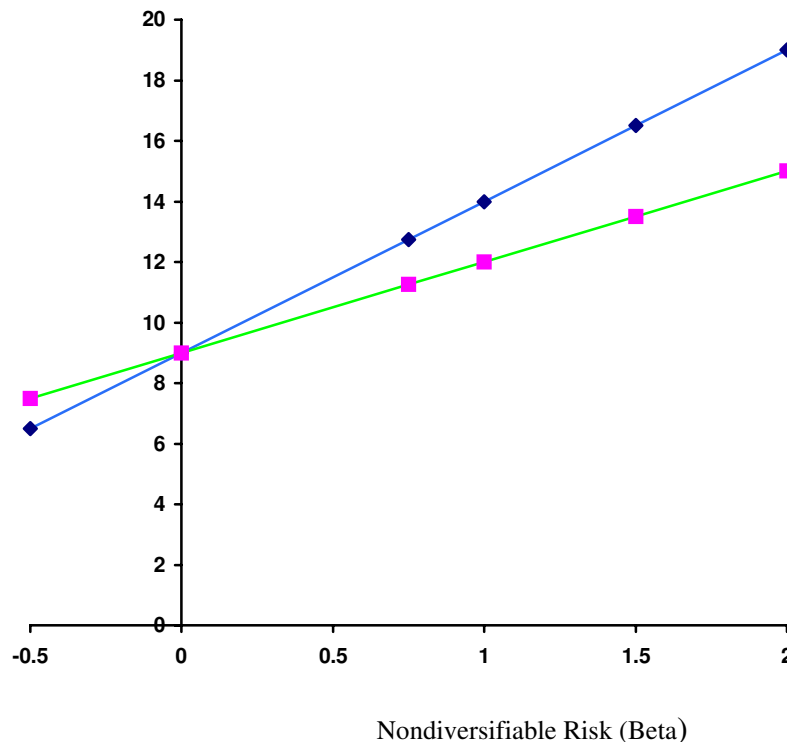
$$k_B = 9\%$$

$$k_C = 9\%$$

$$k_D = 9\%$$

$$9\%)] =$$

$$k_E = 9\%$$



150% as responsive

75% as responsive as

twice as responsive

unaffected by market

only half as the market, but opposite direction as

new SML.

$$+ [1.5 \times (12\% - 9\%)]$$

$$+ [.75 \times (12\% - 9\%)]$$

$$+ [2.0 \times (12\% - 9\%)]$$

$$+ [0 \times (12\% -$$

$$9.00\%$$

$$+ [-.5 \times (12\% - 9\%)]$$

e. The steeper slope of SML_b indicates a higher risk premium than SML_d for these market conditions. When investor risk aversion declines, investors require lower returns for any given risk level (beta).

Chapter 5 Case

Analyzing Risk and Return on Chargers Products' Investments

This case requires students to review and apply the concept of the risk-return trade-off by analyzing two possible asset investments using standard deviation, coefficient of variation, and CAPM.

a.

$$\text{Expected rate of return: } k_t = \frac{(P_t - P_{t-1} + C_t)}{P_{t-1}}$$

Asset X:

Year	Cash Flow (C_t)	Ending Value (P_t)	Beginning Value (P_{t-1})	Gain/Loss	Annual Rate of Return
1994	\$1,000	\$22,000	\$20,000	\$2,000	15.00%
1995	1,500	21,000	22,000	- 1,000	2.27
1996	1,400	24,000	21,000	3,000	20.95
1997	1,700	22,000	24,000	- 2,000	- 1.25
1998	1,900	23,000	22,000	1,000	13.18
1999	1,600	26,000	23,000	3,000	20.00
2000	1,700	25,000	26,000	- 1,000	2.69
2001	2,000	24,000	25,000	- 1,000	4.00
2002	2,100	27,000	24,000	3,000	21.25
2003	2,200	30,000	27,000	3,000	19.26

Average expected return for Asset X = 11.74%

Asset Y:

Year	Cash Flow (C_t)	Ending Value (P_t)	Beginning Value (P_{t-1})	Gain/Loss	Annual Rate of Return
1994	\$1,500	\$20,000	\$20,000	\$0	7.50%
1995	1,600	20,000	20,000	0	8.00
1996	1,700	21,000	20,000	1,000	13.50
1997	1,800	21,000	21,000	0	8.57
1998	1,900	22,000	21,000	1,000	13.81
1999	2,000	23,000	22,000	1,000	13.64
2000	2,100	23,000	23,000	0	9.13
2001	2,200	24,000	23,000	1,000	13.91
2002	2,300	25,000	24,000	1,000	13.75
2003	2,400	25,000	25,000	0	9.60

Average expected return for Asset Y = 11.14%

b.

$$\sigma_k = \sqrt{\sum_{i=1}^n (k_i - \bar{k})^2 \div (n-1)}$$

Asset X:

Year	Return k_i	Average Return, \bar{k}	$(k_i - \bar{k})$	$(k_i - \bar{k})^2$
------	--------------	---------------------------	-------------------	---------------------

Chapter 5 Risk and Return

1994	15.00%	11.74%	3.26%	10.63%
1995	2.27	11.74	- 9.47	89.68
1996	20.95	11.74	9.21	84.82
1997	- 1.25	11.74	-12.99	168.74
1998	13.18	11.74	1.44	2.07
1999	20.00	11.74	8.26	68.23
2000	2.69	11.74	- 9.05	81.90
2001	4.00	11.74	- 7.74	59.91
2002	21.25	11.74	9.51	90.44
2003	19.26	11.74	7.52	<u>56.55</u>
				<u>712.97</u>

$$\sigma_x = \sqrt{\frac{712.97}{10-1}} = \sqrt{79.22} = 8.90\%$$

$$CV = \frac{8.90}{11.74\%} = .76$$

Asset Y-

Year	Return k_i	Average Return, \bar{k}	$(k_i - \bar{k})$	$(k_i - \bar{k})^2$
1994	7.50%	11.14%	- 3.64%	13.25%
1995	8.00	11.14	- 3.14	9.86
1996	13.50	11.14	2.36	5.57
1997	8.57	11.14	- 2.57	6.60
1998	13.81	11.14	2.67	7.13
1999	13.64	11.14	2.50	6.25
2000	9.13	11.14	- 2.01	4.04
2001	13.91	11.14	2.77	7.67
2002	13.75	11.14	2.61	6.81
2003	9.60	11.14	-1.54	<u>2.37</u>
				<u>69.55</u>

$$\sigma_Y = \sqrt{\frac{69.55}{10-1}} = \sqrt{7.73} = 2.78\%$$

$$CV = \frac{2.78}{11.14\%} = .25$$

c. Summary Statistics:

	<u>Asset X</u>	<u>Asset Y</u>
Expected Return	11.74%	11.14%
Standard Deviation	8.90%	2.78%
Coefficient of Variation	.76	.25

Comparing the expected returns calculated in part a, Asset X provides a return of 11.74 percent, only slightly above the return of 11.14 percent expected from Asset Y. The higher standard deviation and coefficient of variation of Investment X indicates greater risk. With just this information, it is difficult to

determine whether the .60 percent difference in return is adequate compensation for the difference in risk. Based on this information, however, Asset Y appears to be the better choice.

- d. Using the capital asset pricing model, the required return on each asset is as follows:

Capital Asset Pricing Model: $k_j = R_F + [b_j \times (k_m - R_F)]$

Asset	$R_F + [b_j \times (k_m - R_F)]$	=	k_j
X	$7\% + [1.6 \times (10\% - 7\%)]$	=	11.8%
Y	$7\% + [1.1 \times (10\% - 7\%)]$	=	10.3%

From the calculations in part a, the expected return for Asset X is 11.74%, compared to its required return of 11.8%. On the other hand, Asset Y has an expected return of 11.14% and a required return of only 10.8%. This makes Asset Y the better choice.

- e. In part c, we concluded that it would be difficult to make a choice between X and Y because the additional return on X may or may not provide the needed compensation for the extra risk. In part d, by calculating a required rate of return, it was easy to reject X and select Y. The required return on Asset X is 11.8%, but its expected return (11.74%) is lower; therefore Asset X is unattractive. For Asset Y the reverse is true, and it is a good investment vehicle.

Clearly, Charger Products is better off using the standard deviation and coefficient of variation, rather than a strictly subjective approach, to assess investment risk. Beta and CAPM, however, provide a link between risk and return. They quantify risk and convert it into a required return that can be compared to the expected return to draw a definitive conclusion about investment acceptability. Contrasting the conclusions in the responses to questions c and d above should clearly demonstrate why Junior is better off using beta to assess risk.

- f. (1) **Increase in risk-free rate to 8 % and market return to 11 %:**

Asset	$R_F + [b_j \times (k_m - R_F)]$	=	k_j
X	$8\% + [1.6 \times (11\% - 8\%)]$	=	12.8%
Y	$8\% + [1.1 \times (11\% - 8\%)]$	=	11.3%

- (2) **Decrease in market return to 9 %:**

Asset	$R_F + [b_j \times (k_m - R_F)]$	=	k_j
X	$7\% + [1.6 \times (9\% - 7\%)]$	=	10.2%
Y	$7\% + [1.1 \times (9\% - 7\%)]$	=	9.2%

In situation (1), the required return rises for both assets, and neither has an expected return above the firm's required return.

With situation (2), the drop in market rate causes the required return to decrease so that the expected returns of both assets are above the required return. However, Asset Y provides a larger return compared to its required return ($11.14 - 9.20 = 1.94$), and it does so with less risk than Asset X.

CHAPTER 6

Interest Rates and Bond Valuation

INSTRUCTOR'S RESOURCES

Overview

This chapter begins with a thorough discussion of interest rates, yield curves, and their relationship to required returns. Features of the major types of bond issues are presented along with their legal issues, risk characteristics, and indenture covenants. The chapter then introduces students to the important concept of valuation and demonstrates the impact of cash flows, timing, and risk on value. It explains models for valuing bonds and the calculation of yield-to-maturity using either the trial-and-error approach or the approximate yield formula.

PMF DISK

PMF Tutor: Bond and Stock Valuation

This module provides problems for the valuation of conventional bonds and for the constant growth and variable growth models for common stock valuation.

PMF Problem-Solver: Bond and Stock Valuation

This module's routines are Bond Valuation and Common Stock Valuation.

PMF Templates

Spreadsheet templates are provided for the following problems:

<u>Problem</u>	<u>Topic</u>
Self-Test 6-1	Bond valuation
Self-Test 6-2	Yield to maturity
Problem 6-2	Real rate of interest
Problem 6-24	Bond valuation—Semiannual interest
Problem 6-26	Bond valuation—Quarterly interest

Study Guide

Suggested *Study Guide* examples for classroom presentation:

<u>Example</u>	<u>Topic</u>
1	Valuation of any asset
4	Bond valuation
9	Yield to call

ANSWERS TO REVIEW QUESTIONS

- 6-1** The *real rate of interest* is the rate which creates an equilibrium between the supply of savings and demand for investment funds. The nominal rate of interest is the actual rate of interest charged by the supplier and paid by the demander. The nominal rate of interest differs from the real rate of interest due to two factors: (1) a premium due to inflationary expectations (IP) and (2) a premium due to issuer and issue characteristic risks (RP). The nominal rate of interest for a security can be defined as $k_1 = k^* + IP + RP$. For a three-month U.S. Treasury bill, the nominal rate of interest can be stated as $k_1 = k^* + IP$. The default risk premium, RP, is assumed to be zero since the security is backed by the U.S. government; this security is commonly considered the risk-free asset.
- 6-2** The *term structure of interest rates* is the relationship of the rate of return to the time to maturity for any class of similar-risk securities. The graphic presentation of this relationship is the yield curve.
- 6-3** For a given class of securities, the slope of the curve reflects an expectation about the movement of interest rates over time. The most commonly used class of securities is U.S. Treasury securities.
- a. Downward sloping: long-term borrowing costs are lower than short-term borrowing costs.
 - b. Upward sloping: Short-term borrowing costs are lower than long-term borrowing costs.
 - c. Flat: Borrowing costs are relatively similar for short- and long-term loans.
- The upward-sloping yield curve has been the most prevalent historically.
- 6-4**
- a. According to the *expectations theory*, the yield curve reflects investor expectations about future interest rates, with the differences based on inflation expectations. The curve can take any of the three forms. An upward-sloping curve is the result of increasing inflationary expectations, and vice versa.
 - b. The *liquidity preference theory* is an explanation for the upward-sloping yield curve. This theory states that long-term rates are generally higher than short-term rates due to the desire of investors for greater liquidity, and thus a premium must be offered to attract adequate long-term investment.
 - c. The *market segmentation theory* is another theory which can explain any of the three curve shapes. Since the market for loans can be segmented based on maturity, sources of supply and demand for loans within each segment determine the prevailing interest rate. If supply is greater than demand for short-term funds at a time when demand for long-term loans is higher than the supply of funding, the yield curve would be upward-sloping. Obviously, the reverse also holds true.
- 6-5** In the Fisher Equation, $k = k^* + IP + RP$, the risk premium, RP, consists of the following issuer- and issue-related components:
- *Default risk.* The possibility that the issuer will not pay the contractual interest or principal as scheduled.
 - *Maturity (interest rate) risk:* The possibility that changes in the interest rates on similar securities will cause the value of the security to change by a greater amount the longer its maturity, and vice versa.

- *Liquidity risk*: The ease with which securities can be converted to cash without a loss in value.
- *Contractual provisions*: Covenants included in a debt agreement or stock issue defining the rights and restrictions of the issuer and the purchaser. These can increase or reduce the risk of a security.
- *Tax risk*: Certain securities issued by agencies of state and local governments are exempt from federal, and in some cases state and local, taxes, thereby reducing the nominal rate of interest by an amount which brings the return into line with the after-tax return on a taxable issue of similar risk.

The risks that are debt-specific are default, maturity, and contractual provisions.

- 6-6** Most corporate bonds are issued in denominations of \$1,000 with maturities of 10 to 30 years. The *stated interest rate* on a bond represents the percentage of the bond's par value that will be paid out annually, although the actual payments may be divided up and made quarterly or semi-annually.

Both *bond indentures* and *trustees* are means of protecting the bondholders. The bond indenture is a complex and lengthy legal document stating the conditions under which a bond is issued. The trustee may be a paid individual, corporation, or commercial bank trust department that acts as a third-party "watch dog" on behalf of the bondholders to ensure that the issuer does not default on its contractual commitment to the bondholders.

- 6-7** Long-term lenders include *restrictive covenants* in loan agreements in order to place certain operating and/or financial constraints on the borrower. These constraints are intended to assure the lender that the borrowing firm will maintain a specified financial condition and managerial structure during the term of the loan. Since the lender is committing funds for a long period of time, he seeks to protect himself against adverse financial developments that may affect the borrower. The restrictive provisions (also called *negative covenants*) differ from the so-called *standard debt provisions* in that they place certain constraints on the firm's operations, whereas the standard provisions (also called *affirmative covenants*) require the firm to operate in a respectable and businesslike manner. Standard provisions include such requirements as providing audited financial statements on a regular schedule, paying taxes and liabilities when due, maintaining all facilities in good working order, and keeping accounting records in accordance with GAAP.

Violation of any of the standard or restrictive loan provisions gives the lender the right to demand immediate repayment of both accrued interest and principal of the loan. However, the lender does not normally demand immediate repayment but instead evaluates the situation in order to determine if the violation is serious enough to jeopardize the loan. The lender's options are: Waive the violation, waive the violation and renegotiate terms of the original agreement, or demand repayment.

- 6-8** *Short-term borrowing* is normally less expensive than *long-term borrowing* due to the greater uncertainty associated with longer maturity loans. The major factors affecting the cost of long-term debt (or the interest rate), in addition to loan maturity, are loan size, borrower risk, and the basic cost of money.

- 6-9** If a bond has a *conversion feature*, the bondholders have the option of converting the bond into a certain number of shares of stock within a certain period of time. A *call feature* gives the issuer the opportunity to repurchase, or call, bonds at a stated price prior to maturity. It provides extra compensation to bondholders for the potential opportunity losses that would result if the bond were called due to declining interest rates. This feature allows the issuer to retire outstanding debt prior to maturity and, in the case of convertibles, to

force conversion. *Stock purchase warrants*, which are sometimes included as part of a bond issue, give the holder the right to purchase a certain number of shares of common stock at a specified price.

Bonds are rated by independent rating agencies such as Moody's and Standard & Poor's with respect to their overall quality, as measured by the safety of repayment of principal and interest. Ratings are the result of detailed financial ratio and cash flow analyses of the issuing firm. The bond rating affects the rate of return on the bond. The higher the rating, the less risk and the lower the rate.

- 6-10** The bond quotation for corporate bonds includes six pieces of information of interest to the investor. It includes the name of the issuer, the coupon rate, the year of maturity, the volume of bonds traded for the reporting day, the trading price for the last trade of the day (called the close price), and the change in the last trading price from the preceding trading day. The closing price and the change in price are quoted as a percent of the maturity value of the bond.
- 6-11** *Eurobonds* are bonds issued by an international borrower and sold to investors in countries with currencies other than that in which the bond is denominated. For example, a dollar-denominated Eurobond issued by an American corporation can be sold to French, German, Swiss, or Japanese investors. A *foreign bond*, on the other hand, is issued by a foreign borrower in a host country's capital market and denominated in the host currency. An example is a French-franc denominated bond issued in France by an English company.
- 6-12** A financial manager must understand the valuation process in order to judge the value of benefits received from stocks, bonds, and other assets in view of their risk, return, and combined impact on share value.
- 6-13** Three key inputs to the valuation process are:
1. *Cash flows* - the cash generated from ownership of the asset;
 2. *Timing* - the time period(s) in which cash flows are received; and
 3. *Required return* - the interest rate used to discount the future cash flows to a present value. The selection of the required return allows the level of risk to be adjusted; the higher the risk, the higher the required return (discount rate).
- 6-14** The valuation process applies to assets that provide an intermittent cash flow or even a single cash flow over any time period.
- 6-15** The value of any asset is the present value of future cash flows expected from the asset over the relevant time period. The three key inputs in the valuation process are cash flows, the required rate of return, and the timing of cash flows. The equation for value is:

$$V_0 = \frac{CF_1}{(1+k)^1} + \frac{CF_2}{(1+k)^2} + \dots + \frac{CF_n}{(1+k)^n}$$

where:

- V_0 = value of the asset at time zero
- CF_t = cash flow expected at the end of year t
- k = appropriate required return (discount rate)
- n = relevant time period

6-16 The basic *bond valuation equation* for a bond that pays annual interest is:

$$V_0 = I \times \left[\sum_{t=1}^n \frac{1}{(1 + k_d)^t} \right] + M \times \left[\frac{1}{(1 + k_d)^n} \right]$$

where:

- V_0 = value of a bond that pays annual interest
- I = interest
- n = years to maturity
- M = dollar par value
- k_d = required return on the bond

To find the value of bonds paying interest semiannually, the basic bond valuation equation is adjusted as follows to account for the more frequent payment of interest:

1. The annual interest must be converted to semiannual interest by dividing by two.
2. The number of years to maturity must be multiplied by two.
3. The required return must be converted to a semiannual rate by dividing it by 2.

6-17 A bond sells at a *discount* when the required return exceeds the coupon rate. A bond sells at a *premium* when the required return is less than the coupon rate. A bond sells at par value when the required return equals the coupon rate. The coupon rate is generally a fixed rate of interest, whereas the required return fluctuates with shifts in the cost of long-term funds due to economic conditions and/or risk of the issuing firm. The disparity between the required rate and the coupon rate will cause the bond to be sold at a discount or premium.

6-18 If the required return on a bond is constant until maturity and different from the coupon interest rate, the bond's value approaches its \$1,000 par value as the time to maturity declines.

6-19 To protect against the impact of rising interest rates, a risk-averse investor would prefer bonds with short periods until maturity. The responsiveness of the bond's market value to interest rate fluctuations is an increasing function of the time to maturity.

6-20 The *yield-to-maturity (YTM)* on a bond is the rate investors earn if they buy the bond at a specific price and hold it until maturity. The trial-and-error approach to calculating the YTM requires finding the value of the bond at various rates to determine the rate causing the calculated bond value to equal its current value. The approximate approach for calculating YTM uses the following equation:

$$\text{Approximate Yield} = \frac{I + [(M - B_0) / n]}{(M + B_0) / 2}$$

where:

- I = annual interest
- M = maturity value
- B₀ = market value
- n = periods to maturity

The YTM can be found precisely by using a hand-held financial calculator and using the time value functions. Enter the B₀ as the present value, the I as the annual payment, and the n as the number of periods until maturity. Have the calculator solve for the interest rate. This interest value is the YTM. Many calculators are already programmed to solve for the Internal Rate of Return (IRR). Using this feature will also obtain the YTM since the YTM and IRR are determined the same way.

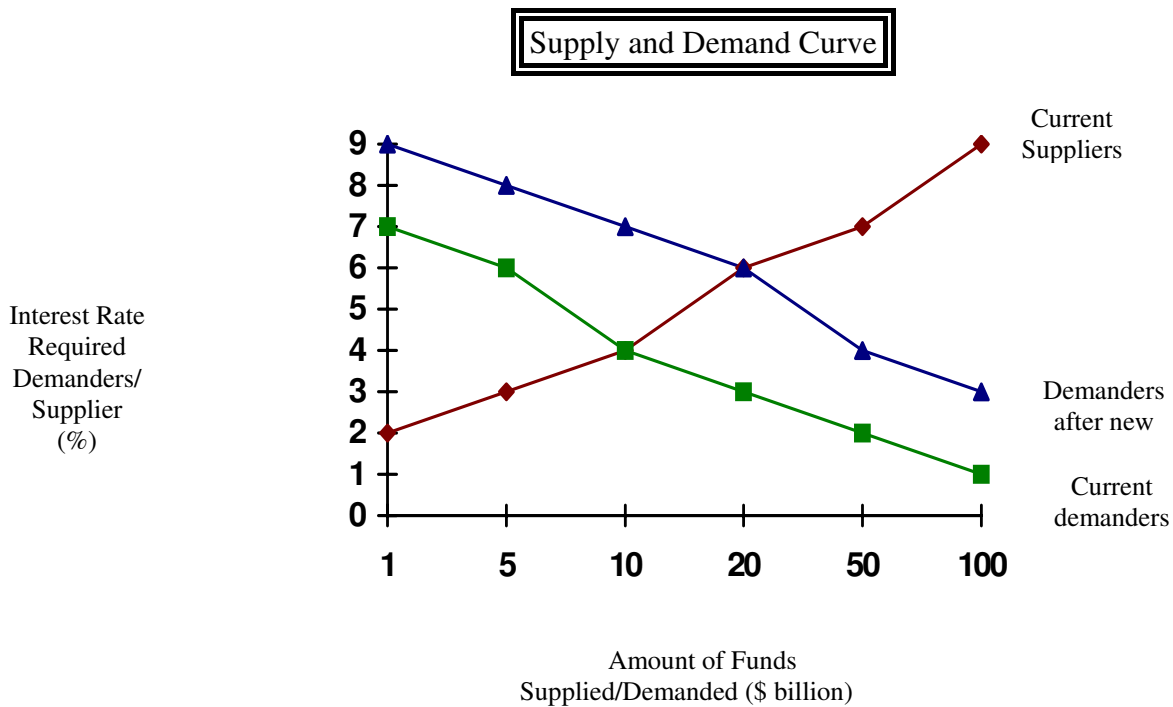
SOLUTIONS TO PROBLEMS

6-1 LG 1: Interest Rate Fundamentals: The Real Rate of Return

Real rate of return = $5.5\% - 2.0\% = 3.5\%$

6-2 LG 1: Real Rate of Interest

a.



- b. The real rate of interest creates an equilibrium between the supply of savings and the demand for funds, which is shown on the graph as the intersection of lines for current suppliers and current demanders. $K_0 = 4\%$
- c. See graph.
- d. A change in the tax law causes an upward shift in the demand curve, causing the equilibrium point between the supply curve and the demand curve (the real rate of interest) to rise from $k_0 = 4\%$ to $k_0 = 6\%$ (intersection of lines for current suppliers and demanders after new law).

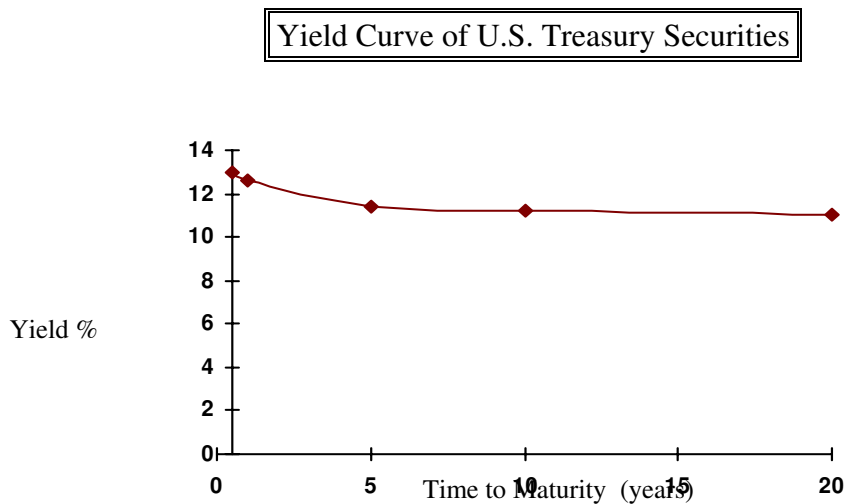
6-3 LG 1: Real and Nominal Rates of Interest

a. 4 shirts

- b. $\$100 + (\$100 \times .09) = \$109$
- c. $\$25 + (\$25 \times .05) = \$26.25$
- d. The number of polo shirts in one year = $\$109 \div \$26.25 = 4.1524$. He can buy 3.8% more shirts ($4.1524 \div 4 = .0381$).
- e. The real rate of return is $9\% - 5\% = 4\%$. The change in the number of shirts that can be purchased is determined by the real rate of return since the portion of the nominal return for expected inflation (5%) is available just to maintain the ability to purchase the same number of shirts.

6-4 LG 1: Yield Curve

a.



- b. The yield curve is slightly downward sloping, reflecting lower expected future rates of interest. The curve may reflect a general expectation for an economic recovery due to inflation coming under control and a stimulating impact on the economy from the lower rates.

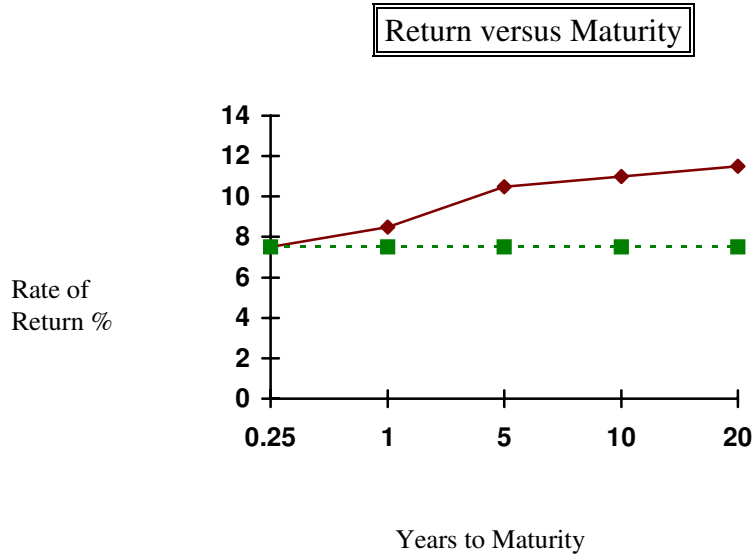
6-5 LG 1: Nominal Interest Rates and Yield Curves

- a. $k_I = k^* + IP + RP_1$
 For U.S. Treasury issues, $RP = 0$
 $R_F = k^* + IP$

20 year bond: $R_F = 2.5 + 9\% = 11.5\%$
 3 month bill: $R_F = 2.5 + 5\% = 7.5\%$
 1 year note: $R_F = 2.5 + 6\% = 8.5\%$
 5 year bond: $R_F = 2.5 + 8\% = 10.5\%$

- b. If the real rate of interest (k^*) drops to 2.0%, the nominal interest rate in each case would decrease by 0.5 percentage point.

c.



The yield curve for U.S. Treasury issues is upward sloping, reflecting the prevailing expectation of higher future inflation rates.

- d. Followers of the liquidity preference theory would state that the upward sloping shape of the curve is due to the desire by lenders to lend short-term and the desire by business to borrow long term. The dashed line in the part c graph shows what the curve would look like without the existence of liquidity preference, ignoring the other yield curve theories.

- e. Market segmentation theorists would argue that the upward slope is due to the fact that under current economic conditions there is greater demand for long-term loans for items such as real estate than for short-term loans such as seasonal needs.

6-6 LG 1: Nominal and Real Rates and Yield Curves

Real rate of interest (k^*):

$$k_i = k^* + IP + RP$$

$$RP = 0 \text{ for Treasury issues}$$

$$k^* = k_i - IP$$

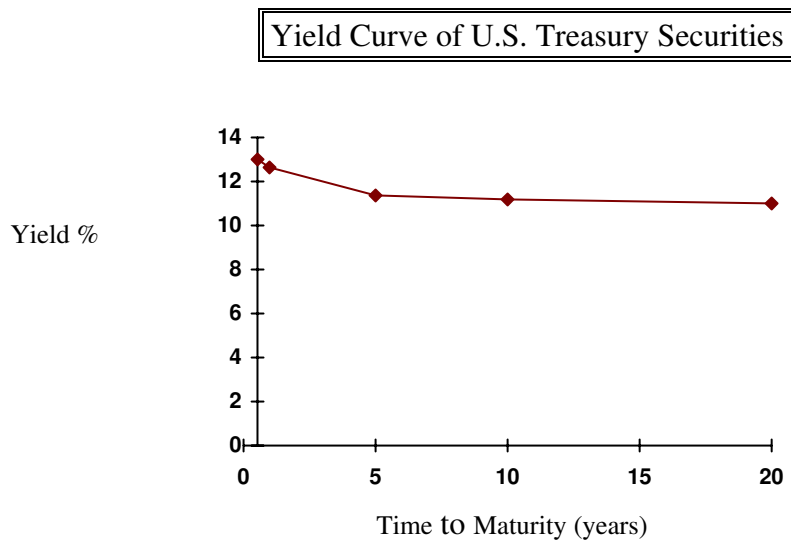
a.

Security	Nominal rate (k_i)	-	IP	=	Real rate of interest (k^*)
A	12.6%	-	9.5%	=	3.1%

B	11.2%	-	8.2%	=	3.0%
C	13.0%	-	10.0%	=	3.0%
D	11.0%	-	8.1%	=	2.9%
E	11.4%	-	8.3%	=	3.1%

- b.** The real rate of interest decreased from January to March, remained stable from March through August, and finally increased in December. Forces which may be responsible for a change in the real rate of interest include changing economic conditions such as the international trade balance, a federal government budget deficit, or changes in tax legislation.

c.

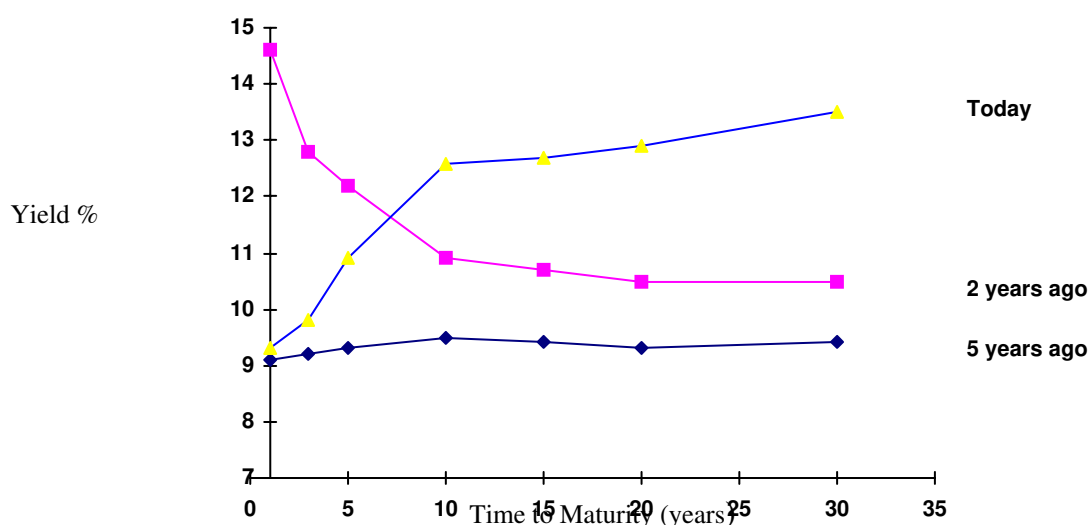


- d.** The yield curve is slightly downward sloping, reflecting lower expected future rates of interest. The curve may reflect a general expectation for an economic recovery due to inflation coming under control and a stimulating impact on the economy from the lower rates.

6-7 LG 1: Term Structure of Interest Rates

a.

Yield Curve of High-Quality Corporate Bonds



b. and c.

Five years ago, the yield curve was relatively flat, reflecting expectations of stable interest rates and stable inflation. Two years ago, the yield curve was downward sloping, reflecting lower expected interest rates due to a decline in the expected level of inflation. Today, the yield curve is upward sloping, reflecting higher expected inflation and higher future rates of interest.

6-8 LG 1: Risk-Free Rate and Risk Premiums

a. Risk-free rate: $R_F = k^* + IP$

Security	k^*	+	IP	=	R_F
A	3%	+	6%	=	9%
B	3%	+	9%	=	12%
C	3%	+	8%	=	11%
D	3%	+	5%	=	8%
E	3%	+	11%	=	14%

b. Since the expected inflation rates differ, it is probable that the maturity of each security differs.

c. Nominal rate: $k = k^* + IP + RP$

Security	k^*	+	IP	+	RP	=	k
A	3%	+	6%	+	3%	=	12%
B	3%	+	9%	+	2%	=	14%
C	3%	+	8%	+	2%	=	13%
D	3%	+	5%	+	4%	=	12%
E	3%	+	11%	+	1%	=	15%

6-9 LG 1: Risk Premiums

a. $R_{Fi} = k^* + IP_t$

Security A: $R_{F3} = 2\% + 9\% = 11\%$

Security B: $R_{F15} = 2\% + 7\% = 9\%$

- b. Risk premium:
 $RP = \text{default risk} + \text{interest rate risk} + \text{liquidity risk} + \text{other risk}$
 Security A: $RP = 1\% + 0.5\% + 1\% + 0.5\% = 3\%$
 Security B: $RP = 2\% + 1.5\% + 1\% + 1.5\% = 6\%$
- c. $k_i = k^* + IP + RP$ or $k_i = R_F + \text{Risk premium}$
 Security A: $k_i = 11\% + 3\% = 14\%$
 Security B: $k_i = 9\% + 6\% = 15\%$

Security A has a higher risk-free rate of return than Security B due to expectations of higher near-term inflation rates. The issue characteristics of Security A in comparison to Security B indicate that Security A is less risky.

6-10 LG 2: Bond Interest Payments Before and After Taxes

- a. Yearly interest = $(\$1,000 \times .07) = \70.00
- b. Total interest expense = $\$70.00 \text{ per bond} \times 2,500 \text{ bonds} = \$175,000$
- c.

Total before tax interest	\$175,000
Interest expense tax savings $(.35 \times \$175,000)$	<u>61,250</u>
Net after-tax interest expense	<u>\$113,750</u>

6-11 LG 3: Bond Quotation

- a. Tuesday, November 7
- b. $1.0025 \times \$1,000 = \$1,002.50$
- c. 2005d
- d. 558
- e. $8 \frac{3}{4}\%$
- f. current yield = $\$87.50 \div \$1,002.50 = 8.73\%$ or 8.7% per the quote
- g. The price declined by $5/8\%$ of par value. This decline means the previous close was $100 \frac{7}{8}$ or $\$1,008.75$.

6-12 LG 4: Valuation Fundamentals

- a. Cash Flows: $CF_{1-5} \quad \$1,200$
 $CF_5 \quad \$5,000$
 Required return: 6%
- b.
$$V_0 = \frac{CF_1}{(1+k)^1} + \frac{CF_2}{(1+k)^2} + \frac{CF_3}{(1+k)^3} + \frac{CF_4}{(1+k)^4} + \frac{CF_5}{(1+k)^5}$$

$$V_0 = \frac{\$1,200}{(1+.06)^1} + \frac{\$1,200}{(1+.06)^2} + \frac{\$1,200}{(1+.06)^3} + \frac{\$1,200}{(1+.06)^4} + \frac{\$6,200}{(1+.06)^5}$$

$$V_0 = \$8,791$$

Using PVIF formula:

$$V_0 = [(CF_1 \times PVIF_{6\%,1}) + (CF_2 \times PVIF_{6\%,2}) \dots (CF_5 \times PVIF_{6\%,5})]$$

$$V_0 = [(\$1,200 \times .943) + (\$1,200 \times .890) + (\$1,200 \times .840) + (\$1,200 \times .792) + (\$6,200 \times .747)]$$

$$V_0 = \$1,131.60 + \$1,068.00 + \$1,008 + \$950.40 + \$4,631.40$$

$$V_0 = \$8,789.40$$

Calculator solution: \$8,791.13

The maximum price you should be willing to pay for the car is \$8,789, since if you paid more than that amount, you would be receiving less than your required 6% return.

6-13 LG 4: Valuation of Assets

Asset	End of Year	Amount	PVIF or PVIFA _{k%,n}	Present Value of Cash Flow
A	1	\$5000		
	2	\$5000	2.174	
	3	\$5000		<u>\$10,870.00</u>
		Calculator solution:		\$10,871.36
B	1 - ∞	\$ 300	1 ÷ .15	\$ 2,000
C	1	0		
	2	0		
	3	0		
	4	0		
	5	\$35,000	.476	<u>\$16,660.00</u>
		Calculator solution:		\$16,663.96
D	1-5	\$1,500	3.605	\$ 5,407.50
	6	8,500	.507	<u>4,309.50</u>
				<u>\$ 9,717.00</u>
		Calculator solution:		\$ 9,713.52
E	1	\$2,000	.877	\$ 1,754.00
	2	3,000	.769	2,307.00
	3	5,000	.675	3,375.00

4	7,000	.592	4,144.00
5	4,000	.519	2,076.00
6	1,000	.456	<u>456.00</u>
			<u>\$14,112.00</u>
	Calculator solution:		\$14,115.27

6-14 LG 1: Asset Valuation and Risk

a.

		10% Low Risk		15% Average Risk		22% High Risk	
		PVIFA	PV of CF	PVIFA	PV of CF	PVIFA	PV of CF
CF ₁₋₄	\$3,000	3.170	\$ 9,510	2.855	\$ 8,565	2.494	\$ 7,482
CF ₅	15,000	.621	<u>9,315</u>	.497	<u>7,455</u>	.370	<u>5,550</u>
Present Value of CF:			<u>\$18,825</u>		<u>\$ 16,020</u>		<u>\$13,032</u>
Calculator solutions:			\$18,823.42		\$16,022.59		\$13,030.91

- b. The maximum price Laura should pay is \$13,032. Unable to assess the risk, Laura would use the most conservative price, therefore assuming the highest risk.
- c. By increasing the risk of receiving cash flow from an asset, the required rate of return increases, which reduces the value of the asset.

6-15 LG 5: Basic Bond Valuation

- a.
- $$B_0 = I \times (PVIFA_{kd\%,n}) + M \times (PVIF_{kd\%,n})$$
- $$B_0 = 120 \times (PVIFA_{10\%,16}) + M \times (PVIF_{10\%,16})$$
- $$B_0 = \$120 \times (7.824) + \$1,000 \times (.218)$$
- $$B_0 = \$938.88 + \$218$$
- $$B_0 = \$1,156.88$$
- Calculator solution: \$1,156.47

- b. Since Complex Systems' bonds were issued, there may have been a shift in the supply-demand relationship for money or a change in the risk of the firm.

- c.
- $$B_0 = I \times (PVIFA_{kd\%,n}) + M \times (PVIF_{kd\%,n})$$
- $$B_0 = 120 \times (PVIFA_{12\%,16}) + M \times (PVIF_{12\%,16})$$
- $$B_0 = \$120 \times (6.974) + \$1,000 \times (.163)$$
- $$B_0 = \$836.88 + \$163$$
- $$B_0 = \$999.88$$
- Calculator solution: \$1,000

When the required return is equal to the coupon rate, the bond value is equal to the par value. In contrast to a. above, if the required return is less than the coupon rate, the bond will sell at a premium (its value will be greater than par).

6-16 LG 5: Bond Valuation—Annual Interest

$$B_0 = I \times (PVIFA_{kd\%,n}) + M \times (PVIF_{kd\%,n})$$

Calculator

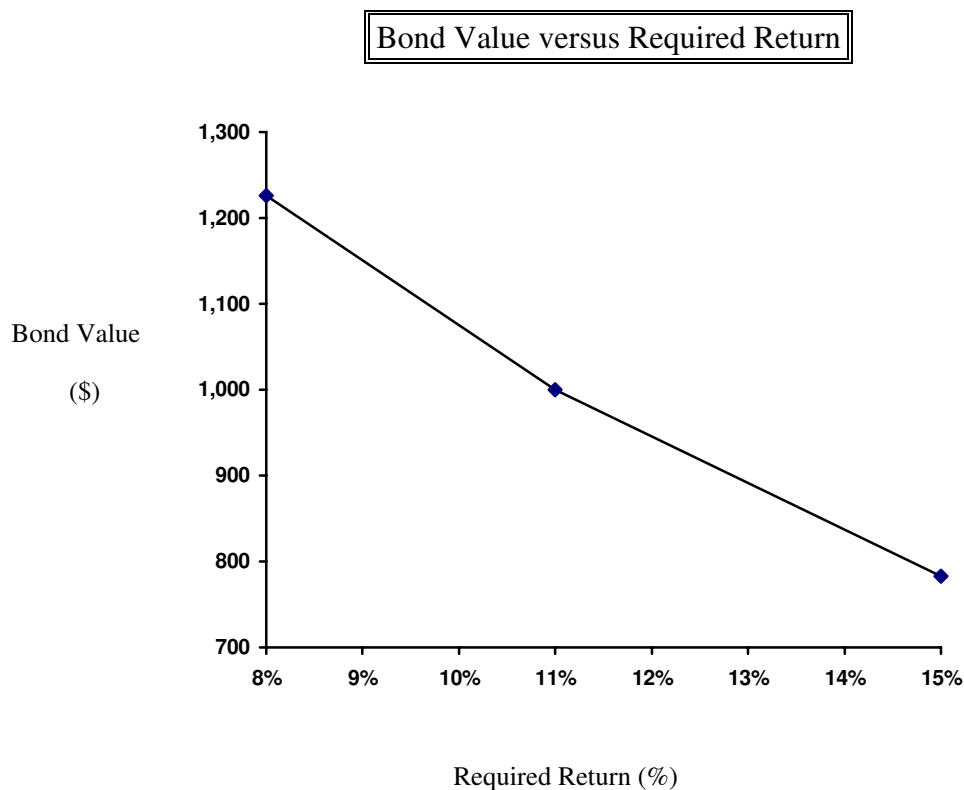
Bond	Table Values	Solution
A	$B_o = \$140 \times (7.469) + \$1,000 \times (.104) = \$1,149.66$	\$1,149.39
B	$B_o = \$80 \times (8.851) + \$1,000 \times (.292) = \$1,000.00$	\$1,000.00
C	$B_o = \$10 \times (4.799) + \$100 \times (.376) = \$ 85.59$	\$ 85.60
D	$B_o = \$80 \times (4.910) + \$500 \times (.116) = \$ 450.80$	\$ 450.90
E	$B_o = \$120 \times (6.145) + \$1,000 \times (.386) = \$1,123.40$	\$1,122.89

6-17 LG 5: Bond Value and Changing Required Returns

$$B_o = I \times (PVIFA_{kd\%,n}) + M \times (PVIF_{kd\%,n})$$

a.	Bond	Table Values	Calculator Solution
	(1)	$B_o = \$110 \times (6.492) + \$1,000 \times (.286) = \$1,000.00$	\$1,000.00
	(2)	$B_o = \$110 \times (5.421) + \$1,000 \times (.187) = \$ 783.31$	\$ 783.18
	(3)	$B_o = \$110 \times (7.536) + \$1,000 \times (.397) = \$1,225.96$	\$1,226.08

b.



- c. When the required return is less than the coupon rate, the market value is greater than the par value and the bond sells at a premium. When the required return is greater than the coupon rate, the market value is less than the par value; the bond therefore sells at a discount.
- d. The required return on the bond is likely to differ from the coupon interest rate because either (1) economic conditions have changed, causing a shift in the basic cost of long-term funds, or (2) the firm's risk has changed.

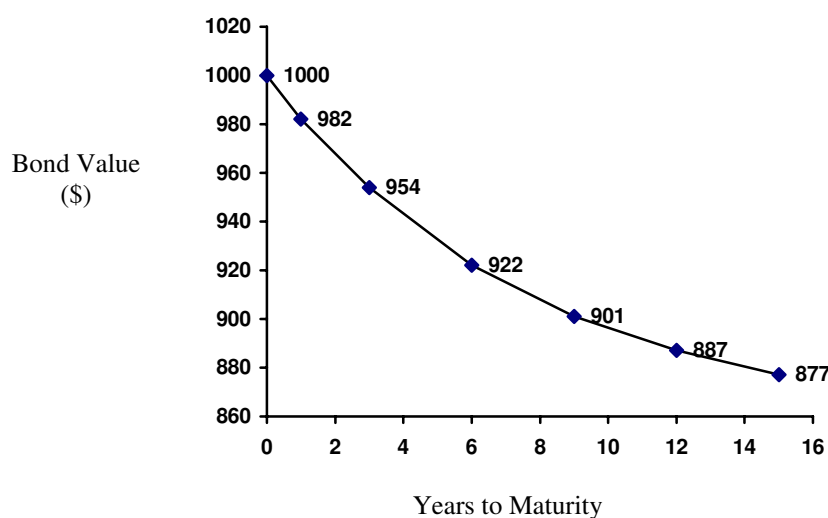
6-18 LG 5: Bond Value and Time-Constant Required Returns

$$B_0 = I \times (PVIFA_{kd\%,n}) + M \times (PVIF_{kd\%,n})$$

a.	Bond	Table Values	Calculator Solution
(1)		$B_0 = \$120 \times (6.142) + \$1,000 \times (.140) =$	\$ 877.16
(2)		$B_0 = \$120 \times (5.660) + \$1,000 \times (.208) =$	\$ 886.79
(3)		$B_0 = \$120 \times (4.946) + \$1,000 \times (.308) =$	\$ 901.07
(4)		$B_0 = \$120 \times (3.889) + \$1,000 \times (.456) =$	\$ 922.23
(5)		$B_0 = \$120 \times (2.322) + \$1,000 \times (.675) =$	\$ 953.57
(6)		$B_0 = \$120 \times (0.877) + \$1,000 \times (.877) =$	\$ 982.46

b.

Bond Value versus Years to Maturity



- c. The bond value approaches the par value.

6-19 LG 5: Bond Value and Time-Changing Required Returns

$$B_0 = I \times (PVIFA_{kd\%,n}) + M \times (PVIF_{kd\%,n})$$

a.	Bond	Table Values	Calculator Solution
	(1)	$B_0 = \$110 \times (3.993) + \$1,000 \times (.681) = \$1,120.23$	\$1,119.78
	(2)	$B_0 = \$110 \times (3.696) + \$1,000 \times (.593) = \$1,000.00$	\$1,000.00
	(3)	$B_0 = \$110 \times (3.433) + \$1,000 \times (.519) = \$896.63$	\$897.01

b.	Bond	Table Values	Calculator Solution
	(1)	$B_0 = \$110 \times (8.560) + \$1,000 \times (.315) = \$1,256.60$	\$1,256.78
	(2)	$B_0 = \$110 \times (7.191) + \$1,000 \times (.209) = \$1,000.00$	\$1,000.00
	(3)	$B_0 = \$110 \times (6.142) + \$1,000 \times (.140) = \$815.62$	\$815.73

c.	Required Return	Value	
		Bond A	Bond B
	8%	\$1,120.23	\$1,256.60
	11%	1,000.00	1,000.00
	14%	896.63	815.62

The greater the length of time to maturity, the more responsive the market value of the bond to changing required returns, and vice versa.

- d. If Lynn wants to minimize interest rate risk in the future, she would choose Bond A with the shorter maturity. Any change in interest rates will impact the market value of Bond A less than if she held Bond B.

6-20 LG 6: Yield to Maturity

Bond A is selling at a discount to par.

Bond B is selling at par value.

Bond C is selling at a premium to par.

Bond D is selling at a discount to par.
Bond E is selling at a premium to par.

6-21 LG 6: Yield to Maturity

- a. Using a financial calculator the YTM is 12.685%. The correctness of this number is proven by putting the YTM in the bond valuation model. This proof is as follows:

$$\begin{aligned} B_0 &= 120 \times (\text{PVIFA}_{12.685\%,15}) + 1,000 \times (\text{PVIF}_{12.685\%,15}) \\ B_0 &= \$120 \times (6.569) + \$1,000 \times (.167) \\ B_0 &= \$788.28 + 167 \\ B_0 &= \$955.28 \end{aligned}$$

Since B_0 is \$955.28 and the market value of the bond is \$955, the YTM is equal to the rate derived on the financial calculator.

- b. The market value of the bond approaches its par value as the time to maturity declines. The yield to maturity approaches the coupon interest rate as the time to maturity declines.

6-22 LG 6: Yield to Maturity

a.	Bond	Approximate YTM	Trial-and-error YTM Approach	Error (%)	Calculator Solution
	A	$= \frac{\$90 + [(\$1,000 - \$820) \div 8]}{[(\$1,000 + \$820) \div 2]}$			
		= 12.36%	12.71%	-0.35	12.71%
	B	= 12.00%	12.00%	0.00	12.00%
	C	$= \frac{\$60 + [(\$500 - \$560) \div 12]}{[(\$500 + \$560) \div 2]}$			
		= 10.38%	10.22%	+0.15	10.22%
	Bond	Approximate YTM	Trial-and-error YTM Approach	Error (%)	Calculator Solution
	D	$= \frac{\$150 + [(\$1,000 - \$1,120) \div 10]}{[(\$1,000 + \$1,120) \div 2]}$			
		= 13.02%	12.81%	+0.21	12.81%
	E	$= \frac{\$50 + [(\$1,000 - \$900) \div 3]}{[(\$1,000 + \$900) \div 2]}$			
		= 8.77%	8.94%	-.017	8.95%

- b. The market value of the bond approaches its par value as the time to maturity declines. The yield-to-maturity approaches the coupon interest rate as the time to maturity declines.

6-23 LG 2, 5, 6: Bond Valuation and Yield to Maturity

a. $B_A = \$60(PVIFA_{12\%,5}) + \$1,000(PVIF_{12\%,5})$
 $B_A = \$60(3.605) + \$1,000(.567)$
 $B_A = \$216.30 + 567$
 $B_A = \$783.30$

$$B_B = \$140(PVIFA_{12\%,5}) + \$1,000(PVIF_{12\%,5})$$

$$B_B = \$140(3.605) + \$1,000(.567)$$

$$B_B = \$504.70 + 567$$

$$B_B = \$1,071.70$$

b.

$$\text{Number of bonds} = \frac{\$20,000}{\$783.30} = 25.533 \text{ of bond A}$$

$$\text{Number of bonds} = \frac{\$20,000}{\$1,071.70} = 18.662 \text{ of bond B}$$

c. Interest income of A = 25.533 bonds x \$60 = \$1,531.98
Interest income of B = 18.66194 bonds x \$140 = \$2,612.67

d. At the end of the 5 years both bonds mature and will sell for par of \$1,000.

$$FV_A = \$60(FVIFA_{10\%,5}) + \$1,000$$

$$FV_A = \$60(6.105) + \$1,000$$

$$FV_A = \$366.30 + \$1,000 = \$1,366.30$$

$$FV_B = \$140(FVIFA_{10\%,5}) + \$1,000$$

$$FV_B = \$140(6.105) + \$1,000$$

$$FV_B = \$854.70 + \$1,000 = \$1,854.70$$

e. The difference is due to the differences in interest payments received each year. The principal payments at maturity will be the same for both bonds. Using the calculator, the yield to maturity of bond A is 11.77% and the yield to maturity of bond B is 11.59% with the 10% reinvestment rate for the interest payments. Mark would be better off investing in bond A. The reasoning behind this result is that for both bonds the principal is priced to yield the YTM of 12%. However, bond B is more dependent upon the reinvestment of the large coupon payment at the YTM to earn the 12% than is the lower coupon payment of A.

6-24 LG 6: Bond Valuation–Semiannual Interest

$$\begin{aligned}
 B_o &= I \times (PVIFA_{kd\%,n}) + M \times (PVIF_{kd\%,n}) \\
 B_o &= \$50 \times (PVIFA_{7\%,12}) + M \times (PVIF_{7\%,12}) \\
 B_o &= \$50 \times (7.943) + \$1,000 \times (.444) \\
 B_o &= \$397.15 + \$444 \\
 B_o &= \$841.15 \\
 \text{Calculator solution: } &\$841.15
 \end{aligned}$$

6-25 LG 6: Bond Valuation–Semiannual Interest

$$B_o = I \times (PVIFA_{kd\%,n}) + M \times (PVIF_{kd\%,n})$$

Bond	Table Values	Calculator Solution
A	$B_o = \$50 \times (15.247) + \$1,000 \times (.390) = \$1,152.35$	\$ 1,152.47
B	$B_o = \$60 \times (15.046) + \$1,000 \times (.097) = \$1,000.00$	\$ 1,000.00
C	$B_o = \$30 \times (7.024) + \$500 \times (.508) = \$464.72$	\$ 464.88
D	$B_o = \$70 \times (12.462) + \$1,000 \times (.377) = \$1,249.34$	\$ 1,249.24
E	$B_o = \$3 \times (5.971) + \$100 \times (.582) = \$76.11$	\$76.11

6-26 LG 6: Bond Valuation–Quarterly Interest

$$\begin{aligned}
 B_o &= I \times (PVIFA_{kd\%,n}) + M \times (PVIF_{kd\%,n}) \\
 B_o &= \$125 \times (PVIFA_{3\%,40}) + \$5,000 \times (PVIF_{3\%,40}) \\
 B_o &= \$125 \times (23.115) + \$5,000 \times (.307) \\
 B_o &= \$2,889.38 + \$1,535 \\
 B_o &= \$4,424.38 \\
 \text{Calculator solution: } &\$4,422.13
 \end{aligned}$$

CHAPTER 6 CASE**Evaluating Annie Hegg's Proposed Investment in Atilier Industries Bonds**

This case demonstrates how a risky investment can affect a firm's value. First, students must calculate the current value of Suarez's bonds and stock, rework the calculations assuming that the firm makes the risky investment, and then draw some conclusions about the value of the firm in this situation. In addition to gaining experience in valuation of bonds and stock, students will see the relationship between risk and valuation.

- a.** Annie should convert the bonds. The value of the stock if the bond is converted is:

$$50 \text{ shares} \times \$30 \text{ per share} = \$1,500$$

while if the bond was allowed to be called in the value would be on \$1,080

b **Current value of bond under different required returns – annual interest**

- (1) $B_0 = I \times (PVIFA_{6\%,25 \text{ yrs.}}) + M \times (PVIF_{6\%,25 \text{ yrs.}})$
 $B_0 = \$80 \times (12.783) + \$1,000 \times (.233)$
 $B_0 = \$1,022.64 + \233
 $B_0 = \$1,255.64$
 Calculator solution: \$1,255.67
 The bond would be at a premium.

- (2) $B_0 = I \times (PVIFA_{8\%,25 \text{ yrs.}}) + M \times (PVIF_{8\%,25 \text{ yrs.}})$
 $B_0 = \$80 \times (10.674) + \$1,000 \times (.146)$
 $B_0 = \$853.92 + \146
 $B_0 = \$999.92$
 Calculator solution: \$1,000.00
 The bond would be at par value..

- (3) $B_0 = I \times (PVIFA_{10\%,25 \text{ yrs.}}) + M \times (PVIF_{10\%,25 \text{ yrs.}})$
 $B_0 = \$80 \times (9.077) + \$1,000 \times (.092)$
 $B_0 = \$726.16 + \92
 $B_0 = \$818.16$
 Calculator solution: \$818.46
 The bond would be at a discount.

c **Current value of bond under different required returns – semiannual interest**

- (1) $B_0 = I \times (PVIFA_{3\%,50 \text{ yrs.}}) + M \times (PVIF_{3\%,50 \text{ yrs.}})$
 $B_0 = \$40 \times (25.730) + \$1,000 \times (.228)$
 $B_0 = \$1,029.20 + \228

$$B_0 = \$1,257.20$$

Calculator solution: \$1,257.30

The bond would be at a premium.

(2) $B_0 = I \times (PVIFA_{4\%,50 \text{ yrs.}}) + M \times (PVI_{4\%,50 \text{ yrs.}})$

$$B_0 = \$40 \times (21.482) + \$1,000 \times (.141)$$

$$B_0 = \$859.28 + \$146$$

$$B_0 = \$1005.28$$

Calculator solution: \$1,000.00

The bond would be at par value..

(3) $B_0 = I \times (PVIFA_{5\%,50 \text{ yrs.}}) + M \times (PVIF_{5\%,50 \text{ yrs.}})$

$$B_0 = \$40 \times (18.256) + \$1,000 \times (.087)$$

$$B_0 = \$730.24 + \$87$$

$$B_0 = \$817.24$$

Calculator solution: \$817.44

The bond would be at a discount.

Under all 3 required returns for both annual and semiannual interest payments the bonds are consistent in their direction of pricing. When the required return is above (below) the coupon the bond sells at a discount (premium). When the required return and coupon are equal the bond sells at par. When the change is made from annual to semiannual payments the value of the premium and par value bonds increase while the value of the discount bond decreases. This difference is due to the higher effective return associated with compounding frequency more often than annual.

- d. If expected inflation increases by 1% the required return will increase from 8% to 9%, and the bond price would drop to \$908.84. This amount is the maximum Annie should pay for the bond.

$$B_0 = I \times (PVIFA_{9\%,25 \text{ yrs.}}) + M \times (PVIF_{9\%,25 \text{ yrs.}})$$

$$B_0 = \$80 \times (9.823) + \$1,000 \times (.116)$$

$$B_0 = \$785.84 + \$123$$

$$B_0 = \$908.84$$

Calculator solution: \$901.77

- e. The value of the bond would decline to \$925.00 due to the higher required return and the inverse relationship between bond yields and bond values.

$$B_0 = I \times (PVIFA_{8.75\%,25 \text{ yrs.}}) + M \times (PVIF_{8.75\%,25 \text{ yrs.}})$$

$$B_0 = \$80 \times (10.025) + \$1,000 \times (.123)$$

$$B_0 = \$802.00 + \$123$$

$$B_0 = \$925.00$$

Calculator solution: \$924.81

- f. The bond would increase in value and a gain of \$110.88 would be earned by Annie.

Bond value at 7% and 22 years to maturity.

$$B_0 = I \times (PVIFA_{7\%,22 \text{ yrs.}}) + M \times (PVIF_{7\%,22 \text{ yrs.}})$$

$$B_0 = \$80 \times (11.061) + \$1,000 \times (.226)$$

$$B_0 = \$884.88 + \$226$$

$$B_0 = \$1,110.88$$

Calculator solution: \$1,110.61

- g. The bond would increase in value and a gain of \$90.64 would be earned by Annie.

Bond value at 7% and 15 years to maturity.

$$B_0 = I \times (PVIFA_{7\%,15 \text{ yrs.}}) + M \times (PVIF_{7\%,15 \text{ yrs.}})$$

$$B_0 = \$80 \times (9.108) + \$1,000 \times (.362)$$

$$B_0 = \$728.64 + \$362$$

$$B_0 = \$1,090.64$$

Calculator solution: \$1,091.08

The bond is more sensitive to interest rate changes when the time to maturity is longer (22 years) than when the time to maturity is shorter (15 years). Maturity risk decreases as the bond gets closer to maturity.

- h. Using the calculator the YTM on this bond assuming annual interest payments of \$80, 25 years to maturity, and a current price of \$983.75 would be 8.15%.
- i. Annie should probably not invest in the Atilier bond. There are several reasons for this conclusion.
1. The term to maturity is long and thus the maturity risk is high.
 2. An increase in interest rates is likely due to the potential downgrading of the bond thus driving the price down.
 3. An increase in interest rates is likely due to the possibility of higher inflation thus driving the price down.
 4. The price of \$983.75 is well above her minimum price of \$908.84 assuming an increase in interest rates of 1%.

CHAPTER 7

Stock Valuation

INSTRUCTOR'S RESOURCES

Overview

This chapter continues on the valuation process introduced in Chapter 6 for bonds. Models for valuing preferred and common stock are presented. For common stock, the zero growth, constant growth, and variable growth models are examined. The relationship between stock valuation and efficient markets is presented. The role of venture capitalists and investment bankers is also discussed. The free cash flow model is explained and compared with the dividend discount models. Other approaches to common stock valuation and their shortcomings are explained. The chapter ends with a discussion of the interrelationship between financial decisions, expected return, risk, and a firm's value.

PMF DISK

PMF Tutor: Stock Valuation

This module provides problems for the valuation of the constant growth and variable growth models for common stock valuation.

PMF Problem-Solver: Stock Valuation

This module's routines are Common Stock Valuation.

PMF Templates

Spreadsheet templates are provided for the following problem:

<u>Problem</u>	<u>Topic</u>
Problem 7-6	Common stock valuation–Zero growth

Study Guide

Suggested *Study Guide* examples for classroom presentation:

<u>Example</u>	<u>Topic</u>
1	Constant growth rate model
4	Mixed growth rates

ANSWERS TO REVIEW QUESTIONS

- 7-1** *Equity capital* is permanent capital representing ownership, while *debt capital* represents a loan that must be repaid at some future date. The holders of equity capital receive a claim on the income and assets of the firm that is secondary to the claims of the firm's creditors. Suppliers of debt must receive all interest owed prior to any distribution to equity holders, and in liquidation all unpaid debts must be satisfied prior to any distribution to the firm's owners. Equity capital is perpetual while debt has a specified maturity date. Both income from debt (interest) and income from equity (dividends) are taxed as ordinary income. To the corporation, debt interest is a tax deductible expense while dividends are not.
- 7-2** Common stockholders are the true owners of the firm, since they invest in the firm only upon the expectation of future returns. They are not guaranteed any return, but merely get what is left over after all the other claims have been satisfied. Since the common stockholders receive only what is left over after all other claims are satisfied, they are placed in a quite uncertain or risky position with respect to returns on invested capital. As a result of this risky position, they expect to be compensated in terms of both dividends and capital gains of sufficient quantity to justify the risk they take.
- 7-3** Rights offerings protect against *dilution of ownership* by allowing existing stockholders to purchase additional shares of any new stock issues. Without this protection current shareholders may have their voting power reduced. *Rights* are financial instruments issued to current stockholders that permit these stockholders to purchase additional shares at a price below the market price, in direct proportion to their number of owned shares.
- 7-4**
- *Authorized shares* are stated in the company's corporate charter which specifies the maximum number of shares the firm can sell without receiving approval from the shareholders.
 - When authorized shares are sold to the public and are in the hands of the public, they are called *outstanding shares*.
 - When a firm purchases back its own shares from the public, they are classified as *treasury stock*. Treasury stock is not considered outstanding since it is not in the hands of the public.
 - *Issued shares* are the shares of common stock that have been put into circulation. Issued shares include both outstanding shares and treasury stock.
- 7-5** Issuing stock outside of their home markets can benefit corporations by broadening the investor base and also allowing them to become better integrated into the local business scene. A local stock listing both increases local press coverage and serves as effective corporate advertising. Locally traded stock can also be used to make corporate acquisitions.
- ADRs are claims issued by U.S. banks and represent ownership of shares of a foreign company's stock held on deposit by the U.S. bank in the foreign market. ADRs are issued in dollars by an American bank to U.S. investors and are subject to U.S. securities laws; yet still give investors the opportunity to internationally diversify their portfolios.

7-6 The claims of preferred stockholders are senior to those of the common stockholders with respect to the distribution of both earnings and assets.

7-7 *Cumulative preferred stock* gives the holder the right to receive any dividends in arrears prior to the payment of dividends to common stockholders.

The *call feature* in a preferred stock issue allows the issuer to retire outstanding preferred stock within a certain period of time at a prespecified price. This feature is not usually exercisable until a few years after issuance. The call normally takes place at a price above the initial issuance price and may decrease according to a predefined schedule. The call feature allows the issuer to escape the fixed payment commitment of the preferred stock which would remain on the books indefinitely. The call feature is also needed in order to force conversion of convertible preferred stock.

7-8 *Venture capitalists* are typically business entities that are organized for the purpose of investing in attractive growth companies. *Angel capitalists* are generally wealthy individuals that provide private financing to new businesses. Firms usually obtain angel financing first, then as their funding needs get too large for individual investors they seek funds from venture capitalists.

7-9 There are four bodies into which institutional venture capitalists are most commonly organized.

- *Small business investment companies (SBICs)* are corporations chartered by the federal government.
- *Financial VC funds* are subsidiaries of financial institutions, particularly banks.
- *Corporate VC funds* are firms, sometimes subsidiaries, established by non financial firms.
- *VC limited partnerships* are limited partnerships organized by professional VC firms, who serve as general partner.

Venture capitalist investments are made under a legal contract that clearly allocates responsibilities and ownership interest between existing owners and the VC fund or limited partnership. The specific financial terms will depend on factors such as: the business structure, stage of development, and outlook. Although each VC investment is unique, the transaction will be structured to provide the VC with a high rate of return that is consistent with the typically high risk of such transactions.

7-10 The general steps that a private firm must go through to public via an *initial public offering* are listed below.

- The firm must obtain the approval of its current shareholders.
- The company's auditors and lawyers must certify that all documents for the company are legitimate.
- The firm then finds an investment bank willing to underwrite the offering.
- A registration statement must then be filed with the Securities Exchange Commission.
- Once the registration statement is approved by the SEC the investment public can begin analyzing the company's prospects.

- 7-11** The *investment banker's* main activity is to underwrite the issue. In addition to underwriting the IB provides the issuer with advice about pricing and other important aspects of the issue.

The IB may organize an *underwriting syndicate* to help underwrite the issue and thus to share part of the risk. The IB and the syndicate will put together a *selling group* who share the responsibility of selling a portion of the issue.

- 7-12** The first item in a stock quotation is the year-to-date return. The next items are the highest and lowest price the stock traded for during the past 52 weeks, the company name, the company ticker symbol, the annualized dividend based on the last dividend paid, the dividend yield, the price/earnings ratio, the number of round lots traded for the trading day, the close (last) trade price for the day, and the change in the close price from the previous trading day.

The P/E ratio is calculated by dividing the closing market price by the firm's most recent annual earnings per share. The P/E is believed to reflect investor expectations concerning the firm's future prospects – higher P/E ratios reflect investor optimism and confidence; lower P/E ratios reflect investor pessimism and concern.

- 7-13** The *efficient market hypothesis* says that in an efficient market, investors would buy an asset if the expected return exceeds the current return, thereby increasing its price (market value) and decreasing the expected return, until expected and required returns are equal.

- 7-14** According to the efficient market hypothesis:

- a. Securities prices are in equilibrium (fairly priced with expected returns equal to required returns);
- b. Securities prices fully reflect all public information available and will react quickly to new information; and
- c. Investors should therefore not waste time searching for mispriced (over- or undervalued) securities.

The efficient market hypothesis is generally accepted as being reasonable for securities traded on major exchanges; this is supported by research on the subject.

- 7-15** a. The *zero growth model* of common stock valuation assumes a constant, no growing dividend stream. The stock is valued as a perpetuity and discounted at a rate k_s :

$$P_0 = \frac{P_0}{k_s}$$

- b. The *constant growth model* of common stock valuation, also called the Gordon model, assumes that dividends will grow at a constant rate, g . The stock is valued as the present value of the constantly growing cash flow stream:

$$P_0 = \frac{D_1}{k_s - g}$$

- c. The *variable growth model* of common stock valuation assumes that dividends grow at a variable rate. The stock with a single shift in the growth rate is valued as the present value of the dividend stream during the initial growth phase plus the present value of the price of stock at the end of the initial growth phase:

$$P_0 = \sum_{t=1}^N \frac{D_0 \times (1 + g_1)^t}{(1 + k_s)^t} + \left(\frac{1}{(1 + k_s)^N} \times \frac{D_{N+1}}{(k_s - g_2)} \right)$$

- 7-16** The *free cash flow valuation model* takes the present value of all future free cash flows. Since this present value represents the total value of the firm the value of debt and preferred stock must be subtracted to get the free cash flow available to stockholders. Dividing the resulting value by the number of shares outstanding arrives at the stock price.

The free cash flow model differs from the dividend valuation model in 2 main ways.

1. The total cash flows of the company are evaluated, not just dividends.
2. The firm's cost of capital is used as the discount rate, not the required return on stock.

- 7-17** a. *Book value* is the value of the stock in the event all assets are liquidated for their book value and the proceeds remaining after paying all liabilities are divided among the common stockholders.
- b. *Liquidation value* is the actual amount each common stockholder would expect to receive if the firm's assets are sold, creditors and preferred stockholders are paid, and any remaining money is divided among the common stockholders.
- c. *Price earnings multiples* are another way to estimate common stock value. The share value is estimated by multiplying expected earnings per share by the average price/earnings ratio for the industry.

Both the book value and liquidation value approaches ignore the earning power of a firm's assets and lack a relationship to the firm's value in the marketplace. The price/earnings multiples approach is considered the best approach to valuation since it considers expected earnings. The P/E ratio also has the strongest theoretical roots. One divided by the P/E ratio can be viewed as the rate at which investors discount the firm's earnings. If the projected earnings per share is assumed to be earned indefinitely, the P/E multiple approach can be looked on as a method of finding the present value of a perpetuity of projected EPS at a rate equal to the P/E ratio.

- 7-18** A decision or action by the financial manager can have an effect on the risk and expected return of the stock, both of which are part of the stock valuation model.

- 7-19** CAPM: $k_s = R_F + [b_j \times (k_m - R_F)]$ and $b_j > 1.00$:

- a. As beta (risk) increases, required return increases and stock price falls.
- b. As the risk-free rate declines, the required return would also decline. Substituting k_s into the Gordon model $P_0 = D_1 \div (k_s - g)$, as k_s declines, P_0 increases.

- c. As D_1 decreases, the P_0 also decreases since the numerator in the dividend valuation models will decline.
- d. As g increases, the P_0 also increases. In the Gordon growth model the value of $(k-g)$ in the denominator will become smaller resulting in a higher value.

SOLUTIONS TO PROBLEMS**7-1 LG 2: Authorized and Available Shares**

- a. Maximum shares available for sale

Authorized shares	2,000,000
Less: Shares outstanding	<u>1,400,000</u>
Available shares	600,000

- b. $\text{Total shares needed} = \frac{\$48,000,000}{\$60} = 800,000 \text{ shares}$

The firm requires an additional 200,000 authorized shares to raise the necessary funds at \$60 per share.

- c. Aspin must amend its corporate charter to authorize the issuance of additional shares.

7-2 LG 2: Preferred Dividends

- a. \$8.80 per year or \$2.20 per quarter
- b. \$2.20 For a no cumulative preferred only the latest dividend has to be paid before dividends can be paid on common stock.
- c. \$8.80 For cumulative preferred all dividends in arrears must be paid before dividends can be paid on common stock. In this case the board must pay the 3 dividends missed plus the current dividend.

7-3 Preferred Dividends

A	\$15.00	2 quarters in arrears plus the latest quarter
B	\$8.80	only the latest quarter
C	\$11.00	only the latest quarter
D	\$25.50	4 quarters in arrears plus the latest quarter
E	\$8.10	only the latest quarter

7-4 LG 2: Convertible Preferred Stock

- a. $\text{Conversion value} = \text{conversion ratio} \times \text{stock price} = 5 \times \$20 = \$100$
- b. Based on comparison of the preferred stock price versus the conversion value the investor should convert. If converted, the investor has \$100 of value versus only \$96 if she keeps ownership of the preferred stock.
- c. If the investor converts to common stock she will begin receiving \$1.00 per share per year of dividends. Conversion will generate \$5.00 per year of total dividends. If the investor keeps the preferred they will receive \$10.00 per year of dividends. This additional \$5.00 per year in dividends may cause the investor to keep the preferred until forced to convert through use of the call feature.

7-5 LG 2: Stock Quotation

- a. Wednesday, December 13

Find out more at www.kawsarbd1.weebly.com

- b. \$81.75
 c. +3.2%
 d. P/E ratio = 23
 The P/E is calculated by dividing the closing market price by the firm's most recent annual earnings per share. The P/E is believed to reflect investor expectations concerning the firm's future prospects. Higher (lower) P/E ratios reflect investor optimism (pessimism) and confidence (concern).
 e. \$81.75
 f. \$1.32
 g. Highest price = \$84.13; Lowest price = \$51.25
 h. 12,432 round lots for total shares of $12,432 \times 100 = 1,243,200$ shares.
 i. The price increased by \$1.63. This increase tells us that the previous close was \$80.12.

7-6 LG 4: Common Stock Valuation–Zero Growth: $P_0 = D_1 \div k_s$

- a. $P_0 = \$2.40 \div .12$
 $P_0 = \$20$
 b. $P_0 = \$2.40 \div .20$
 $P_0 = \$12$
 c. As perceived risk increases, the required rate of return also increases, causing the stock price to fall.

7-7 LG 4: Common Stock Valuation–Zero Growth

$$\text{Value of stock when purchased} = \frac{\$5.00}{.16} = \$31.25$$

$$\text{Value of stock when sold} = \frac{\$5.00}{.12} = \$41.67$$

Sally's capital gain is \$10.42 (\$41.67 - \$31.25).

7-8 LG 4: Preferred Stock Valuation: $PS_0 = D_p \div k_p$

- a. $PS_0 = \$6.40 \div .093$
 $PS_0 = \$68.82$
 b. $PS_0 = \$6.40 \div .105$
 $PS_0 = \$60.95$

The investor would lose \$7.87 per share (\$68.82 - \$60.95) because, as the required rate of return on preferred stock issues increases above the 9.3% return she receives, the value of her stock declines.

7-9 LG 4: Common Stock Value–Constant Growth: $P_0 = D_1 \div (k_s - g)$

Firm	$P_0 = D_1 \div (k_s - g)$	Share Price
A	$P_0 = \$1.20 \div (.13 - .08)$	= \$ 24.00
B	$P_0 = \$4.00 \div (.15 - .05)$	= \$ 40.00
C	$P_0 = \$.65 \div (.14 - .10)$	= \$ 16.25
D	$P_0 = \$6.00 \div (.09 - .08)$	= \$600.00
E	$P_0 = \$2.25 \div (.20 - .08)$	= \$ 18.75

7-10 LG 4: Common Stock Value–Constant Growth**a.**

$$k_s = \frac{D_1}{P_0} + g$$

$$k_s = \frac{\$1.20 \times (1.05)}{\$28} + .05$$

$$k_s = \frac{\$1.26}{\$28} + .05 = .045 + .05 = .095 = 9.5\%$$

b.

$$k_s = \frac{\$1.20 \times (1.10)}{\$28} + .10$$

$$k_s = \frac{\$1.32}{\$28} + .10 = .047 + .10 = .147 = 14.7\%$$

7-11 LG 4: Common Stock Value–Constant Growth: $P_0 = D_1 \div (k_s - g)$

Computation of growth rate:

$$FV = PV \times (1 + k)^n$$

$$\$2.87 = \$2.25 \times (1 + k)^5$$

$$\$2.87 \div \$2.25 = FVIF_{k\%,5}$$

$$1.276 = FVIF_{k\%,5}$$

$$g = k \text{ at } 5\%$$

a. Value at 13% required rate of return:

$$P_0 = \frac{\$3.02}{.13 - .05} = \$37.75$$

b. Value at 10% required rate of return:

$$P_0 = \frac{\$3.02}{.10 - .05} = \$60.40$$

c. As risk increases, the required rate of return increases, causing the share price to fall.**7-12 LG 4: Common Stock Value - Variable Growth:**

P_0 = Present value of dividends during initial growth period
+ present value of price of stock at end of growth period.

Steps 1 and 2: Value of cash dividends and present value of annual dividends

t	D_0	$FVIF_{25\%,t}$	D_t	$PVIF_{15\%,t}$	Present Value of Dividends
1	\$2.55	1.250	\$3.19	.870	\$2.78
2	2.55	1.562	3.98	.756	3.01

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3	2.55	1.953	4.98	.658	<u>3.28</u>
					\$9.07

Step 3: Present value of price of stock at end of initial growth period

$$D_{3+1} = \$4.98 \times (1 + .10)$$

$$D_4 = \$5.48$$

$$P_3 = [D_4 \div (k_s - g_2)]$$

$$P_3 = \$5.48 \div (.15 - .10)$$

$$P_3 = \$109.60$$

$$\text{PV of stock at end of year 3} = P_3 \times (\text{PVIF}_{15\%,3})$$

$$\text{PV} = \$109.60 \times (.658)$$

$$\text{PV} = \$72.12$$

Step 4: Sum of present value of dividends during initial growth period and present value price of stock at end of growth period

$$P_0 = \$9.07 + \$72.12$$

$$P_0 = \$81.19$$

7-13 LG 4: Common Stock Value–Variable Growth

$$P_0 = \sum_{t=1}^N \frac{D_0 \times (1 + g_1)^t}{(1 + k_s)^t} + \frac{1}{(1 + k_s)^N} \times \frac{D_{N+1}}{(k_s - g_2)}$$

P_0 = Present value of dividends during initial growth period + present value of price of stock at end of growth period.

Steps 1 and 2: Value of cash dividends and present value of annual dividends

$$D_1 = \$3.40 \times (1.00) = \$3.40$$

$$D_2 = \$3.40 \times (1.05) = \$3.57$$

$$D_3 = \$3.57 \times (1.05) = \$3.75$$

$$D_4 = \$3.75 \times (1.15) = \$4.31$$

$$D_5 = \$4.31 \times (1.10) = \$4.74$$

t	D_t	$\text{PVIF}_{14\%,t}$	Present Value of Dividends
1	\$3.40	.877	\$2.98
2	3.57	.769	2.75
3	3.75	.675	2.53
4	4.31	.592	<u>2.55</u>
			\$10.81

Step 3: Present value of price of stock at end of initial growth period

$$P_4 = [D_5 \div (k_s - g)]$$

$$P_4 = \$4.74 \div (.14 - .10)$$

$$P_4 = \$118.50$$

PV of stock at end of year 4 = $P_4 \times (PVIF_{14\%,4})$

$$PV = \$118.50 \times (.592)$$

$$PV = \$70.15$$

Step 4: Sum of present value of dividends during initial growth period and present value price of stock at end of growth period

$$P_0 = \$10.81 + \$70.15$$

$$P_0 = \$80.96$$

7-14 LG 4: Common Stock Value–Variable growth

a.

t	D_0	$FVIF_{8\%,t}$	D_t	$PVIF_{11\%,t}$	Present Value of Dividends
1	\$1.80	1.080	\$1.94	.901	\$ 1.75
2	1.80	1.166	2.10	.812	1.71
3	1.80	1.260	2.27	.731	<u>1.66</u>
					<u>\$ 5.12</u>

$$D_4 = D_3(1.05) = \$2.27 \times (1.05) = \$2.38$$

$$P_3 = [D_4 \div (k_s - g)]$$

$$P_3 = \$2.38 \div (.11 - .05)$$

$$P_3 = \$39.67$$

PV of stock at end of year 3 = $P_3 \times (PVIF_{11\%,3})$

$$PV = \$39.67 \times (.731)$$

$$PV = \$29.00$$

$$P_0 = \$29.00 + \$5.12 = \$34.12$$

b. The present value of the first 3 year's dividends is the same as in part a.

$$D_4 = D_3(1.0) = 2.27$$

$$P_3 = [D_4 \div (k_s - g)]$$

$$P_3 = \$2.27 \div .11$$

$$P_3 = \$20.64$$

PV of stock at end of year 3 = $P_3 \times (PVIF_{11\%,3})$

$$PV = \$20.64 \times (.731)$$

$$PV = \$15.09$$

$$P_0 = \$15.09 + \$5.12 = \$20.21$$

- c. The present value of the first 3 year's dividends is the same as in part a.

$$D_4 = D_3(1.10) = 2.50$$

$$P_3 = [D_4 \div (k_s - g)]$$

$$P_3 = \$2.50 \div (.11 - .10)$$

$$P_3 = \$250.00$$

$$\text{PV of stock at end of year 3} = P_3 \times (\text{PVIF}_{11\%,3})$$

$$\text{PV} = \$250.00 \times (.731)$$

$$\text{PV} = \$182.75$$

$$P_0 = \$182.75 + \$5.12 = \$187.87$$

7-15 LG 4: Common Stock Value—All Growth Models

a. $P_0 = (CF_0 \div k)$
 $P_0 = \$42,500 \div .18$
 $P_0 = \$236,111$

b. $P_0 = (CF_1 \div (k - g))$
 $P_0 = (\$45,475^* \div (.18 - .07))$
 $P_0 = \$413,409.10$

$$* CF_1 = \$42,500(1.07) = \$45,475$$

- c. **Steps 1 and 2: Value of cash dividends and present value of annual dividends**

t	D_0	$\text{FVIF}_{12\%,t}$	D_t	$\text{PVIF}_{18\%,t}$	Present Value of Dividends
1	\$42,500	1.120	\$47,600	.847	\$40,317.20
2	\$42,500	1.254	53,295	.718	38,265.81
					<u>\$78,583.01</u>

Step 3: Present value of price of stock at end of initial growth period

$$D_{2+1} = \$53,295 \times (1 + .07)$$

$$D_3 = \$57,025.65$$

$$P_2 = [D_3 \div (k_s - g)]$$

$$P_2 = \$57,025.65 \div (.18 - .07)$$

$$P_2 = \$518,415$$

$$\text{PV of stock at end of year 2} = P_2 \times (\text{PVIF}_{18\%,2})$$

$$\text{PV} = \$518,415 \times (.718)$$

$$\text{PV} = \$372,222$$

Step 4: Sum of present value of dividends during initial growth period and present value price of stock at end of growth period

$$P_0 = \$78,583 + \$372,222$$

$$P_0 = \$450,805$$

7-16 LG 5: Free Cash Flow Valuation

a. The value of the total firm is accomplished in three steps.

(1) Calculate the present value of FCF from 2009 to infinity.

$$FCF = \frac{\$390,000(1.03)}{.11 - .03} = \frac{\$401,700}{.08} = \$5,021,250$$

(2) Add the present value of the cash flow obtained in (1) to the cash flow for 2008.

$$FCF_{2008} = \$5,021,250 + 390,000 = \$5,411,250$$

(3) Find the present value of the cash flows for 2004 through 2008.

<u>Year</u>	<u>FCF</u>	<u>PVIF_{11%,n}</u>	<u>PV</u>
2004	\$200,000	.901	\$180,200
2005	250,000	.812	203,000
2006	310,000	.731	226,610
2007	350,000	.659	230,650
2008	5,411,250	.593	<u>3,208,871</u>
Value of entire company, $V_c =$			<u><u>\$4,049,331</u></u>

b. Calculate the value of the common stock.

$$V_S = V_C - V_D - V_P$$

$$V_S = \$4,049,331 - \$1,500,000 - \$400,000 = \$2,191,331$$

c.

$$\text{Value per share} = \frac{\$2,191,331}{200,000} = \$10.96$$

7-17 LG 5: Using the Free Cash Flow Valuation Model to Price an IPO

a. The value of the firm's common stock is accomplished in four steps.

(1) Calculate the present value of FCF from 2008 to infinity.

$$FCF = \frac{\$1,100,000(1.02)}{.08 - .02} = \frac{\$1,122,000}{.06} = \$18,700,000$$

- (2) Add the present value of the cash flow obtained in (1) to the cash flow for 2007.

$$FCF_{2007} = \$18,700,000 + 1,100,000 = \$19,800,000$$

- (3) Find the present value of the cash flows for 2004 through 2007.

Year	FCF	PVIF _{%,n}	PV
2004	\$700,000	.926	\$648,200
2005	800,000	.857	685,600
2006	950,000	.794	754,300
2007	19,800,000	.735	<u>14,533,000</u>
Value of entire company, $V_c =$			<u>\$16,621,100</u>

- (4) Calculate the value of the common stock using equation 7.8.

$$V_S = V_C - V_D - V_P$$

$$V_S = \$16,621,100 - \$2,700,000 - \$1,000,000 = \$12,921,100$$

$$\text{Value per share} = \frac{\$12,921,100}{1,100,000} = \$11.75$$

- b. Based on this analysis the IPO price of the stock is over valued by \$0.75 (\$12.50 - \$11.75) and you should not buy the stock.

- c. The value of the firm's common stock is accomplished in four steps.

- (1) Calculate the present value of FCF from 2008 to infinity.

$$FCF = \frac{\$1,100,000(1.03)}{.08 - .03} = \frac{\$1,133,000}{.05} = \$22,660,000$$

- (2) Add the present value of the cash flow obtained in (1) to the cash flow for 2007.

$$FCF_{2007} = \$22,660,000 + 1,100,000 = \$23,760,000$$

- (3) Find the present value of the cash flows for 2004 through 2007.

Year	FCF	PVIF _{%,n}	PV
2004	\$700,000	.926	\$648,200
2005	800,000	.857	685,600
2006	950,000	.794	754,300
2007	23,760,000	.735	<u>17,463,000</u>
Value of entire company, $V_c =$			<u>\$19,551,700</u>

- (4) Calculate the value of the common stock using equation 7.8.

$$V_S = V_C - V_D - V_P$$

$$V_S = \$19,551,700 - \$2,700,000 - \$1,000,000 = \$15,851,700$$

$$\text{Value per share} = \frac{\$15,851,700}{1,100,000} = \$14.41$$

If the growth rate is changed to 3% the IPO price of the stock is under valued by \$1.91 (\$14.41 - \$12.50) and you should buy the stock.

7-18 LG 5: Book and Liquidation Value

a. Book value per share:

$$\frac{\text{Book value of assets} - (\text{liabilities} + \text{preferred stock at book value})}{\text{Number of shares outstanding}}$$

$$\text{Book value per share} = \frac{\$780,000 - \$420,000}{10,000} = \$36 \text{ per share}$$

b. Liquidation value:

Cash	\$ 40,000	Liquidation value of assets	722,000
Marketable Securities	60,000	Less: Current Liabilities	(160,000)
Accounts Rec.		Long-term debt	(180,000)
(.90 x \$120,000)	108,000	Preferred Stock	(80,000)
Inventory		Available for CS	<u>\$ 302,000</u>
(.90 x \$160,000)	144,000		
Land and Buildings			
(1.30 x \$150,000)	195,000		
Machinery & Equip.			
(.70 x \$250,000)	<u>175,000</u>		
Liq. Value of Assets	\$722,000		

$$\text{Liquidation value per share} = \frac{\text{Liquidation Value of Assets}}{\text{Number of Shares Outstanding}}$$

$$\text{Liquidation value per share} = \frac{\$302,000}{10,000} = \$30.20 \text{ per share}$$

- c. Liquidation value is below book value per share and represents the minimum value for the firm. It is possible for liquidation value to be greater than book value if assets are undervalued. Generally, they are overvalued on a book value basis, as is the case here.

7-19 LG 5: Valuation with Price/Earnings Multiples

Firm	EPS x P/E	=	Stock Price
A	3.0 x (6.2)	=	\$18.60
B	4.5 x (10.0)	=	\$45.00
C	1.8 x (12.6)	=	\$22.68
D	2.4 x (8.9)	=	\$21.36
E	5.1 x (15.0)	=	\$76.50

7-20 LG 6: Management Action and Stock Value: $P_0 = D_1 \div (k_s - g)$

- a. $P_0 = \$3.15 \div (.15 - .05) = \31.50
 b. $P_0 = \$3.18 \div (.14 - .06) = \39.75
 c. $P_0 = \$3.21 \div (.17 - .07) = \32.10
 d. $P_0 = \$3.12 \div (.16 - .04) = \26.00
 e. $P_0 = \$3.24 \div (.17 - .08) = \36.00

The best alternative in terms of maximizing share price is b.

7-21 LG 4, 6: Integrative–Valuation and CAPM Formulas

$$\begin{array}{ll}
 P_0 = D_1 \div (k_s - g) & k_s = R_F + [b \times (k_m - R_F)] \\
 \$50 = \$3.00 \div (k_s - .09) & .15 = .07 + [b \times (.10 - .07)] \\
 k_s = .15 & b = 2.67
 \end{array}$$

7-22 LG 4: 6: Integrative–Risk and Valuation

a. $k_s = R_F + [b \times (k_m - R_F)]$
 $k_s = .10 + [1.20 \times (.14 - .10)]$
 $k_s = .148$

b. $g: FV = PV \times (1 + k)^n$
 $\$2.45 = \$1.73 \times (1 + k)^6$
 $\frac{\$2.45}{\$1.73} = FVIF_{k\%,6}$
 $1.416 = FVIF_{6\%,6}$
 $g = \text{approximately } 6\%$

$$\begin{array}{ll}
 P_0 = D_1 \div (k_s - g) \\
 P_0 = \$2.60 \div (.148 - .06) \\
 P_0 = \$29.55
 \end{array}$$

- c. A decrease in beta would decrease the required rate of return, which in turn would increase the price of the stock.

7-23 LG 4, 6: Integrative–Valuation and CAPM

- a. g: $FV = PV \times (1 + k)^n$
 $\$3.44 = \$2.45 \times (1 + k)^5$
 $\$3.44 = \$2.45 \times (1 + k)^5$
 $\$3.44 \div \$2.45 = FVIF_{k\%,5}$
 $1.404 = FVIF_{7\%,5}$
 $k = \text{approximately } 7\%$
- $k_s = .09 + [1.25 \times (.13 - .09)]$
 $k_s = .14$
- $D_1 = (\$3.44 \times 1.07) = \3.68
- $P_0 = \$3.68 \div (.14 - .07)$
 $P_0 = \$52.57 \text{ per share}$
- b. (1) $k_s = .09 + [1.25 \times (.13 - .09)]$
- $D_1 = \$3.61 (\$3.44 \times 1.05)$
- $P_0 = \$3.61 \div (.14 - .05)$
 $P_0 = \$40.11 \text{ per share}$
- (2) $k_s = .09 + [1.00 \times (.13 - .09)]$
 $k_s = .13$
- $D_1 = \$3.68$
- $P_0 = \$3.68 \div (.13 - .07)$
 $P_0 = \$61.33 \text{ per share}$

The CAPM supplies an estimate of the required rate of return for common stock. The resulting price per share is a result of the interaction of the risk free rate, the risk level of the security, and the required rate of return on the market. For Craft, the lowering of the dividend growth rate reduced future cash flows resulting in a reduction in share price. The decrease in the beta reflected a reduction in risk leading to an increase in share price.

CHAPTER 7 CASE**Assessing the Impact of Suarez Manufacturing's Proposed Risky Investment on Its Stock Values**

This case demonstrates how a risky investment can affect a firm's value. First, students must calculate the current value of Suarez's stock, rework the calculations assuming that the firm makes the risky investment, and then draw some conclusions about the value of the firm in this situation. In addition to gaining experience in valuation of stock, students will see the relationship between risk and valuation.

a. Current per share value of common stock

Growth rate of dividends:

g can be solved for by using the geometric growth equation as shown below in (1) or by finding the PVIF for the growth as shown in (2).

(1)

$$g = \sqrt[4]{\frac{1.90}{1.30}} - 1 = (1.46154)^{1/4} - 1 = 1.0995 - 1 = .0995 = 10.0\%$$

(2)

$$g = \frac{1.30}{1.90} = .6842$$

PV factor for 4 years closest to .6842 is 10% (.683).

Use the constant growth rate model to calculate the value of the firm's common stock.

$$P_0 = \frac{D_1}{k_s - g} = \frac{\$1.90(1.10)}{.14 - .10} = \frac{\$2.09}{.04} = \$52.25$$

b. Value of common stock if risky investment is made:

$$P_0 = \frac{D_1}{k_s - g} = \frac{\$1.90(1.13)}{.16 - .13} = \frac{\$2.15}{.03} = \$71.67$$

The higher growth rate associated with undertaking the investment increases the market value of the stock.

c. The firm should undertake the proposed project. The price per share increases by \$19.42 (from \$52.25 to \$71.67). Although risk increased and increased the required return, the higher dividend growth offsets this higher risk resulting in a net increase in value.

d. $D_{2004} = 2.15$ (stated in case)

$$D_{2005} = 2.15 (1 + .13) = 2.43$$

$$D_{2006} = 2.43 (1 + .13) = 2.75$$

$$D_{2007} = 2.75 (1 + .10) = 3.11$$

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$$P_{2006} = \frac{D_{2007}}{k_s - g} = \frac{\$3.11}{.16 - .10} = \frac{\$3.11}{.06} = \$51.83$$

Year	Cash Flow	PVIF _{16%,n}	PV
2004	2.15	.862	\$ 1.85
2005	2.43	.743	1.81
2006	2.75 + 51.83	.641	34.99
			<u><u>P₀ = \$38.65</u></u>

Now the firm should not undertake the proposed project. The price per share decreases by \$13.60 (from \$52.25 to \$38.65). Now the increase in risk and increased the required return is not offset by the increase in cash flows. The longer term of the growth is an important factor in this decision.

INTEGRATIVE CASE 2

ENCORE INTERNATIONAL

This case focuses on the valuation of a firm. The student explores various methods of valuation, including the price/earnings multiple, book value, no growth, constant growth, and variable growth models. Risk and return are integrated into the case with the addition of the security market line and the capital asset pricing model. The student is asked to compare stock values generated by various models, discuss the differences, and select the one which best represents the true value of the firm.

a. Book value per share = $\frac{\$60,000,000}{2,500,000} = \24

b. P / E ratio = $\frac{\$40}{\$6.25} = 6.4$

c. (1) $k_s = R_F + [b_j \times (k_m - R_F)]$
 $k_s = 6\% + [1.10 \times (14\% - 6\%)]$
 $k_s = 6\% + 8.8\%$
 $k_s = 14.8\%$

Required return = 14.8%
 Risk premium = 8.8%

(2) $k_s = 6\% + [1.25 \times (14\% - 6\%)]$
 $k_s = 6\% + 10\%$
 $k_s = 16\%$

Required return = 16%
 Risk premium = 10%

(3) As beta rises, the risk premium and required return also rise.

d. Zero growth: $P_0 = \frac{D_1}{k_s}$
 $P_0 = \frac{\$4.00}{.16} = \25

e. (1) Constant growth: $P_0 = \frac{D_1}{(k_s - g)}$

$$P_0 = \frac{(\$4.00 \times 1.06)}{(.16 - .06)} = \frac{\$4.24}{.10} = \$42.40$$

(2) Variable Growth Model: Present Value of Dividends

$$P_0 = \sum_{t=1}^n \left(\frac{D_0 \times (1 + g_1)^t}{(1 + k_s)^t} \right) + \left[\frac{1}{(1 + k_s)^N} \times \frac{D_{N+1}}{(k_s - g_2)} \right]$$

P_0 = Present value of dividends during initial growth period + present value of price of stock at end of growth period.

Steps 1 and 2: Value of cash dividends and present value of annual dividends

Year	t	D_0	$FVIF_{8\%,t}$	D_t	$PVIF_{16\%,t}$	Present Value of Dividends
2004	1	\$4.00	1.080	\$4.32	.862	\$3.72
2005	2	\$4.00	1.166	4.66	.743	<u>3.46</u>
						\$7.18

Step 3: Present value of price of stock at end of initial growth period

$$D_{2003} = \$4.66 \times (1 + .06) = \$4.94$$

$$P_{2005} = [D_{2006} \div (k_s - g_2)]$$

$$P_{2005} = \$4.94 \div (.16 - .06)$$

$$P_{2005} = \$49.40$$

PV of stock at end of year 2 (2005)

$$PV = P_2 \times (PVIF_{16\%,2\text{yrs.}})$$

$$PV = \$49.40 \times (.743)$$

$$PV = \$36.70$$

Step 4: Sum of present value of dividends during initial growth period and present value price of stock at end of growth period

$$P_{2003} = \$7.18 + \$36.70$$

$$P_{2003} = \$43.88$$

f.	<u>Valuation Method</u>	<u>Per Share</u>
	Market value	\$40.00
	Book value	24.00
	Zero growth	25.00
	Constant growth	42.40
	Variable growth	43.88

The book value has no relevance to the true value of the firm. Of the remaining methods, the most conservative estimate of value is given by the zero growth model. Wary analysts may advise paying no more

than \$25 per share, yet this is hardly more than book value. The most optimistic prediction, the variable growth model, results in a value of \$43.88, which is not far from the market value. The market is obviously not as cautious about Encore International's future as the analysts.

Note also the P/E and required return confirm one another. The inverse of the P/E is $1 \div 6.4$, or .156. This is also a measure of required return to the investor. Therefore, the inverse of the P/E (15.6%) and 16% for the CAPM required return are quite close. The question may be asked of the students, "Is the market predicting the beta to rise from 1.10 to 1.25 as reflected in the P/E and the CAPM required return comparison?"

PART 3

Long-Term Investment Decisions

CHAPTERS IN THIS PART

- 8** **Capital Budgeting Cash Flows**
- 9** **Capital Budgeting Techniques**
- 10** **Risk and Refinements in Capital Budgeting**

INTEGRATIVE CASE 3: LASTING IMPRESSIONS COMPANY

CHAPTER 8

Capital Budgeting Cash Flows

INSTRUCTOR'S RESOURCES

Overview

This chapter prepares the student for the techniques of capital budgeting presented in the next chapter (Chapter 9). The steps in the capital budgeting process are described, beginning with proposal generation and ending with follow-up, and the associated terminology is defined. The special concerns involved in international capital budgeting projects are discussed next. The chapter concludes with the basics of determining relevant after-tax cash flows of a project, from the initial cash outlay to annual cash stream of costs and benefits and terminal cash flow. It also describes the special concerns facing capital budgeting for the multinational company.

PMF DISK

PMF Tutor: Capital Budgeting Routines

Chapter topics covered in the tutorial's problems include initial investment, operating cash flow, and terminal cash flow.

PMF Problem Solver: Capital Budgeting

This module allows the student to compute the initial investment required for a given product as well as the relevant cash flows over the life of the project and terminal cash flow at the end of the project.

PMF Templates

A spreadsheet template is provided for the following problem:

<u>Problem</u>	<u>Topic</u>
8-16	Incremental operating cash inflows

Study Guide

The following *Study Guide* example is suggested for classroom presentation:

<u>Example</u>	<u>Topic</u>
2	Expansion-type cash flows

ANSWERS TO REVIEW QUESTIONS

8-1 *Capital budgeting* is the process used to evaluate and select long-term investments consistent with the goal of owner wealth maximization. Capital expenditures are outlays made by the firm that are expected to produce benefits over the long term (a period greater than one year). Not all capital expenditures are made for fixed assets. An expenditure made for an advertising campaign may have long-term benefits.

8-2 The primary motives for making capital expenditures include:

- *Expansion* - increasing the productive capacity of the firm, usually through the acquisition of fixed assets.
- *Replacement* - replacing existing assets with new or more advanced assets which provide the same function.
- *Renewal* - rebuilding or overhauling existing assets to improve efficiency.

Other motives include expenditures for non-tangible projects that improve a firm's profitability, such as advertising, research and development, and product development. A firm may also be required by law to undertake pollution control and similar projects.

Expansion and replacement involve the purchase of new assets as compared with renewal, where old assets are upgraded.

- 8-3**
1. *Proposal generation* is the origination of proposed capital projects for the firm by individuals at various levels of the organization.
 2. *Review and analysis* is the formal process of assessing the appropriateness and economic viability of the project in light of the firm's overall objectives. This is done by developing cash flows relevant to the project and evaluating them through capital budgeting techniques. Risk factors are also incorporated into the analysis phase.
 3. *Decision making* is the step where the proposal is compared against predetermined criteria and either accepted or rejected.
 4. *Implementation* of the project begins after the project has been accepted and funding is made available.
 5. *Follow-up* is the post-implementation audit of expected and actual costs and revenues generated from the project to determine if the return on the proposal meets preimplementation projections.

- 8-4**
- a. *Independent projects* have cash flows unrelated to or independent of each other. *Mutually exclusive* projects have the same function as the other projects being considered. Therefore, they compete with one another; accepting one eliminates the others from further consideration.
 - b. Firms under capital rationing have only a fixed amount of dollars available for the capital budget, whereas a firm with unlimited funds may accept all projects with a specified rate of return.
 - c. The *accept-reject approach* evaluates capital expenditures using a predetermined minimum acceptance criterion. If the project meets the criterion, it's accepted and vice versa. With *ranking*, projects are ranked from best to worst based on some predetermined measure, such as rate of return.

Part 3 Long-Term Investment Decisions

- d. A *conventional cash flow pattern* consists of an initial outflow followed by a series of inflows. A *nonconventional cash flow pattern* is any pattern in which an initial outlay is not followed by a series of inflows.
- 8-5** Capital budgeting projects should be evaluated using *incremental after-tax cash flows*, since after-tax cash flows are what is available to the firm. When evaluating a project, concern is placed only on added cash flows expected to result from its implementation. Expansion decisions can be treated as replacement decisions in which all cash flows from the old assets are zero. Both expansion and replacement decisions involve purchasing new assets. Replacement decisions are more complex because incremental cash flows deriving from the replacement must be determined.
- 8-6** The three components of cash flow for any project are 1. initial investment, 2. operating cash flows, and 3. terminal cash flows.
- 8-7** *Sunk costs* are costs that have already been incurred and thus the money has already been spent. *Opportunity costs* are cash flows that could be realized from the next best alternative use of an owned asset. Sunk costs are not relevant to the investment decision because they are not incremental. These costs will not change no matter what the final accept/reject decision. Opportunity costs are a relevant cost. These cash flows could be realized if the decision is made not to change the current asset structure but to utilize the owned asset for its alternative purpose.
- 8-8** To minimize long-term currency risk, companies can finance a foreign investment in local capital markets so that the project's revenues and costs are in the local currency rather than dollars. Techniques such as currency futures, forwards, and options market instruments protect against short-term currency risk. Financial and operating strategies that reduce political risk include structuring the investment as a joint venture with a competent and well-connected local partner; and using debt rather than equity financing, since debt service payments are legally enforceable claims while equity returns such as dividends are not.
- 8-9**
- a. The *cost of the new asset* is the purchase price. (Outflow)
 - b. *Installation costs* are any added costs necessary to get an asset into operation. (Outflow)
 - c. *Proceeds from sale of old asset* are cash inflows resulting from the sale of an existing asset, reduced by any removal costs. (Inflow)
 - d. *Tax on sale of old asset* is incurred when the replaced asset is sold due to recaptured depreciation, capital gain, or capital loss. (May be an inflow or an outflow.)
 - e. The *change in net working capital* is the difference between the change in current assets and the change in current liabilities. (May be an inflow or an outflow)
- 8-10** The *book value* of an asset is its strict accounting value.

Book value = Installed cost of asset - Accumulated depreciation

The three key forms of taxable income are 1) capital gain: portion of sale price above initial purchase price, taxed at the ordinary rate; 2) recaptured depreciation: portion of sale price in excess of book value that represents a recovery of previously taken depreciation, taxed at the ordinary rate; and 3) loss on the sale of an asset: amount by which sale price is less than book value, taxed at the ordinary rate and deducted from ordinary income if the asset is depreciable and used in business. If the asset is not

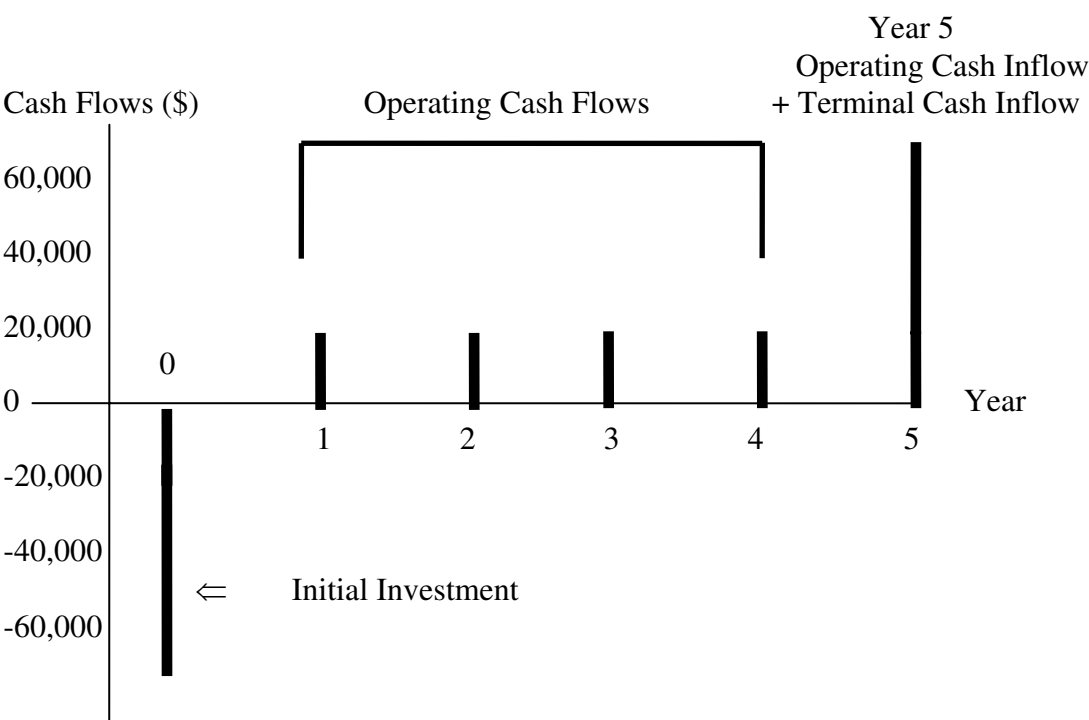
depreciable or is not used in business, it is also taxed at the ordinary rate but is deductible only against capital gains.

- 8-11** The asset may be sold 1) above its initial purchase price, 2) below the initial purchase price but above its book value, 3) at a price equal to its book value, or 4) below book value. In the first case, both capital gains and ordinary taxes arising from depreciation recapture would be required; in the second case, only ordinary taxes from depreciation recapture would be required; in the third case, no taxes would be required; and in the fourth case, a tax credit would occur.
- 8-12** The depreciable value of an asset is the installed cost of a new asset and is based on the depreciable cost of the new project, including installation cost.
- 8-13** Depreciation is used to decrease the firm's total tax liability and then is added back to net profits after taxes to determine cash flow.
- 8-14** To calculate incremental operating cash inflow for both the existing situation and the proposed project, the depreciation on assets is added back to the after-tax profits to get the cash flows associated with each alternative. The difference between the cash flows of the proposed and present situation, the incremental after-tax cash flows, are the relevant operating cash flows used in evaluating the proposed project.
- 8-15** The *terminal cash flow* is the cash flow resulting from termination and liquidation of a project at the end of its economic life. The form of calculating terminal cash flows is shown below:

Terminal Cash Flow Calculation:

$$\begin{aligned}
 &\text{After-tax proceeds from sale of new asset} = \\
 &\quad \text{Proceeds from sale of new asset} \\
 &\quad \pm \text{Tax on sale of new asset} \\
 &- \text{After-tax proceeds from sale of old asset} = \\
 &\quad \text{Proceeds from sale of old asset} \\
 &\quad \pm \text{Tax on sale of old asset} \\
 &\pm \text{Change in net working capital} \\
 &= \text{Terminal cash flow}
 \end{aligned}$$

- 8-16** The *relevant cash flows* necessary for a conventional capital budgeting project are the incremental after-tax cash flows attributable to the proposed project: the initial investment, the operating cash inflows, and the terminal cash flow. The initial investment is the initial outlay required, taking into account the installed cost of the new asset, proceeds from the sale of the old asset, tax on the sale of the old asset, and any change in net working capital. The operating cash inflows are the additional cash flows received as a result of implementing a proposal. Terminal cash flow represents the after-tax cash flows expected to result from the liquidation of the project at the end of its life. These three components represent the positive or negative cash flow impact if the firm implements the project and are depicted in the following diagram.



SOLUTIONS TO PROBLEMS

Note: The MACRS depreciation percentages used in the following problems appear in Chapter 3, Table 3.2. The percentages are rounded to the nearest integer for ease in calculation.

For simplification, five-year-lived projects with 5 years of cash inflows are used throughout this chapter. Projects with usable lives equal to the number of years cash inflows are also included in the end-of-chapter problems. It is important to recall from Chapter 3 that, under the Tax Reform Act of 1986, MACRS depreciation results in $n + 1$ years of depreciation for an n -year class asset. This means that in actual practice projects will typically have at least one year of cash flow beyond their recovery period.

8-1 LG 1: Classification of Expenditures

- a. Operating expenditure
- b. Capital expenditure
- c. Capital expenditure
- d. Operating expenditure
- e. Capital expenditure
- f. Capital expenditure
- g. Capital expenditure
- h. Operating expenditure

8-2 LG 2: Basic Terminology

	<u>Situation A</u>	<u>Situation B</u>	<u>Situation C</u>
a.	mutually exclusive	mutually exclusive	independent
b.	unlimited	unlimited	capital rationing
c.	ranking	accept-reject	ranking
d.	conventionnel	nonconventional	conventionnel (2&4) Nonconventional (1&3)

8-3 LG 3: Relevant Cash Flow Pattern Fundamentals

a.	<u>Year</u>		<u>Cash Flow</u>
	Initial investment		(\$120,000)
	1-18	\$25,000 - \$5,000	= \$ 20,000

0	1	2	3	16	17	18
-120,000	20,000	20,000	20,000	-----	20,000	20,000

b.	Initial investment	(\$85,000 - \$30,000)	=	(\$55,000)
	1-5		=	\$ 20,000
	6	\$20,000 + \$20,000 - \$10,000	=	\$ 30,000

0	1	2	3	4	5
<hr/>					

c.

Initial investment							(\$2,000,000)
1-5	\$300,000 - \$20,000	=	\$ 280,000				
6	\$300,000 - \$500,000	=	(\$ 200,000)				
7-10	\$300,000 - \$20,000	=	\$ 280,000				

A horizontal timeline starting at year 0 and ending at year 10. Vertical tick marks are placed at each integer year. Below the timeline, the following values are aligned with their respective years:

-2,000,000	280,000	280,000	•••••	280,000	-200,000	280,000	••	280,000
------------	---------	---------	-------	---------	----------	---------	----	---------

a.	<u>Year</u>	<u>Relevant Cash Flows</u>
	Initial investment	(\$28,000)
	1	4,000
	2	6,000
	3	8,000
	4	10,000
	5	4,000

8-5 LG 3: Sunk Costs and Opportunity Costs

c.

Cash Flows

$-\$1,800,000$ $\$750,000$ $\$750,000$ $\$750,000$ $\$750,000$ $\$750,000$
 $+\$250,000$

0 1 2 3 9 10

End of Year

a. Sunk cost - The funds for the tooling had already been expended and would not change, no matter whether the new technology would be acquired or not.

- b. Opportunity cost - The development of the computer programs can be done without additional expenditures on the computers; however, the loss of the cash inflow from the leasing arrangement would be a lost opportunity to the firm.
- c. Opportunity cost - Covol will not have to spend any funds for floor space but the lost cash inflow from the rent would be a cost to the firm.
- d. Sunk cost - The money for the storage facility has already been spent, and no matter what decision the company makes there is no incremental cash flow generated or lost from the storage building.
- e. Opportunity cost - Foregoing the sale of the crane costs the firm \$180,000 of potential cash inflows.

8-7 LG 4: Book Value

Asset	Installed Cost	Accumulated Depreciation	Book Value
A	\$ 950,000	\$ 674,500	\$275,500
B	40,000	13,200	26,800
C	96,000	79,680	16,320
D	350,000	70,000	280,000
E	1,500,000	1,170,000	330,000

8-8 LG 4: Book Value and Taxes on Sale of Assets

- a. Book value = \$80,000 - (.71 x \$80,000)
= \$23,200

	Capital gain	Tax on capital gain	Depreciation recovery	Tax on recovery	Total tax
Sale price	\$20,000	\$8,000	\$56,800	\$22,720	\$30,720
\$100,000					
56,000	-0-	-0-	32,800	13,120	13,120
23,200	-0-	-0-	-0-	-0-	-0-
15,000	-0-	-0-	(8,200)	(3,280)	(3,280)

8-9 LG 4: Tax Calculations

$$\text{Current book value} = \$200,000 - [(.52 \times (\$200,000))] = \$96,000$$

	(a)	(b)	(c)	(d)
Capital gain	\$ 20,000	-0-	-0-	-0-
Recaptured depreciation	104,000	54,000	-0-	(16,000)
Tax on capital gain	\$ 8,000	-0-	-0-	-0-
Tax on depreciation recovery	<u>41,600</u>	<u>21,600</u>	<u>-0-</u>	<u>(6,400)</u>
Total tax	\$ 49,600	\$21,600	\$ -0-	(\$6,400)

8-10 LG 4: Change in Net Working Capital Calculation

- a. Current assets Current liabilities

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Part 3 Long-Term Investment Decisions

Cash	\$ + 15,000	Accounts payable	\$ + 90,000
Accounts receivable	+ 150,000	Accruals	+ 40,000
Inventory	<u>- 10,000</u>		
Net change	\$ 155,000		\$ 130,000

Net working capital = current assets - current liabilities

$\Delta \text{NWC} = \$155,000 - \$130,000$

$\Delta \text{NWC} = \$ 25,000$

- b.** Analysis of the purchase of a new machine reveals an increase in net working capital. This increase should be treated as an initial outlay and is a cost of acquiring the new machine.
- c.** Yes, in computing the terminal cash flow, the net working capital increase should be reversed.

8-11 LG 4: Calculating Initial Investment

- a.** Book value = $(\$325,000 \times .48) = \$156,000$

- b.**
- | | |
|------------------------------|----------------|
| Sales price of old equipment | \$200,000 |
| Book value of old equipment | <u>156,000</u> |
| Recapture of depreciation | \$ 44,000 |

Taxes on recapture of depreciation = $\$44,000 \times .40 = \$17,600$

After-tax proceeds = $\$200,000 - \$17,600 = \$182,400$

- c.**
- | | |
|---------------------------------------|---------------|
| Cost of new machine | \$325,000 |
| Less sales price of old machine | (200,000) |
| Plus tax on recapture of depreciation | <u>44,000</u> |
| Initial investment | \$169,000 |

8-12 LG 4: Initial Investment–Basic Calculation

Installed cost of new asset =

Cost of new asset	\$35,000	
+ Installation Costs	<u>5,000</u>	
Total installed cost (depreciable value)		\$40,000

After-tax proceeds from sale of old asset =

Proceeds from sale of old asset	(\$25,000)	
+ Tax on sale of old asset	<u>7,680</u>	
Total after-tax proceeds-old asset		<u>(\$17,320)</u>
Initial investment		<u>\$22,680</u>

$$\text{Book value of existing machine} = \$20,000 \times (1 - (.20 + .32 + .19)) = \$5,800$$

$$\text{Recaptured depreciation} = \$20,000 - \$5,800 = \$14,200$$

$$\text{Capital gain} = \$25,000 - \$20,000 = \$5,000$$

$$\text{Tax on recaptured depreciation} = \$14,200 \times (.40) = \$5,680$$

$$\text{Tax on capital gain} = \$5,000 \times (.40) = \underline{2,000}$$

$$\text{Total tax} = \underline{\underline{\$7,680}}$$

8-13 LG 4: Initial investment at Various Sale Prices

	(a)	(b)	(c)	(d)
Installed cost of new asset:				
Cost of new asset	\$24,000	\$24,000	\$24,000	\$24,000
+ Installation cost	<u>2,000</u>	<u>2,000</u>	<u>2,000</u>	<u>2,000</u>
Total installed-cost	\$26,000	\$26,000	\$26,000	\$26,000
After-tax proceeds from sale of old asset				
Proceeds from sale of old asset	(11,000)	(7,000)	(2,900)	(1,500)
+ Tax on sale of old asset*	<u>3,240</u>	<u>1,640</u>	<u>0</u>	<u>(560)</u>
Total after-tax proceeds	<u>(7,760)</u>	<u>(5,360)</u>	<u>(2,900)</u>	<u>(2,060)</u>
Initial investment	\$18,240	\$20,640	\$23,100	\$23,940

$$\text{Book value of existing machine} = \$10,000 \times [1 - (.20 - .32 - .19)] = \$2,900$$

* Tax Calculations:

- a.** Recaptured depreciation = \$10,000 - \$2,900 = \$7,100
Capital gain = \$11,000 - \$10,000 = \$1,000
- Tax on ordinary gain = \$7,100 x (.40) = \$2,840
Tax on capital gain = \$1,000 x (.40) = 400
Total tax = \$3,240
- b.** Recaptured depreciation = \$7,000 - \$2,900 = \$4,100
Tax on ordinary gain = \$4,100 x (.40) = \$1,640
- c.** 0 tax liability
- d.** Loss on sale of existing asset = \$1,500 - \$2,900 = (\$1,400)
Tax benefit = - \$1,400 x (.40) = \$ 560

8-14 LG 4: Calculating Initial Investment

a. Book value = $(\$61,000 \times .31) = \$18,910$

b.	Sales price of old equipment	\$35,000
	Book value of old equipment	<u>18,910</u>
	Recapture of depreciation	\$ 16,090

Taxes on recapture of depreciation = $\$16,090 \times .40 = \$6,436$

	Sale price of old roaster	\$35,000
	Tax on recapture of depreciation	<u>(6,436)</u>
	After-tax proceeds from sale of old roaster	\$28,564

c.	Changes in current asset accounts	
	Inventory	\$ 50,000
	Accounts receivable	<u>70,000</u>
	Net change	\$120,000

	Changes in current liability accounts	
	Accruals	\$ (20,000)
	Accounts payable	40,000
	Notes payables	<u>15,000</u>
	Net change	\$ 35,000

Change in net working capital \$ 85,000

d.	Cost of new roaster	\$130,000
	Less after-tax proceeds from sale of old roaster	28,564
	Plus change in net working capital	<u>85,000</u>
	Initial investment	<u>\$186,436</u>

8-15 LG 4: Depreciation

Depreciation Schedule			
Year	Depreciation Expense		
1	$\$68,000 \times .20$	=	\$13,600
2	$68,000 \times .32$	=	21,760

3	68,000 x .19	=	12,920
4	68,000 x .12	=	8,160
5	68,000 x .12	=	8,160
6	68,000 x .05	=	3,400

8-16 LG 5: Incremental Operating Cash Inflows

- a. Incremental profits before tax and depreciation = \$1,200,000 - \$480,000
= \$720,000 each year

b. Year	(1)	(2)	(3)	(4)	(5)	(6)
PBDT	\$720,000	\$720,000	\$720,000	\$720,000	\$720,000	\$720,000
Depr.	<u>400,000</u>	<u>640,000</u>	<u>380,000</u>	<u>240,000</u>	<u>240,000</u>	<u>100,000</u>
NPBT	320,000	80,000	340,000	480,000	480,000	620,000
Tax	<u>128,000</u>	<u>32,000</u>	<u>136,000</u>	<u>192,000</u>	<u>192,000</u>	<u>248,000</u>
NPAT	192,000	48,000	204,000	288,000	288,000	372,000

- c. Cash Flow \$592,000 \$688,000 \$584,000 \$528,000 \$528,000 \$472,000
(NPAT + depreciation)

PBDT = Profits before depreciation and taxes

NPBT = Net profits before taxes

NPAT = Net profits after taxes

8-17 LG 5: Incremental Operating Cash Inflows–Expense Reduction

Year	(1)	(2)	(3)	(4)	(5)	(6)
Incremental Expense savings	\$16,000	\$16,000	\$16,000	\$16,000	\$16,000	\$0
Incremental profits Before dep. and taxes*	\$16,000	\$16,000	\$16,000	\$16,000	\$16,000	\$0
Depreciation	<u>9,600</u>	<u>15,360</u>	<u>9,120</u>	<u>5,760</u>	<u>5,760</u>	<u>2,400</u>
Net profits Before taxes	6,400	640	6,880	10,240	10,240	-2,400
Taxes	<u>2,560</u>	<u>256</u>	<u>2,752</u>	<u>4,096</u>	<u>4,096</u>	<u>-960</u>
Net profits After taxes	3,840	384	4,128	6,144	6,144	-1,440
Operating cash Inflows**	13,440	15,744	13,248	11,904	11,904	960

* Incremental profits before depreciation and taxes will increase the same amount as the decrease in expenses.

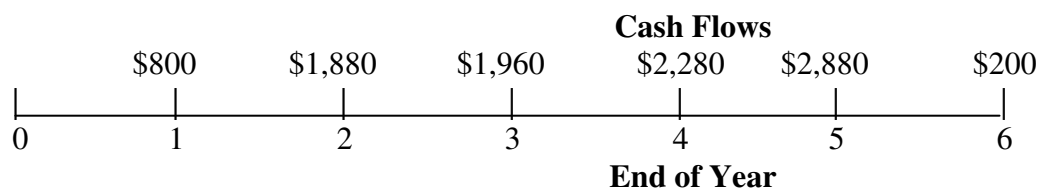
** Net profits after taxes plus depreciation expense.

Profits		(excluding	Depreciation		Net Profits		Net
Year	Revenue	Cash	and Taxes	Depreciation	Before Taxes	Taxes	After
Tax	Inflows	depreciation)					
New Lathe							
1	\$40,000	\$30,000	\$10,000	\$2,000	\$8,000	\$3,200	\$4,800
2	41,000	30,000	11,000	3,200	7,800	3,120	4,680
3	42,000	30,000	12,000	1,900	10,100	4,040	6,060
4	43,000	30,000	13,000	1,200	11,800	4,720	7,080
5	44,000	30,000	14,000	1,200	12,800	5,120	7,680
6	-0-	-0-	-0-	500	(500)	(200)	(300)
Old Lathe							
1-5	\$35,000	\$25,000	\$10,000	-0-	\$10,000	\$4,000	\$6,000

b. Calculation of Incremental Cash Inflows

Year	New Lathe	Old Lathe	Incremental Cash Flows
1	\$ 6,800	\$ 6,000	\$ 800
2	7,880	6,000	1,880
3	7,960	6,000	1,960
4	8,280	6,000	2,280
5	8,880	6,000	2,880
6	200	-0-	200

c.

**8-19 LG 5: Determining Operating Cash Flows**a.

Year					
1	2	3	4	5	6

Revenues:(000)

New buses	\$1,850	\$1,850	\$1,830	\$1,825	\$1,815	\$1,800
Old buses	<u>1,800</u>	<u>1,800</u>	<u>1,790</u>	<u>1,785</u>	<u>1,775</u>	<u>1,750</u>
Incremental revenue	\$ 50	\$ 50	\$ 40	\$ 40	\$ 40	\$ 50

Expenses: (000)

New buses	\$ 460	\$ 460	\$ 468	\$ 472	\$ 485	\$ 500
Old buses	<u>500</u>	<u>510</u>	<u>520</u>	<u>520</u>	<u>530</u>	<u>535</u>
Incremental expense	\$ (40)	\$ (50)	\$ (52)	\$ (48)	\$ (45)	\$ (35)

Depreciation: (000)

New buses	\$ 600	\$ 960	\$ 570	\$ 360	\$ 360	\$ 150
Old buses	<u>324</u>	<u>135</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>
Incremental depr.	\$ 276	\$ 825	\$ 570	\$ 360	\$ 360	\$ 150
Incremental depr. tax savings @40%	110	330	228	144	144	60

Net Incremental Cash Flows

	Year					
	1	2	3	4	5	6
Cash Flows: (000)						
Revenues	\$ 50	\$ 50	\$ 40	\$ 40	\$ 40	\$ 50
Expenses	40	50	52	48	45	35
Less taxes @40%	(36)	(40)	(37)	(35)	(34)	(34)
Depr. tax savings	<u>110</u>	<u>330</u>	<u>228</u>	<u>144</u>	<u>144</u>	<u>60</u>
Net operating cash inflows	<u>\$ 164</u>	<u>\$ 390</u>	<u>\$ 283</u>	<u>\$ 197</u>	<u>\$ 195</u>	<u>\$ 111</u>

8-20 LG 6: Terminal Cash Flows–Various Lives and Sale Prices

a.

After-tax proceeds from sale of new asset =	<u>3-year*</u>	<u>5-year*</u>	<u>7-year*</u>
Proceeds from sale of proposed asset	\$10,000	\$10,000	\$10,000
± Tax on sale of proposed asset*	<u>+ 16,880</u>	<u>- 400</u>	<u>- 4,000</u>

Part 3 Long-Term Investment Decisions

Total after-tax proceeds-new	\$26,880	\$ 9,600	\$ 6,000
+ Change in net working capital	<u>+ 30,000</u>	<u>+30,000</u>	<u>+ 30,000</u>
Terminal cash flow	\$ 56,800	\$39,600	\$ 36,000

* (1) Book value of asset = $[1 - (.20 + .32 + .19) \times (\$180,000)] = \$52,200$

Proceeds from sale = \$10,000
 $\$10,000 - \$52,200 = (\$42,200)$ loss
 $\$42,200 \times (.40) = \$16,880$ tax benefit

(2) Book value of asset = $[1 - (.20 + .32 + .19 + .12 + .12) \times (\$180,000)]$
= \$9,000
 $\$10,000 - \$9,000 = \$1,000$ recaptured depreciation
 $\$1,000 \times (.40) = \400 tax liability

(3) Book value of asset = \$0
 $\$10,000 - \$0 = \$10,000$ recaptured depreciation
 $\$10,000 \times (.40) = \$4,000$ tax liability

- b. If the usable life is less than the normal recovery period, the asset has not been depreciated fully and a tax benefit may be taken on the loss; therefore, the terminal cash flow is higher.

c.

	(1)	(2)
After-tax proceeds from sale of new asset =		
Proceeds from sale of new asset	\$ 9,000	\$170,000
+ Tax on sale of proposed asset*	0	(64,400)
+ Change in net working capital	<u>+ 30,000</u>	<u>+ 30,000</u>
Terminal cash flow	\$ 39,000	\$135,600

* (1) Book value of the asset = $\$180,000 \times .05 = \$9,000$; no taxes are due

(2) Tax = $(\$170,000 - \$9,000) \times 0.4 = \$64,400$.

- d. The higher the sale price, the higher the terminal cash flow.

8-21 LG 6: Terminal Cash Flow–Replacement Decision

After-tax proceeds from sale of new asset =			
Proceeds from sale of new machine	\$75,000		
- Tax on sale of new machine ¹	<u>(14,360)</u>		
Total after-tax proceeds-new asset		\$60,640	-
proceeds from sale of old asset			After-tax
Proceeds from sale of old machine	(15,000)		
+ Tax on sale of old machine ²	<u>6,000</u>		
Total after-tax proceeds-old asset		(9,000)	
+ Change in net working capital		<u>25,000</u>	

Terminal cash flow

\$76,640

- ¹ Book value of new machine at end of year 4:
[1 - (.20 + .32 + .19 + .12) x (\$230,000)] = \$39,100
\$75,000 - \$39,100 = \$35,900 recaptured depreciation
\$35,900 x (.40) = \$14,360 tax liability
- ² Book value of old machine at end of year 4:
\$0
\$15,000 - \$0 = \$15,000 recaptured depreciation
\$15,000 x (.40) = \$ 6,000 tax benefit

8-22 LG 4, 5, 6: Relevant Cash Flows for a Marketing Campaign

Marcus Tube
Calculation of Relevant Cash Flow
(\$000)

**Calculation of Net Profits after Taxes and Operating Cash Flow:
With Marketing Campaign**

	<u>2004</u>	<u>2005</u>	<u>2006</u>	<u>2007</u>	<u>2008</u>
Sales	\$20,500	\$21,000	\$21,500	\$22,500	\$23,500
CGS (@ 80%)	<u>16,400</u>	<u>16,800</u>	<u>17,200</u>	<u>18,000</u>	<u>18,800</u>
Gross Profit	\$ 4,100	\$ 4,200	\$ 4,300	\$ 4,500	\$ 4,700
Less: Operating Expenses					
General and Administrative					
(10% of sales)	\$ 2,050	\$ 2,100	\$ 2,150	\$ 2,250	\$ 2,350
Marketing Campaign	150	150	150	150	150
Depreciation	<u>500</u>	<u>500</u>	<u>500</u>	<u>500</u>	<u>500</u>
Total operating expenses	2,700	2,750	2,800	2,900	3,000
Net profit before taxes	\$1,400	\$1,450	\$1,500	\$1,600	\$1,700
Less: Taxes 40%	<u>560</u>	<u>580</u>	<u>600</u>	<u>640</u>	<u>680</u>
Net profit after taxes	\$ 840	\$ 870	\$ 900	\$ 960	\$1,020
+Depreciation	<u>500</u>	<u>500</u>	<u>500</u>	<u>500</u>	<u>500</u>
Operating CF	\$1,340	\$1,370	\$1,400	\$1,460	\$1,520

**Without Marketing Campaign
Years 2004 - 2008**

Net profit after taxes	\$ 900
+Depreciation	<u>500</u>
Operating cash flow	\$ 1,400

**Relevant Cash Flow
(\$000)**

Year	<u>With Marketing Campaign</u>	<u>Without Marketing Campaign</u>	<u>Incremental Cash Flow</u>
2004	\$1,340	\$1,400	\$(60)
2005	1,370	1,400	(30)
2006	1,400	1,400	-0-
2007	1,460	1,400	60
2008	1,520	1,400	120

8-23 LG 4, 5: Relevant Cash Flows—No Terminal Value

a.	Installed cost of new asset	
	Cost of new asset	\$76,000
+	Installation costs	<u>4,000</u>

Chapter 8 Capital Budgeting Cash Flows

Total cost of new asset	\$80,000
- After-tax proceeds from sale of old asset	
Proceeds from sale of old asset	(55,000)
+ Tax on sale of old asset*	<u>16,200</u>
Total proceeds, sale of old asset	<u>(38,800)</u>
Initial investment	<u>\$41,200</u>

* Book value of old machine:

$$[1 - (.20 + .32 + .19)] \times \$50,000 = \$14,500$$

$$\$55,000 - \$14,500 = \$40,500 \quad \text{gain on asset}$$

$$\$35,500 \text{ recaptured depreciation} \times .40 = \$14,200$$

$$\$5,000 \text{ capital gain} \times .40 = \underline{2,000}$$

$$\text{Total tax on sale of asset} = \underline{\underline{\$16,200}}$$

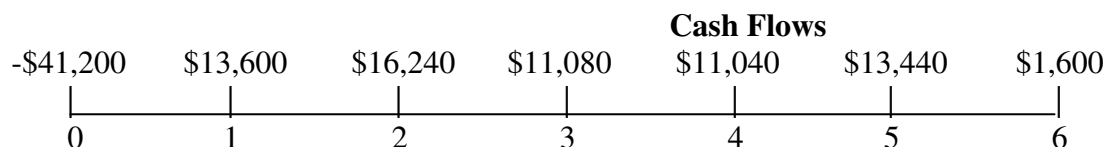
b. Calculation of Operating Cash Flow

Old Machine						
Year	(1)	(2)	(3)	(4)	(5)	(6)
PBDT	\$14,000	\$16,000	\$20,000	\$18,000	\$14,000	\$ 0
Depreciation	<u>6,000</u>	<u>6,000</u>	<u>2,500</u>	<u>0</u>	<u>0</u>	<u>0</u>
NPBT	\$ 8,000	\$10,000	\$17,500	\$18,000	\$14,000	0
Taxes	<u>3,200</u>	<u>4,000</u>	<u>7,000</u>	<u>7,200</u>	<u>5,600</u>	<u>0</u>
NPAT	\$4,800	\$ 6,000	\$10,500	\$10,800	\$ 8,400	\$ 0
Depreciation	<u>6,000</u>	<u>6,000</u>	<u>2,500</u>	<u>0</u>	<u>0</u>	<u>0</u>
Cash flow	<u>\$10,800</u>	<u>\$12,000</u>	<u>\$13,000</u>	<u>\$10,800</u>	<u>\$ 8,400</u>	<u>\$ 0</u>

New Machine						
Year	(1)	(2)	(3)	(4)	(5)	(6)
PBDT	\$30,000	\$30,000	\$30,000	\$30,000	\$30,000	\$ 0
Depreciation	<u>16,000</u>	<u>25,600</u>	<u>15,200</u>	<u>9,600</u>	<u>9,600</u>	<u>4,000</u>
NPBT	\$14,000	\$ 4,400	\$14,800	\$20,400	\$20,400	-\$4,000
Taxes	<u>5,600</u>	<u>1,760</u>	<u>5,920</u>	<u>8,160</u>	<u>8,160</u>	<u>-1,600</u>
NPAT	\$ 8,400	\$ 2,640	\$ 8,880	\$12,240	\$12,240	-\$2,400
Depreciation	<u>16,000</u>	<u>25,600</u>	<u>15,200</u>	<u>9,600</u>	<u>9,600</u>	<u>4,000</u>
Cash flow	<u>\$24,400</u>	<u>\$28,240</u>	<u>\$24,080</u>	<u>\$21,840</u>	<u>\$21,840</u>	<u>\$1,600</u>

Year	(1)	(2)	(3)	(4)	(5)	(6)
Incremental After-tax Cash flows	\$13,600	\$16,240	\$11,080	\$11,040	\$13,440	\$ 1,600

c.



8-24 LG 4, 5, 6: Integrative–Determining Relevant Cash Flows**a.** Initial investment:

Installed cost of new asset	=		
Cost of new asset		\$105,000	
+ Installation costs		<u>5,000</u>	
Total cost of new asset			\$110,000
- After-tax proceeds from sale of old asset	=		
Proceeds from sale of old asset		(70,000)	
+ Tax on sale of old asset*		<u>16,480</u>	
Total proceeds from sale of old asset			(53,520)
+ Change in working capital			<u>12,000</u>
Initial investment			<u>\$68,480</u>

* Book value of old asset:
 $[1 - (.20 + .32)] \times \$60,000 = \$28,800$

$\$70,000 - \$28,800 = \$41,200$ gain on sale of asset

$\$31,200$ recaptured depreciation $\times .40 = \$12,480$
 $\$10,000$ capital gain $\times .40 = \underline{4,000}$
 Total tax of sale of asset = $\underline{\$16,480}$

b.**Calculation of Operating Cash Inflows**

Year	Profits Before Depreciation and Taxes	Depre- ciation	Net Profits Before Taxes	Taxes	Net Profits After Taxes	Operating Cash Inflows
New Grinder						
1	\$43,000	\$22,000	\$21,000	\$ 8,400	\$12,600	\$34,600
2	43,000	35,200	7,800	3,120	4,680	39,880
3	43,000	20,900	22,100	8,840	13,260	34,160
4	43,000	13,200	29,800	11,920	17,880	31,080
5	43,000	13,200	29,800	11,920	17,880	31,080
6	--0-	5,500	-5,500	-2,200	-3,300	2,200
Existing Grinder						
1	\$26,000	\$11,400	\$14,600	\$5,840	\$ 8,760	\$20,160

Chapter 8 Capital Budgeting Cash Flows

2	24,000	7,200	16,800	6,720	10,080	17,280
3	22,000	7,200	14,800	5,920	8,880	16,080
4	20,000	3,000	17,000	6,800	10,200	13,200
5	18,000	-0-	18,000	7,200	10,800	10,800
6	-0-	-0-	-0-	-0-	-0-	-0-

Calculation of Incremental Cash Inflows

Year	New Grinder	Existing Grinder	Incremental Operating Cash Flow
1	\$34,600	\$20,160	\$14,440
2	39,880	17,280	22,600
3	34,160	16,080	18,080
4	31,080	13,200	17,880
5	31,080	10,800	20,280
6	2,200	-0-	2,200

c. Terminal Cash Flow:

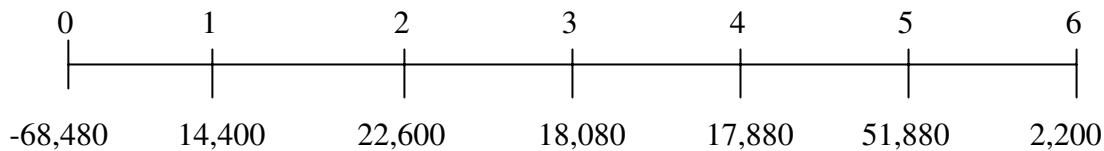
After-tax proceeds from sale of new asset =		
Proceeds from sale of new asset	\$29,000	
- Tax on sale of new asset*	(9,400)	
Total proceeds from sale of new asset		<u>19,600</u>
- After-tax proceeds from sale of old asset =		
Proceeds from sale of old asset	0	
+ Tax on sale of old asset	<u>0</u>	
Total proceeds from sale of old asset		0
+ Change in net working capital		<u>12,000</u>
Terminal cash flow		<u>\$31,600</u>

* Book value of asset at end of year 5 = \$ 5,500
 \$29,000 - \$5,500 = \$23,500 recaptured depreciation
 \$23,500 x .40 = \$ 9,400

d. Year 5 Relevant Cash Flow:

Operating cash flow	\$20,280
Terminal cash flow	<u>31,600</u>
Total inflow	<u>\$51,880</u>

Part 3 Long-Term Investment Decisions



8-25 LG 4, 5, 6: Integrative–Determining Relevant Cash Flows

a. Initial investment:	A	B
Installed cost of new asset		
Cost of new asset	\$40,000	\$54,000
+ Installation costs	<u>8,000</u>	<u>6,000</u>
Total proceeds, sale of new asset	48,000	60,000
- After-tax proceeds from sale of old asset		
Proceeds from sale of old asset	(18,000)	(18,000)
+ Tax on sale of old asset *	<u>3,488</u>	<u>3,488</u>
Total proceeds, sale of old asset	(14,512)	(14,512)
+ Change in working capital	<u>4,000</u>	<u>6,000</u>
Initial investment	<u>\$37,488</u>	<u>\$51,488</u>
* Book value of old asset:		
$[1 - (.20 + .32 + .19)] \times (\$32,000) =$	\$9,280	

b. Calculation of Operating Cash Inflows

Year	Profits before Depreciation and Taxes	Depre- ciation	Net Profits Before Taxes	Taxes	Net Profits After Taxes	Operating Cash Inflows
Hoist A						
1	\$21,000	\$ 9,600	\$11,400	\$4,560	\$6,840	\$16,440
2	21,000	15,360	5,640	2,256	3,384	18,744
3	21,000	9,120	11,880	4,752	7,128	16,248
4	21,000	5,760	15,240	6,096	9,144	14,904
5	21,000	5,760	15,240	6,096	9,144	14,904
6	-0-	2,400	-2,400	-960	-1,440	960

Hoist B						
1	\$22,000	\$12,000	\$10,000	\$4,000	\$6,000	18,000
2	24,000	19,200	4,800	1,920	2,880	22,080
3	26,000	11,400	14,600	5,840	8,760	20,160
4	26,000	7,200	18,800	7,520	11,280	18,480
5	26,000	7,200	18,800	7,520	11,280	18,480
6	-0-	3,000	-3,000	-1,200	-1,800	1,200

Existing Hoist						
1	\$14,000	\$3,840	\$10,160	\$4,064	\$6,096	\$9,936
2	14,000	3,840	10,160	4,064	6,096	9,936
3	14,000	1,600	12,400	4,960	7,440	9,040

Chapter 8 Capital Budgeting Cash Flows

4	14,000	-0-	14,000	5,600	8,400	8,400
5	14,000	--0-	14,000	5,600	8,400	8,400
6	-0-	-0-	-0-	-0-	-0-	-0-

Calculation of Incremental Cash Inflows

Year	Hoist A	Hoist B	Existing Hoist	Incremental Cash Flow	
				Hoist A	Hoist B
1	\$16,440	\$18,000	\$9,936	\$6,504	\$ 8,064
2	18,744	22,080	9,936	8,808	12,144
3	16,248	20,160	9,040	7,208	11,120
4	14,904	18,480	8,400	6,504	10,080
5	14,904	18,480	8,400	6,504	10,080
6	960	1,200	-0-	960	1,200

c. Terminal Cash Flow:

	(A)	(B)
After-tax proceeds form sale of new asset		
Proceeds from sale of new asset	\$12,000	\$20,000
- Tax on sale of new asset ¹	<u>(3,840)</u>	<u>(6,800)</u>
Total proceeds-new asset	8,160	13,200
- After-tax proceeds from sale of old asset		
Proceeds from sale of old asset	(1,000)	(1,000)
+ Tax on sale of old asset ²	400	400
Total proceeds-old asset	(600)	(600)
+ Change in net working capital	<u>4,000</u>	<u>6,000</u>
Terminal cash flow	<u>\$11,560</u>	<u>\$18,600</u>

¹ Book value of Hoist A at end of year 5 = \$2,400
\$12,000 - \$2,400 = \$9,600 recaptured depreciation
\$9,600 x .40 = \$3,840 tax

Book value of Hoist B at end of year 5 = \$3,000
\$20,000 - \$3,000 = \$17,000 recaptured depreciation
\$17,000 x .40 = \$6,800 tax

² Book value of Existing Hoist at end of year 5 = \$0
\$1,000 - \$0 = \$1,000 recaptured depreciation
\$1,000 x .40 = \$400 tax

Year 5 Relevant Cash Flow - Hoist A:

Operating cash flow	\$ 6,504
Terminal cash flow	<u>11,560</u>
Total inflow	\$18,064

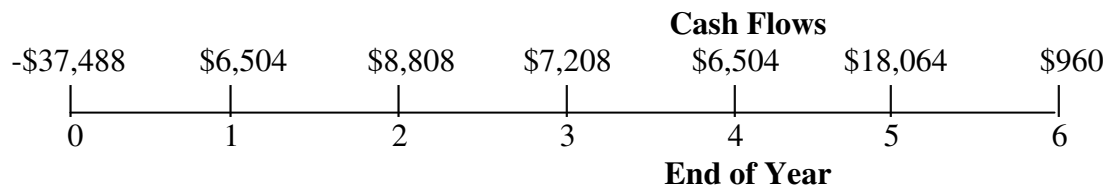
Part 3 Long-Term Investment Decisions

Year 5 Relevant Cash Flow - Hoist B:

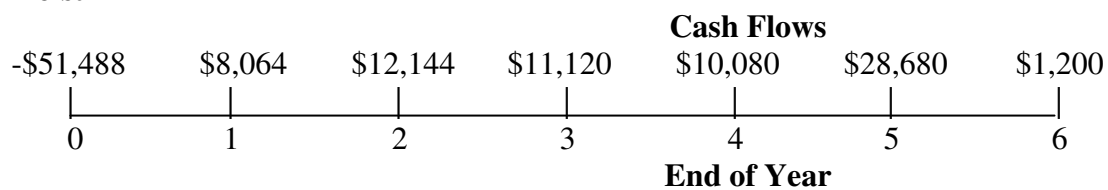
Operating cash flow	\$ 10,080
Terminal cash flow	<u>18,600</u>
Total inflow	\$28,680

d.

Hoist A



Hoist B



CHAPTER 8 CASE**Determining Relevant Cash Flows for Clark Upholstery Company's Machine Renewal or Replacement Decision**

Clark Upholstery is faced with a decision to either renew its major piece of machinery or to replace the machine. The case tests the students' understanding of the concepts of initial investment and relevant cash flows.

a. Initial Investment

	<u>Alternative 1</u>	<u>Alternative 2</u>
Installed cost of new asset		
Cost of asset	\$90,000	\$100,000
+ Installation costs	<u>0</u>	<u>10,000</u>
Total proceeds, sale of new asset	90,000	110,000
- After-tax proceeds from sale of old asset		
Proceeds from sale of old asset	0	(20,000)
+ Tax on sale of old asset*	<u>0</u>	<u>8,000</u>
Total proceeds, sale of old asset	0	(12,000)
+ Change in working capital	<u>15,000</u>	<u>22,000</u>
Initial investment	<u>\$105,000</u>	<u>\$120,000</u>

* Book value of old asset	=	0
\$20,000 - \$0	=	\$20,000 recaptured depreciation
\$20,000 x (.40)	=	\$ 8,000 tax

b.**Calculation of Operating Cash Inflows**

Year	Profits before Depreciation and Taxes	Depre- ciation	Net Profits Before Taxes	Taxes	Net Profits After Taxes	Operating Cash Inflows
Alternative 1						
1	\$198,500	\$18,000	\$180,500	\$ 72,200	\$108,300	\$126,300
2	290,800	28,800	262,000	104,800	157,200	186,000
3	381,900	17,100	364,800	145,920	218,880	235,980
4	481,900	10,800	471,100	188,440	282,660	293,460
5	581,900	10,800	571,100	228,440	342,660	353,460
6	-0-	4,500	-4,500	-1,800	-2,700	1,800

Alternative 2

1	\$235,500	\$22,000	\$213,500	\$85,400	\$128,100	\$150,100
2	335,200	35,200	300,000	120,000	180,000	215,200
3	385,100	20,900	364,200	145,680	218,520	239,420
4	435,100	13,200	421,900	168,760	253,140	266,340
5	551,100	13,200	537,900	215,160	322,740	335,940
6	-0-	5,500	-5,500	-2,200	-3,300	2,200

Calculation of Incremental Cash Inflows

Year	Alternative 1	Alternative 2	Existing	<u>Incremental Cash Flow</u>	
				Alt. 1	Alt. 2
1	\$ 126,300	\$150,100	\$100,000	\$26,300	\$50,100
2	186,000	215,200	150,000	36,000	65,200
3	235,980	239,420	200,000	35,980	39,420

Part 3 Long-Term Investment Decisions

4	293,460	266,340	250,000	43,460	16,340
5	353,460	335,940	320,000	33,460	15,940
6	1,800	2,200	-0-	1,800	2,200

c. Terminal Cash Flow:

	<u>Alternative 1</u>	<u>Alternative 2</u>
After-tax proceeds from		
Sale of new asset =		
Proceeds from sale of new asset	\$8,000	\$25,000
- Tax on sale of new asset ¹	<u>(1,400)</u>	<u>(7,800)</u>
Total proceeds, sale of new asset	6,600	17,200
- After-tax proceeds from sale of old asset =		
Proceeds from sale of old asset	(2,000)	(2,000)
+ Tax on sale of old asset ²	<u>800</u>	<u>800</u>
Total proceeds, sale of old asset	(1,200)	(1,200)
+ Change in working capital	<u>15,000</u>	<u>22,000</u>
Terminal cash flow	<u>\$20,400</u>	<u>\$38,000</u>

¹ Book value of Alternative 1 at end of year 5: = \$4,500
 \$8,000 - \$4,500 = \$3,500 recaptured depreciation
 \$3,500 x (.40) = \$1,400 tax

Book value of Alternative 2 at end of year 5: = \$5,500
 \$25,000 - \$5,500 = \$19,500 recaptured depreciation
 \$19,500 x (.40) = \$7,800 tax

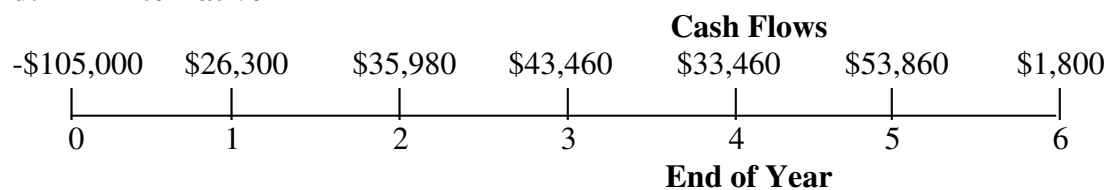
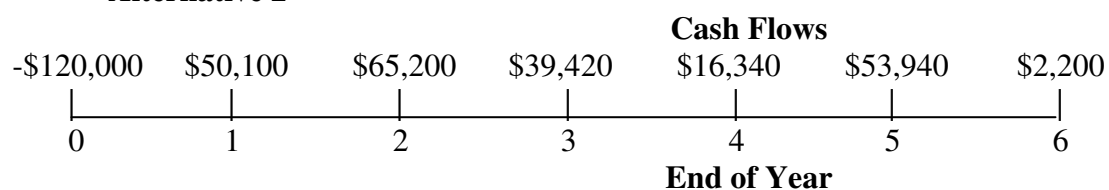
² Book value of old asset at end of year 5: = \$0
 \$2,000 - \$0 = \$2,000 recaptured depreciation
 \$2,000 x (.40) = \$800 tax

Alternative 1

Year 5 Relevant Cash Flow:	Operating Cash Flow:	\$33,460
	Terminal Cash Flow	<u>20,400</u>
	Total Cash Inflow	<u>\$53,860</u>

Alternative 2

Year 5 Relevant Cash Flow:	Operating Cash Flow:	\$15,940
	Terminal Cash Flow	<u>38,000</u>
	Total Cash Inflow	<u>\$53,940</u>

d. Alternative 1**Alternative 2**

- e.** Alternative 2 appears to be slightly better because it has the larger incremental cash flow amounts in the early years.

CHAPTER 9

Capital Budgeting Techniques

INSTRUCTOR'S RESOURCES

Overview

This chapter continues the discussion of capital budgeting begun in the preceding chapter (Chapter 8), which established the basic principles of determining relevant cash flows. Both the sophisticated (net present value and the internal rate of return) and unsophisticated (average rate of return and payback period) capital budgeting techniques are presented. Discussion centers on the calculation and evaluation of the NPV and IRR in investment decisions, with and without a capital rationing constraint.

PMF DISK

PMF Tutor

Topics covered for this chapter include net present value, internal rate of return, payback method, and risk-adjusted discount rates (RADRs).

PMF Problem–Solver: Capital Budgeting Techniques

This module allows the student to determine the length of the payback period, the net present value, and internal rate of return for a project.

PMF Templates

Spreadsheet templates are provided for the following problems:

<u>Problem</u>	<u>Topic</u>
9-4	NPV
9-12	IRR–Mutually exclusive projects

Study Guide

The following *Study Guide* examples are suggested for classroom presentation:

<u>Example</u>	<u>Topic</u>
1	Payback
2	Net present value
8	Internal rate of return

ANSWERS TO REVIEW QUESTIONS

- 9-1** Once the relevant cash flows have been developed, they must be analyzed to determine whether the projects are acceptable or to rank the projects in terms of acceptability in meeting the firm's goal.
- 9-2** The *payback period* is the exact amount of time required to recover the firm's initial investment in a project. In the case of a mixed stream, the cash inflows are added until their sum equals the initial investment in the project. In the case of an annuity, the payback is calculated by dividing the initial investment by the annual cash inflow.
- 9-3** The weaknesses of using the payback period are 1) no explicit consideration of shareholders' wealth; 2) failure to take fully into account the time factor of money; and 3) failure to consider returns beyond the payback period and, hence, overall profitability of projects.
- 9-4** *Net present value* computes the present value of all relevant cash flows associated with a project. For conventional cash flow, NPV takes the present value of all cash inflows over years 1 through n and subtracts from that the initial investment at time zero. The formula for the net present value of a project with conventional cash flows is:

$$\text{NPV} = \text{present value of cash inflows} - \text{initial investment}$$

- 9-5** Acceptance criterion for the net present value method is if $\text{NPV} > 0$, accept; if $\text{NPV} < 0$, reject. If the firm undertakes projects with a positive NPV, the market value of the firm should increase by the amount of the NPV.
- 9-6** The *internal rate of return* on an investment is the discount rate that would cause the investment to have a net present value of zero. It is found by solving the NPV equation given below for the value of k that equates the present value of cash inflows with the initial investment.

$$\text{NPV} = \sum_{t=1}^n \frac{\text{CF}_t}{(1+k)^t} - I_0$$

- 9-7** If a project's internal rate of return is greater than the firm's cost of capital, the project should be accepted; otherwise, the project should be rejected. If the project has an acceptable IRR, the value of the firm should increase. Unlike the NPV, the amount of the expected value increase is not known.
- 9-8** The NPV and IRR always provide consistent accept/reject decisions. These measures, however, may not agree with respect to ranking the projects. The NPV may conflict with the IRR due to different cash flow characteristics of the projects. The greater the difference between timing and magnitude of cash inflows, the more likely it is that rankings will conflict.
- 9-9** A *net present value profile* is a graphic representation of the net present value of a project at various discount rates. The net present value profile may be used when conflicting rankings of projects exist by depicting each project as a line on the profile and determining the point of intersection. If the intersection occurs at a positive discount rate, any discount rate below the intersection will cause conflicting rankings, whereas any discount rates above the intersection will provide consistent rankings. Conflicts in project

Part 3 Long-Term Investment Decisions

rankings using NPV and IRR result from differences in the magnitude and timing of cash flows. Projects with similar-sized investments having low early-year cash inflows tend to be preferred at lower discount rates. At high discount rates, projects with the higher early-year cash inflows are favored, as later-year cash inflows tend to be severely penalized in present value terms.

- 9-10** The *reinvestment rate assumption* refers to the rate at which reinvestment of intermediate cash flows theoretically may be achieved under the NPV or the IRR methods. The NPV method assumes the intermediate cash flows are reinvested at the discount rate, whereas the IRR method assumes intermediate cash flows are reinvested at the IRR. On a purely theoretical basis, the NPV's reinvestment rate assumption is superior because it provides a more realistic rate, the firm's cost of capital, for reinvestment. The cost of capital is generally a reasonable estimate of the rate at which a firm could reinvest these cash inflows. The IRR, especially one well exceeding the cost of capital, may assume a reinvestment rate the firm cannot achieve. In practice, the IRR is preferred due to the general disposition of business people toward rates of return rather than pure dollar returns.

SOLUTIONS TO PROBLEMS

Note to instructor: In most problems involving the internal rate of return calculation, a financial calculator has been used.

9-1 LG 2: Payback Period

- a. $\$42,000 \div \$7,000 = 6 \text{ years}$
- b. The company should accept the project, since $6 < 8$.

9-2 LG 2: Payback Comparisons

- a. Machine 1: $\$14,000 \div \$3,000 = 4 \text{ years, 8 months}$
Machine 2: $\$21,000 \div \$4,000 = 5 \text{ years, 3 months}$
- b. Only Machine 1 has a payback faster than 5 years and is acceptable.
- c. The firm will accept the first machine because the payback period of 4 years, 8 months is less than the 5-year maximum payback required by Nova Products.
- d. Machine 2 has returns which last 20 years while Machine 1 has only seven years of returns. Payback cannot consider this difference; it ignores all cash inflows beyond the payback period.

9-3 LG 2, 3: Choosing Between Two Projects with Acceptable Payback Periods

a.

Project A			Project B		
Year	Cash Inflows	Investment Balance	Year	Cash Inflows	Investment Balance
0		-\$100,000	0		-\$100,000
1	\$10,000	-90,000	1	40,000	-60,000
2	20,000	-70,000	2	30,000	-30,000
3	30,000	-40,000	3	20,000	-10,000
4	40,000	0	4	10,000	0
5	20,000		5	20,000	

Both project A and project B have payback periods of exactly 4 years.

- b. Based on the minimum payback acceptance criteria of 4 years set by John Shell, both projects should be accepted. However, since they are mutually exclusive projects, John should accept project B.
- c. Project B is preferred over A because the larger cash flows are in the early years of the project. The quicker cash inflows occur, the greater their value.

9-4 LG 3: NPV

a. $PV_n = PMT \times (PVIFA_{14\%, 20 \text{ yrs}})$
 $PV_n = \$2,000 \times 6.623$

b. $PV_n = \$3,000 \times 6.623$

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Part 3 Long-Term Investment Decisions

$$PV_n = \$13,246$$

$$NPV = PV_n - \text{Initial investment}$$

$$NPV = \$13,246 - \$10,000$$

$$NPV = \$3,246$$

$$\text{Calculator solution: } \$3,246.26$$

Accept

$$PV_n = \$19,869$$

$$NPV = PV_n - \text{Initial investment}$$

$$NPV = \$19,869 - \$25,000$$

$$NPV = -\$5,131$$

$$\text{Calculator solution: } -\$5,130.61$$

Reject

c. $PV_n = \$5,000 \times 6.623$

$$PV_n = \$33,115$$

$$NPV = PV_n - \text{Initial investment}$$

$$NPV = \$33,115 - \$30,000$$

$$NPV = \$3,115$$

$$\text{Calculator solution: } \$3,115.65$$

Accept

9-5 LG 3: NPV for Varying Cost of Capital

$$PV_n = PMT \times (PVIFA_{k\%, 8 \text{ yrs.}})$$

a. $\underline{10\%}$

$$PV_n = \$5,000 \times (5.335)$$

$$PV_n = \$26,675$$

$$NPV = PV_n - \text{Initial investment}$$

$$NPV = \$26,675 - \$24,000$$

$$NPV = \$2,675$$

$$\text{Calculator solution: } \$2,674.63$$

Accept; positive NPV

b. $\underline{12\%}$

$$PV_n = \$5,000 \times (4.968)$$

$$PV_n = \$24,840$$

$$NPV = PV_n - \text{Initial investment}$$

$$NPV = \$24,840 - \$24,000$$

$$NPV = \$840$$

$$\text{Calculator solution: } \$838.19$$

Accept; positive NPV

c. $\underline{14\%}$

$$PV_n = \$5,000 \times (4.639)$$

$$PV_n = \$23,195$$

$$NPV = PV_n - \text{Initial investment}$$

$$NPV = \$23,195 - \$24,000$$

$$NPV = -\$805$$

$$\text{Calculator solution: } -\$805.68$$

Reject; negative NPV

9-6 LG 2: NPV-Independent Projects**Project A**

$$PV_n = PMT \times (PVIFA_{14\%, 10 \text{ yrs.}})$$

$$PV_n = \$4,000 \times (5.216)$$

$$PV_n = \$20,864$$

$$NPV = \$20,864 - \$26,000$$

$$NPV = -\$5,136$$

$$\text{Calculator solution: } -\$5,135.54$$

Reject

Project B-PV of Cash Inflows

Year	CF	PVIF _{14%,n}	PV
1	\$100,000	.877	\$ 87,700
2	120,000	.769	92,280
3	140,000	.675	94,500
4	160,000	.592	94,720
5	180,000	.519	93,420
6	200,000	.456	91,200
			<u>\$553,820</u>

NPV = PV of cash inflows - Initial investment = \$553,820 - \$500,000

NPV = \$53,820

Calculator solution: \$53,887.93

Accept

Project C-PV of Cash Inflows

Year	CF	PVIF _{14%,n}	PV
1	\$20,000	.877	\$ 17,540
2	19,000	.769	14,611
3	18,000	.675	12,150
4	17,000	.592	10,064
5	16,000	.519	8,304
6	15,000	.456	6,840
7	14,000	.400	5,600
8	13,000	.351	4,563
9	12,000	.308	3,696
10	11,000	.270	2,970
			<u>\$86,338</u>

NPV = PV of cash inflows - Initial investment = \$86,338 - \$170,000

NPV = - \$83,662

Calculator solution: - \$83,668.24

Reject

Project D

$PV_n = PMT \times (PVIFA_{14\%,8 \text{ yrs.}})$

$PV_n = \$230,000 \times 4.639$

$PV_n = \$1,066,970$

NPV = PV_n - Initial investment

NPV = \$1,066,970 - \$950,000

NPV = \$116,970

Calculator solution: \$116,938.70

Accept

Project E-PV of Cash Inflows

Year	CF	PVIF _{14%,n}	PV
4	\$20,000	.592	\$ 11,840

Part 3 Long-Term Investment Decisions

5	30,000	.519	15,570
6	0		0
7	50,000	.400	20,000
8	60,000	.351	21,060
9	70,000	.308	<u>21,560</u>
			<u>\$90,030</u>

NPV = PV of cash inflows - Initial investment

NPV = \$90,030 - \$80,000

NPV = \$10,030

Calculator solution: \$9,963.62

Accept

9-7 LG 3: NPV

a. $PVA = \$385,000 \times (PVIFA_{9\%,5})$

$PVA = \$385,000 \times (3.890)$

$PVA = \$1,497,650$

Calculator solution: \$1,497,515.74

The immediate payment of \$1,500,000 is not preferred because it has a higher present value than does the annuity.

b.
$$PMT = \frac{PVA}{PVIFA_{9\%,5}} = \frac{\$1,500,000}{3.890} = \$385,604$$

Calculator solution: \$385,638.69

c. $PVA_{\text{due}} = \$385,000 \times (PVIFA_{9\%,4} + 1)$

$PVA_{\text{due}} = \$385,000 \times (3.24 + 1)$

$PVA_{\text{due}} = \$385,000 \times (4.24)$

$PVA_{\text{due}} = \$1,632,400$

Changing the annuity to a beginning-of-the-period annuity due would cause Simes Innovations to prefer the \$1,500,000 one-time payment since the PV of the annuity due is greater than the lump sum.

d. No, the cash flows from the project will not influence the decision on how to fund the project. The investment and financing decisions are separate.

9-8 LG 3: NPV and Maximum Return

$PV_n = PMT \times (PVIFA_{k\%,n})$

a. $PV_n = \$4,000 \times (PVIFA_{10\%,4})$

$PV_n = \$4,000 \times (3.170)$

$PV_n = \$12,680$

NPV = PV_n - Initial investment

NPV = \$12,680 - \$13,000

NPV = -\$320

Calculator solution: -\$320.54

Reject this project due to its negative NPV.

b. $\$13,000 = \$4,000 \times (PVIFA_{k\%,n})$
 $\$13,000 \div \$4,000 = (PVIFA_{k\%,4})$
 $3.25 = PVIFA_{9\%,4}$
 Calculator solution: 8.86%

9% is the maximum required return that the firm could have for the project to be acceptable. Since the firm's required return is 10% the cost of capital is greater than the expected return and the project is rejected.

9-9 LG 3: NPV–Mutually Exclusive Projects

$$PV_n = PMT \times (PVIFA_{k\%,n})$$

a. & b.

Press

PV of cash inflows; NPV

A

$$PV_n = PMT \times (PVIFA_{15\%,8 \text{ yrs.}})$$

$$PV_n = \$18,000 \times 4.487$$

$$PV_n = \$80,766$$

$$NPV = PV_n - \text{Initial investment}$$

$$NPV = \$80,766 - \$85,000$$

$$NPV = -\$4,234$$

Calculator solution: -\$4,228.21

Reject

B

Year	CF	PVIF _{15%,n}	PV
1	\$12,000	.870	\$10,440
2	14,000	.756	10,584
3	16,000	.658	10,528
4	18,000	.572	10,296
5	20,000	.497	9,940
6	25,000	.432	10,800
			<u>\$62,588</u>

$$NPV = \$62,588 - \$60,000$$

$$NPV = \$2,588$$

Calculator solution: \$2,584.33

Accept

C

Year	CF	PVIF _{15%,n}	PV
1	\$50,000	.870	\$ 43,500
2	30,000	.756	22,680
3	20,000	.658	13,160
4	20,000	.572	11,440
5	20,000	.497	9,940
6	30,000	.432	12,960
7	40,000	.376	15,040
8	50,000	.327	16,350
			<u>\$145,070</u>

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$$\text{NPV} = \$145,070 - \$130,000$$

$$\text{NPV} = \$15,070$$

Calculator solution: \$15,043.88

Accept

c. Ranking - using NPV as criterion

<u>Rank</u>	<u>Press</u>	<u>NPV</u>
1	C	\$15,070
2	B	2,588
3	A	- 4,234

9-10 LG 2, 3: Payback and NPV

<u>a.</u>	<u>Project</u>	<u>Payback Period</u>
	A	$\$40,000 \div \$13,000 = 3.08 \text{ years}$
	B	$3 + (\$10,000 \div \$16,000) = 3.63 \text{ years}$
	C	$2 + (\$5,000 \div \$13,000) = 2.38 \text{ years}$

Project C, with the shortest payback period, is preferred.

b. Project

$$\text{A} \quad \text{PV}_n = \$13,000 \times 3.274$$

$$\text{PV}_n = \$42,562$$

$$\text{PV} = \$42,562 - \$40,000$$

$$\text{NPV} = \$2,562$$

Calculator solution: \$2,565.82

B	<u>Year</u>	<u>CF</u>	<u>PVIF_{16%,n}</u>	<u>PV</u>
	1	\$ 7,000	.862	6,034
	2	10,000	.743	7,430
	3	13,000	.641	8,333
	4	16,000	.552	8,832
	5	19,000	.476	9,044
				<u>\$39,673</u>

$$\text{NPV} = \$39,673 - \$40,000$$

$$\text{NPV} = - \$327$$

Calculator solution: - \$322.53

C	<u>Year</u>	<u>CF</u>	<u>PVIF_{16%,n}</u>	<u>PV</u>
	1	\$19,000	.862	\$16,378
	2	16,000	.743	11,888
	3	13,000	.641	8,333
	4	10,000	.552	5,520
	5	7,000	.476	3,332
				<u>\$45,451</u>

$$\text{NPV} = \$45,451 - \$40,000$$

$$\text{NPV} = \$5,451$$

Calculator solution: \$5,454.17

Project C is preferred using the NPV as a decision criterion.

- c. At a cost of 16%, Project C has the highest NPV. Because of Project C's cash flow characteristics, high early-year cash inflows, it has the lowest payback period and the highest NPV.

9-11 LG 4: Internal Rate of Return

IRR is found by solving:

$$\$0 = \sum_{t=1}^n \left[\frac{\text{CF}_t}{(1 + \text{IRR})^t} \right] - \text{Initial Investment}$$

It can be computed to the nearest whole percent by the estimation method as shown for Project A below or by using a financial calculator. (Subsequent IRR problems have been solved with a financial calculator and rounded to the nearest whole percent.)

Project A

$$\text{Average Annuity} = (\$20,000 + \$25,000 + \$30,000 + \$35,000 + \$40,000) \div 5$$

$$\text{Average Annuity} = \$150,000 \div 5$$

$$\text{Average Annuity} = \$30,000$$

$$\text{PVIFA}_{k\%, 5\text{yrs.}} = \$90,000 \div \$30,000 = 3.000$$

$$\text{PVIFA}_{19\%, 5\text{yrs.}} = 3.0576$$

$$\text{PVIFA}_{20\%, 5\text{yrs.}} = 2.991$$

However, try 17% and 18% since cash flows are greater in later years.

	CF_t	$\text{PVIF}_{17\%, t}$	PV@17\% [(1) x (2)]	$\text{PVIF}_{18\%, t}$	PV@18\% [(1) x (4)]
Year _t	(1)	(2)	(3)	(4)	(5)
1	\$20,000	.855	\$17,100	.847	\$16,940
2	25,000	.731	18,275	.718	17,950
3	30,000	.624	18,720	.609	18,270
4	35,000	.534	18,690	.516	18,060
5	40,000	.456	18,240	.437	17,480
			<u>\$91,025</u>		<u>\$88,700</u>
	Initial investment		<u>- 90,000</u>		<u>- 90,000</u>
	NPV		\$ 1,025		- \$ 1,300

NPV at 17% is closer to \$0, so IRR is 17%. If the firm's cost of capital is below 17%, the project would be acceptable.

Calculator solution: 17.43%

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Project B

$$\begin{aligned}PV_n &= PMT \times (PVIFA_{k\%,4 \text{ yrs.}}) \\ \$490,000 &= \$150,000 \times (PVIFA_{k\%,4 \text{ yrs.}}) \\ \$490,000 \div \$150,000 &= (PVIFA_{k\%,4 \text{ yrs.}}) \\ 3.27 &= PVIFA_{k\%,4} \\ 8\% < IRR < 9\% \\ \text{Calculator solution: } IRR &= 8.62\%\end{aligned}$$

The firm's maximum cost of capital for project acceptability would be 8% (8.62%).

Project C

$$\begin{aligned}PV_n &= PMT \times (PVIFA_{k\%,5 \text{ yrs.}}) \\ \$20,000 &= \$7,500 \times (PVIFA_{k\%,5 \text{ yrs.}}) \\ \$20,000 \div \$7,500 &= (PVIFA_{k\%,5 \text{ yrs.}}) \\ 2.67 &= PVIFA_{k\%,5 \text{ yrs.}} \\ 25\% < IRR < 26\% \\ \text{Calculator solution: } IRR &= 25.41\%\end{aligned}$$

The firm's maximum cost of capital for project acceptability would be 25% (25.41%).

Project D

$$\$0 = \frac{\$120,000}{(1+IRR)^1} + \frac{\$100,000}{(1+IRR)^2} + \frac{\$80,000}{(1+IRR)^3} + \frac{\$60,000}{(1+IRR)^4} - \$240,000$$

$$IRR = 21\%; \text{ Calculator solution: } IRR = 21.16\%$$

9-12 LG 4: IRR–Mutually Exclusive Projects

a. and b.

Project X

$$\$0 = \frac{\$100,000}{(1+IRR)^1} + \frac{\$120,000}{(1+IRR)^2} + \frac{\$150,000}{(1+IRR)^3} + \frac{\$190,000}{(1+IRR)^4} + \frac{\$250,000}{(1+IRR)^5} - \$500,000$$

IRR = 16%; since IRR > cost of capital, accept.

Calculator solution: 15.67%

Project Y

$$\$0 = \frac{\$140,000}{(1+IRR)^1} + \frac{\$120,000}{(1+IRR)^2} + \frac{\$95,000}{(1+IRR)^3} + \frac{\$70,000}{(1+IRR)^4} + \frac{\$50,000}{(1+IRR)^5} - \$325,000$$

IRR = 17%; since IRR > cost of capital, accept.

Calculator solution: 17.29%

c. Project Y, with the higher IRR, is preferred, although both are acceptable.

9-13 LG 4: IRR, Investment Life, and Cash Inflows

a. $PV_n = PMT \times (PVIFA_{k\%,n})$

$$\begin{aligned}
\$61,450 &= \$10,000 \times (\text{PVIFA}_{k\%,10 \text{ yrs.}}) \\
\$61,450 &\div \$10,000 = \text{PVIFA}_{k\%,10 \text{ Yrs.}} \\
6.145 &= \text{PVIFA}_{k\%,10 \text{ yrs.}} \\
k &= \text{IRR} = 10\% \text{ (calculator solution: 10.0\%)}
\end{aligned}$$

The IRR < cost of capital; reject the project.

b.

$$\begin{aligned}
\text{PV}_n &= \text{PMT} \times (\text{PVIFA}_{\%,n}) \\
\$61,450 &= \$10,000 \times (\text{PVIFA}_{15\%,n}) \\
\$61,450 &\div \$10,000 = \text{PVIFA}_{15\%,n} \\
6.145 &= \text{PVIFA}_{15\%,n} \\
18 \text{ yrs.} &< n < 19 \text{ yrs.} \\
\text{Calculator solution: } &18.23 \text{ years}
\end{aligned}$$

The project would have to run a little over 8 more years to make the project acceptable with the 15% cost of capital.

c.

$$\begin{aligned}
\text{PV}_n &= \text{PMT} \times (\text{PVIFA}_{15\%,10}) \\
\$61,450 &= \text{PMT} \times (5.019) \\
\$61,450 &\div 5.019 = \text{PMT} \\
\$12,243.48 &= \text{PMT} \\
\text{Calculator solution: } &\$12,244.04
\end{aligned}$$

9-14 LG 3, 4: NPV and IRR

a.

$$\begin{aligned}
\text{PV}_n &= \text{PMT} \times (\text{PVIFA}_{10\%,7 \text{ yrs.}}) \\
\text{PV}_n &= \$4,000 \times (4.868) \\
\text{PV}_n &= \$19,472
\end{aligned}$$

$$\begin{aligned}
\text{NPV} &= \text{PV}_n - \text{Initial investment} \\
\text{NPV} &= \$19,472 - \$18,250 \\
\text{NPV} &= \$1,222 \\
\text{Calculator solution: } &\$1,223.68
\end{aligned}$$

b.

$$\begin{aligned}
\text{PV}_n &= \text{PMT} \times (\text{PVIFA}_{k\%,n}) \\
\$18,250 &= \$4,000 \times (\text{PVIFA}_{k\%,7 \text{ yrs.}}) \\
\$18,250 &\div \$4,000 = (\text{PVIFA}_{k\%,7 \text{ yrs.}}) \\
4.563 &= \text{PVIFA}_{k\%,7 \text{ yrs.}} \\
\text{IRR} &= 12\% \\
\text{Calculator solution: } &12.01\%
\end{aligned}$$

c. The project should be accepted since the NPV > 0 and the IRR > the cost of capital.

9-15 LG 3: NPV, with Rankings

a.

$$\begin{aligned}
\text{NPV}_A &= \$20,000(\text{PVIFA}_{15\%,3}) - \$50,000 \\
\text{NPV}_A &= \$20,000(2.283) - \$50,000 \\
\text{NPV}_A &= \$45,660 - \$50,000 = -\$4,340 \\
\text{Calculator solution: } &-\$4,335.50 \\
&\text{Reject}
\end{aligned}$$

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$$NPV_B = \$35,000(PVIF_{15\%,1}) + \$50,000(PVIFA_{15\%,2})(PVIF_{15\%,1}) - \$100,000$$

$$NPV_B = \$35,000(.870) + \$50,000(1.626)(.870) - \$100,000$$

$$NPV_B = \$30,450 + \$70,731 - \$100,000 = \$1,181$$

Calculator solution: \$1,117.78

Accept

$$NPV_C = \$20,000(PVIF_{15\%,1}) + \$40,000(PVIF_{15\%,2}) + \$60,000(PVIF_{15\%,3}) - \$80,000$$

$$NPV_C = \$20,000(.870) + \$40,000(.756) + \$60,000(.658) - \$80,000$$

$$NPV_C = \$17,400 + \$30,240 + \$39,480 - \$80,000 = \$7,120$$

Calculator solution: \$7,088.02

Accept

$$NPV_D = \$100,000(PVIF_{15\%,1}) + \$80,000(PVIF_{15\%,2}) + \$60,000(PVIF_{15\%,3})$$

$$- \$180,000$$

$$NPV_D = \$100,000(.870) + \$80,000(.756) + \$60,000(.658) - \$180,000$$

$$NPV_D = \$87,000 + \$60,480 + \$39,480 - \$180,000 = \$6,960$$

Calculator solution: \$6,898.99

Accept

b.	<u>Rank</u>	<u>Press</u>	<u>NPV</u>
	1	C	\$7,120
	2	D	6,960
	3	B	1,181

c. Using the calculator the IRRs of the projects are:

<u>Project</u>	<u>IRR</u>
A	9.70%
B	15.63%
C	19.44%
D	17.51%

Since the lowest IRR is 9.7% all of the projects would be acceptable if the cost of capital was approximately 10%.

NOTE: Since project A was the only reject project from the 4 projects, all that was needed to find the minimum acceptable cost of capital was to find the IRR of A.

9-16 LG 2, 3, 4: All Techniques, Conflicting Rankings

a.

Project A			Project B		
	Cash	Investment		Cash	Investment
Year	Inflows	Balance	Year	Inflows	Balance
0		-\$150,000	0		-\$150,000

1	\$45,000	-105,000	1	\$75,000	-75,000
2	45,000	-60,000	2	60,000	-15,000
3	45,000	-15,000	3	30,000	+15,000
4	45,000	+30,000	4	30,000	0
5	45,000			30,000	
6	45,000			30,000	

$$\text{Payback}_A = \frac{\$150,000}{\$45,000} = 3.33 \text{ years} = 3 \text{ years 4 months}$$

$$\text{Payback}_B = 2 \text{ years} + \frac{\$15,000}{\$30,000} \text{ years} = 2.5 \text{ years} = 2 \text{ years 6 months}$$

- b.** $\text{NPV}_A = \$45,000(\text{PVIFA}_{0\%,6}) - \$150,000$
 $\text{NPV}_A = \$45,000(6) - \$150,000$
 $\text{NPV}_A = \$270,000 - \$150,000 = \$120,000$
 Calculator solution: \$120,000

$$\begin{aligned} \text{NPV}_B &= \$75,000(\text{PVIF}_{0\%,1}) + \$60,000(\text{PVIF}_{0\%,2}) + \$30,000(\text{PVIFA}_{0\%,4})(\text{PVIF}_{0\%,2}) \\ &\quad - \$150,000 \\ \text{NPV}_B &= \$75,000 + \$60,000 + \$30,000(4) - \$150,000 \\ \text{NPV}_B &= \$75,000 + \$60,000 + \$120,000 - \$150,000 = \$105,000 \\ \text{Calculator solution: } &\$105,000 \end{aligned}$$

- c.** $\text{NPV}_A = \$45,000(\text{PVIFA}_{9\%,6}) - \$150,000$
 $\text{NPV}_A = \$45,000(4.486) - \$150,000$
 $\text{NPV}_A = \$201,870 - \$150,000 = \$51,870$
 Calculator solution: \$51,886.34

$$\begin{aligned} \text{NPV}_B &= \$75,000(\text{PVIF}_{9\%,1}) + \$60,000(\text{PVIF}_{9\%,2}) + \$30,000(\text{PVIFA}_{9\%,4})(\text{PVIF}_{9\%,2}) \\ &\quad - \$150,000 \\ \text{NPV}_B &= \$75,000(.917) + \$60,000(.842) + \$30,000(3.24)(.842) - \$150,000 \\ \text{NPV}_B &= \$68,775 + \$50,520 + \$81,842 - \$150,000 = \$51,137 \\ \text{Calculator solution: } &\$51,112.36 \end{aligned}$$

- d.** Using a financial calculator:
 $\text{IRR}_A = 19.91\%$
 $\text{IRR}_B = 22.71\%$

e.

Project	Payback	Rank	
		NPV	IRR
A	2	1	2
B	1	2	1

The project that should be selected is A. The conflict between NPV and IRR is due partially to the reinvestment rate assumption. The assumed reinvestment rate of project B is 22.71%, the project's IRR. The reinvestment rate assumption of A is 9%, the firm's cost of capital. On a practical level project B will

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probably be selected due to management's preference for making decisions based on percentage returns, and their desire to receive a return of cash quickly.

9-17 LG 2, 3: Payback, NPV, and IRR

a. Payback period

$$3 + (\$20,000 \div \$35,000) = 3.57 \text{ years}$$

b. PV of cash inflows

Year	CF	PVIF _{12%,n}	PV
1	\$20,000	.893	\$ 17,860
2	25,000	.797	19,925
3	30,000	.712	21,360
4	35,000	.636	22,260
5	40,000	.567	22,680
			<u>\$104,085</u>

$$\text{NPV} = \text{PV of cash inflows} - \text{Initial investment}$$

$$\text{NPV} = \$104,085 - \$95,000$$

$$\text{NPV} = \$9,085$$

$$\text{Calculator solution: } \$9,080.61$$

$$\text{c. } \$0 = \frac{\$20,000}{(1 + \text{IRR})^1} + \frac{\$25,000}{(1 + \text{IRR})^2} + \frac{\$30,000}{(1 + \text{IRR})^3} + \frac{\$35,000}{(1 + \text{IRR})^4} + \frac{\$40,000}{(1 + \text{IRR})^5} - \$95,000$$

$$\text{IRR} = 15\%$$

$$\text{Calculator solution: } 15.36\%$$

d. NPV = \$9,085; since NPV > 0; accept

IRR = 15%; since IRR > 12% cost of capital; accept

The project should be implemented since it meets the decision criteria for both NPV and IRR.

9-18 LG 3, 4, 5: NPV, IRR, and NPV Profiles

a. and b.

Project A

PV of cash inflows:

Year	CF	PVIF _{12%,n}	PV
1	\$25,000	.893	\$ 22,325
2	35,000	.797	27,895
3	45,000	.712	32,040
4	50,000	.636	31,800
5	55,000	.567	31,185
			<u>\$145,245</u>

$$\text{NPV} = \text{PV of cash inflows} - \text{Initial investment}$$

$$\text{NPV} = \$145,245 - \$130,000$$

$$\text{NPV} = \$15,245$$

Calculator solution: \$15,237.71

Based on the NPV the project is acceptable since the NPV is greater than zero.

$$\$0 = \frac{\$25,000}{(1 + \text{IRR})^1} + \frac{\$35,000}{(1 + \text{IRR})^2} + \frac{\$45,000}{(1 + \text{IRR})^3} + \frac{\$50,000}{(1 + \text{IRR})^4} + \frac{\$55,000}{(1 + \text{IRR})^5} - \$130,000$$

IRR = 16%

Calculator solution: 16.06%

Based on the IRR the project is acceptable since the IRR of 16% is greater than the 12% cost of capital.

Project B

PV of cash inflows:

Year	CF	PVIF _{12%,n}	PV
1	\$40,000	.893	\$ 35,720
2	35,000	.797	27,895
3	30,000	.712	21,360
4	10,000	.636	6,360
5	5,000	.567	<u>2,835</u>
			\$ 94,170

NPV = \$94,170 - \$85,000

NPV = \$9,170

Calculator solution: \$9,161.79

Based on the NPV the project is acceptable since the NPV is greater than zero.

$$\$0 = \frac{\$40,000}{(1 + \text{IRR})^1} + \frac{\$35,000}{(1 + \text{IRR})^2} + \frac{\$30,000}{(1 + \text{IRR})^3} + \frac{\$10,000}{(1 + \text{IRR})^4} + \frac{\$5,000}{(1 + \text{IRR})^5} - \$85,000$$

IRR = 18%

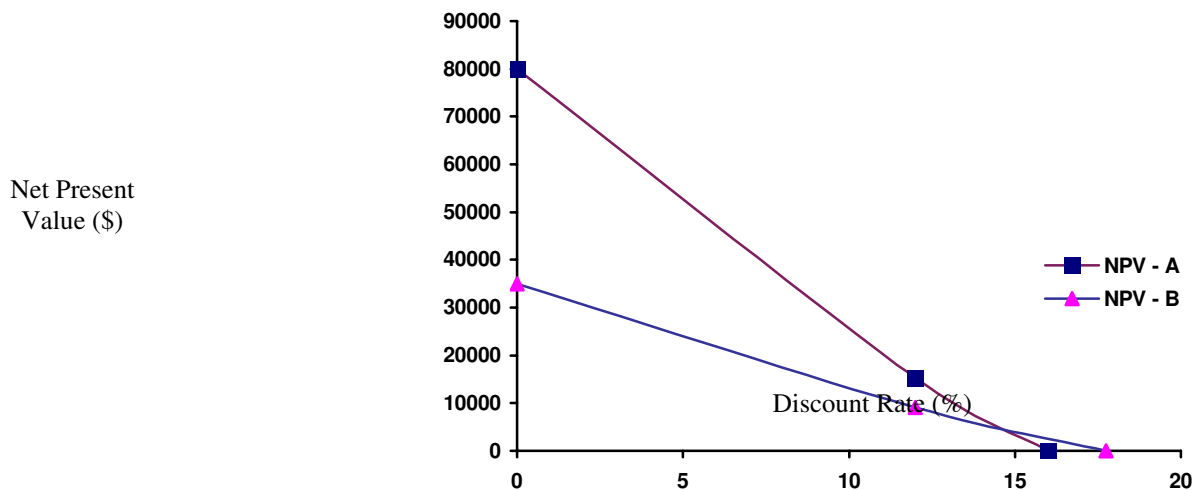
Calculator solution: 17.75%

Based on the IRR the project is acceptable since the IRR of 16% is greater than the 12% cost of capital.

c.

Net Present Value Profile

Part 3 Long-Term Investment Decisions



Data for NPV Profiles

Discount Rate	NPV	
	A	B
0%	\$ 80,000	\$ 35,000
12%	\$ 15,245	-
15%	-	\$ 9,170
16%	0	-
18%	-	0

- d. The net present value profile indicates that there are conflicting rankings at a discount rate lower than the intersection point of the two profiles (approximately 15%). The conflict in rankings is caused by the relative cash flow pattern of the two projects. At discount rates above approximately 15%, Project B is preferable; below approximately 15%, Project A is better.
- e. Project A has an increasing cash flow from year 1 through year 5, whereas Project B has a decreasing cash flow from year 1 through year 5. Cash flows moving in opposite directions often cause conflicting rankings.

9-19 LG 2, 3, 4, 5, 6: All Techniques–Mutually Exclusive Investment Decision

	Project		
	A	B	C
Cash inflows (years 1 - 5)	\$20,000	\$31,500	\$32,500
a. Payback*	3 years	3.2 years	3.4 years
b. NPV*	\$10,340	\$10,786	\$ 4,303
c. IRR*	20%	17%	15%

* Supporting calculations shown below:

- a. **Payback Period:**
- | | |
|------------|---|
| Project A: | $\$60,000 \div \$20,000 = 3 \text{ years}$ |
| Project B: | $\$100,000 \div \$31,500 = 3.2 \text{ years}$ |
| Project C: | $\$110,000 \div \$32,500 = 3.4 \text{ years}$ |
- b. **NPV**
Project A
- c. **IRR**
Project, A

$$\begin{aligned} PV_n &= PMT \times (PVIFA_{13\%, 5 \text{ Yrs.}}) \\ PV_n &= \$20,000 \times 3.517 \\ PV_n &= 70,340 \end{aligned}$$

$$\begin{aligned} NPV &= \$70,340 - \$60,000 \\ NPV &= \$10,340 \\ \text{Calculator solution: } & \$10,344.63 \end{aligned}$$

Project B

$$\begin{aligned} PV_n &= \$31,500.00 \times 3.517 \\ PV_n &= \$110,785.50 \end{aligned}$$

$$\begin{aligned} NPV &= \$110,785.50 - \$100,000 \\ NPV &= \$10,785.50 \\ \text{Calculator solution: } & \$10,792.78 \end{aligned}$$

Project C

$$\begin{aligned} PV_n &= \$32,500.00 \times 3.517 \\ PV_n &= \$114,302.50 \end{aligned}$$

$$\begin{aligned} NPV &= \$114,302.50 - \$110,000 \\ NPV &= \$4,302.50 \\ \text{Calculator solution: } & \$4,310.02 \end{aligned}$$

$$\begin{aligned} NPV \text{ at } 19\% &= \$1,152.70 \\ NPV \text{ at } 20\% &= -\$187.76 \\ \text{Since NPV is closer to zero} \\ \text{at } 20\%, \text{ IRR} &= 20\% \end{aligned}$$

$$\text{Calculator solution: } 19.86\%$$

Project B

$$\begin{aligned} NPV \text{ at } 17\% &= \$779.40 \\ NPV \text{ at } 18\% &= -\$1,494.11 \end{aligned}$$

$$\begin{aligned} \text{Since NPV is closer to zero} \\ \text{at } 17\%, \text{ IRR} &= 17\% \\ \text{Calculator solution: } & 17.34\% \end{aligned}$$

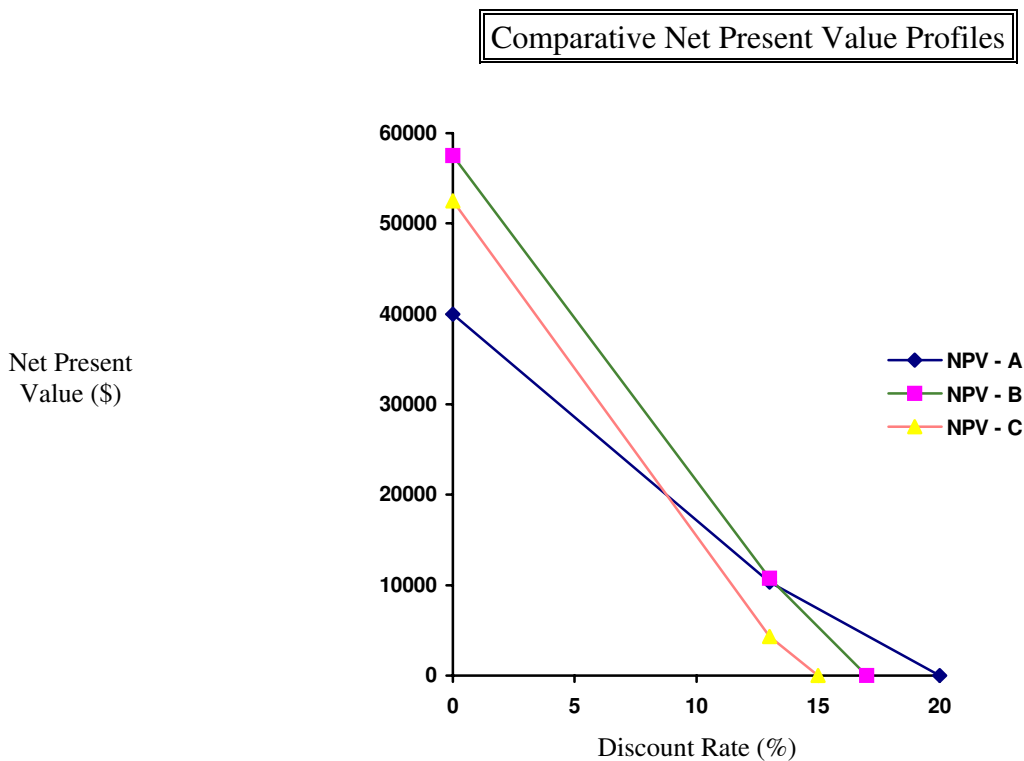
Project C

$$\begin{aligned} NPV \text{ at } 14\% &= \$1,575.13 \\ NPV \text{ at } 15\% &= -\$1,054.96 \end{aligned}$$

$$\begin{aligned} \text{Since NPV is closer to zero at} \\ 15\%, \text{ IRR} &= 15\% \\ \text{Calculator solution: } & 14.59\% \end{aligned}$$

Part 3 Long-Term Investment Decisions

d.



Data for NPV Profiles

Discount Rate	NPV		
	A	B	C
0%	\$ 40,000	\$ 57,500	\$ 52,500
13%	\$ 10,340	10,786	4,303
15%	-	-	0
17%	-	0	-
20%	0	-	-

The difference in the magnitude of the cash flow for each project causes the NPV to compare favorably or unfavorably, depending on the discount rate.

- e. Even though A ranks higher in Payback and IRR, financial theorists would argue that B is superior since it has the highest NPV. Adopting B adds \$445.50 more to the value of the firm than does A.

9-20 LG 2, 3, 4, 5, 6: All Techniques with NPV Profile–Mutually Exclusive Projects

a. Project A

Payback period

Year 1 + Year 2 + Year 3 = \$60,000

Year 4 = \$20,000

Initial investment = \$80,000

Payback = 3 years + (\$20,000 ÷ 30,000)

Payback = 3.67 years

Project B

Payback period

\$50,000 ÷ \$15,000 = 3.33 years

b. Project A

PV of cash inflows

Year	CF	PVIF _{13%,n}	PV
1	\$15,000	.885	\$ 13,275
2	20,000	.783	15,660
3	25,000	.693	17,325
4	30,000	.613	18,390
5	35,000	.543	<u>19,005</u>
			\$83,655

NPV = PV of cash inflows - Initial investment

NPV = \$83,655 - \$80,000

NPV = \$3,655

Calculator solution: \$3,659.68

Project B

NPV = PV of cash inflows - Initial investment

PV_n = PMT x (PVIFA_{13%,n})

PV_n = \$15,000 x 3.517

PV_n = \$52,755

NPV = \$52,755 - \$50,000

= \$2,755

Calculator solution: \$2,758.47

c. Project A

$$\$0 = \frac{\$15,000}{(1 + \text{IRR})^1} + \frac{\$20,000}{(1 + \text{IRR})^2} + \frac{\$25,000}{(1 + \text{IRR})^3} + \frac{\$30,000}{(1 + \text{IRR})^4} + \frac{\$35,000}{(1 + \text{IRR})^5} - \$80,000$$

IRR = 15%

Calculator solution: 14.61%

Project B

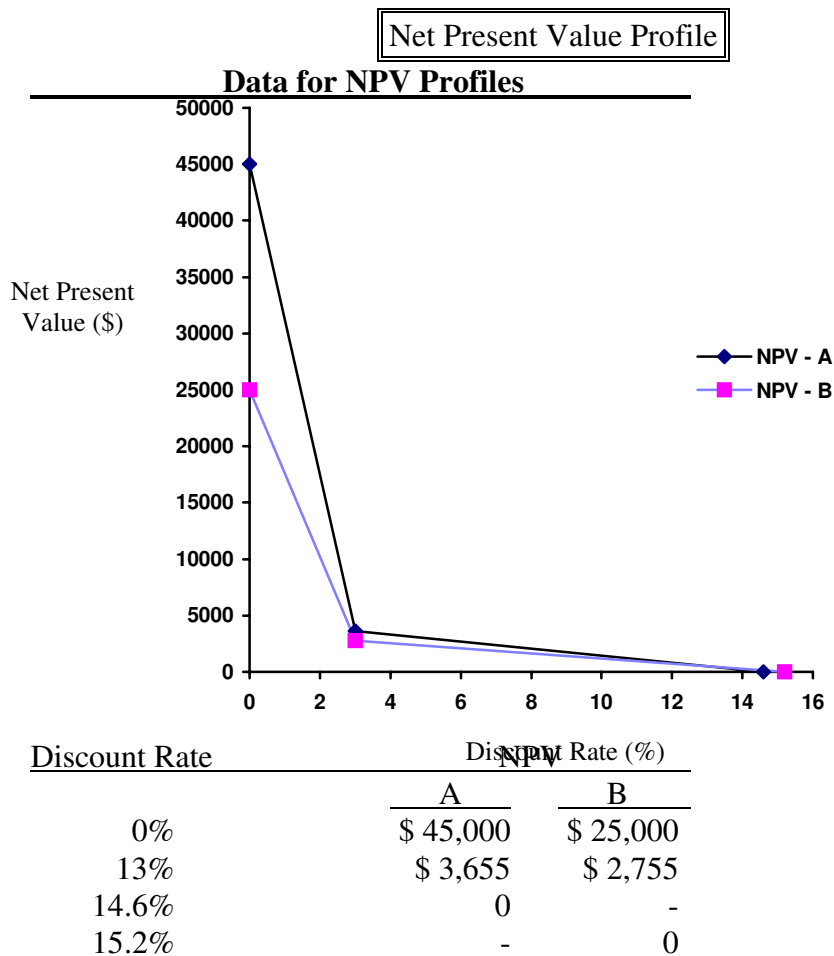
\$0 = \$15,000 x (PVIFA_{k%,5}) - \$50,000

IRR = 15%

Part 3 Long-Term Investment Decisions

Calculator solution: 15.24%

d.



Intersection - approximately 14%

If cost of capital is above 14%, conflicting rankings occur.

The calculator solution is 13.87%.

- e. Both projects are acceptable. Both have positive NPVs and equivalent IRR's that are greater than the cost of capital. Although Project B has a slightly higher IRR, the rates are very close. Since Project A has a higher NPV, and also has the shortest payback, accept Project A.

9-21 LG 2, 3, 4: Integrative-Complete Investment Decision

a. Initial investment:

Installed cost of new press =		
Cost of new press		\$2,200,000
- After-tax proceeds from sale of old asset		
Proceeds from sale of existing press	(1,200,000)	
+ Taxes on sale of existing press *	<u>480,000</u>	
Total after-tax proceeds from sale		<u>(720,000)</u>
Initial investment		<u>\$1,480,000</u>

- * Book value = \$0
 \$1,200,000 - \$1,000,000 = \$200,000 capital gain

$$\begin{aligned}
& \$1,000,000 - \$0 = \$1,000,000 \text{ recaptured depreciation} \\
& \$200,000 \text{ capital gain} \times (.40) = \$80,000 \\
& \$1,000,000 \text{ recaptured depreciation} \times (.40) = \$400,000 \\
& \phantom{\$1,000,000 \text{ recaptured depreciation} \times (.40)} = \$480,000 \text{ tax liability}
\end{aligned}$$

b.

Calculation of Operating Cash Flows

Year	Revenues	Expenses	Depreciation	Net Profits before Taxes	Taxes	Net Profits after Taxes	Cash Flow
1	\$1,600,000	\$800,000	\$440,000	\$360,000	\$144,000	\$216,000	\$656,000
2	1,600,000	800,000	704,000	96,000	38,400	57,600	761,600
3	1,600,000	800,000	418,000	382,000	152,800	229,200	647,200
4	1,600,000	800,000	264,000	536,000	214,400	321,600	585,600
5	1,600,000	800,000	264,000	536,000	214,400	321,600	585,600
6	0	0	110,000	-110,000	-44,000	-66,000	44,000

c. Payback period = 2 years + (\$62,400 ÷ \$647,200) = 2.1 years

d. PV of cash inflows:

Year	CF	PVIF _{11%,n}	PV
1	\$656,000	.901	\$591,056
2	761,600	.812	618,419
3	647,200	.731	473,103
4	585,600	.659	385,910
5	585,600	.593	347,261
6	44,000	.535	23,540
			<u>\$2,439,289</u>

NPV = PV of cash inflows - Initial investment

NPV = \$2,439,289 - \$1,480,000

NPV = \$959,289

Calculator solution: \$959,152

$$\$0 = \frac{\$656,000}{(1 + \text{IRR})^1} + \frac{\$761,600}{(1 + \text{IRR})^2} + \frac{\$647,200}{(1 + \text{IRR})^3} + \frac{\$585,600}{(1 + \text{IRR})^4} + \frac{\$585,600}{(1 + \text{IRR})^5} + \frac{\$44,000}{(1 + \text{IRR})^6} - \$1,480,000$$

IRR = 35%

Calculator solution: 35.04%

Part 3 Long-Term Investment Decisions

- e. The NPV is a positive \$959,289 and the IRR of 35% is well above the cost of capital of 11%. Based on both decision criteria, the project should be accepted.

9-22 LG 3, 4, 5: Integrative–Investment Decision

- a. Initial investment:

Installed cost of new asset =		
Cost of the new machine	\$1,200,000	
+ Installation costs	<u>150,000</u>	
Total cost of new machine		\$1,350,000
- After-tax proceeds from sale of old asset =		
Proceeds from sale of existing machine	(185,000)	
- Tax on sale of existing machine*	<u>(79,600)</u>	
Total after-tax proceeds from sale		(264,600)
+ Increase in net working capital		<u>25,000</u>
Initial investment		<u>\$1,110,400</u>

* Book value = \$384,000

Calculation of Operating Cash Flows
New Machine

Year	Reduction in Operating Costs	Depreciation	Net Profits Before Taxes	Taxes	Net Profits After Taxes	Cash Flow
1	\$350,000	\$270,000	\$ 80,000	\$32,000	\$ 48,000	\$318,000
2	350,000	432,000	- 82,000	- 32,800	- 49,200	382,800
3	350,000	256,500	93,500	37,400	56,100	312,600
4	350,000	162,000	188,000	75,200	112,800	274,800
5	350,000	162,000	188,000	75,200	112,800	274,800
6	0	67,500	- 67,500	- 27,000	- 40,500	27,000

Existing Machine

Year	Depreciation	Net Profits Before Taxes	Taxes	Net Profits After Taxes	Cash Flow
1	\$152,000	- \$152,000	- \$60,800	- \$91,200	\$60,800
2	96,000	- 96,000	- 38,400	- 57,600	38,400
3	96,000	- 96,000	- 38,400	- 57,600	38,400
4	40,000	- 40,000	- 16,000	- 24,000	16,000
5	0	0	0	0	0
6	0	0	0	0	0

Incremental Operating Cash Flows

Year	New Machine	Existing Machine	Incremental Cash Flow
1	\$318,000	\$60,800	\$257,200
2	382,800	38,400	344,400
3	312,600	38,400	274,200
4	274,800	16,000	258,800
5	274,800	0	274,800
6	27,000	0	27,000

Terminal cash flow:

After-tax proceeds from sale of new asset =

Proceeds from sale of new asset	\$200,000	
- Tax on sale of new asset *	<u>(53,000)</u>	
Total proceeds-sale of new asset		\$147,000
- After-tax proceeds from sale of old asset		0
+ Change in net working capital		<u>25,000</u>
Terminal cash flow		<u>\$172,000</u>

* Book value of new machine at the end of year 5 is \$67,500

200,000 - \$67,500 = \$132,500 recaptured depreciation

132,500 x .40 = \$53,000 tax liability

b.

Year	CF	PVIF _{9%,n}	PV
1	\$257,200	.917	\$ 235,852
2	344,400	.842	289,985
3	274,200	.772	211,682
4	258,800	.708	183,230
5	274,800	.650	178,620
Terminal value	172,000	.650	<u>111,800</u>
			\$1,211,169

NPV = PV of cash inflows - Initial investment

NPV = \$1,211,169 - \$1,110,400

NPV = \$100,769

Calculator solution: \$100,900

c.

$$\$0 = \frac{\$257,200}{(1 + \text{IRR})^1} + \frac{\$344,400}{(1 + \text{IRR})^2} + \frac{\$274,200}{(1 + \text{IRR})^3} + \frac{\$258,800}{(1 + \text{IRR})^4} + \frac{\$446,800}{(1 + \text{IRR})^5} - \$1,110,400$$

IRR = 12.2%

Calculator solution: 12.24%

Part 3 Long-Term Investment Decisions

- d.** Since the $NPV > 0$ and the $IRR > \text{cost of capital}$, the new machine should be purchased.
- e.** 12.24%. The criterion is that the IRR must equal or exceed the cost of capital; therefore, 12.24% is the lowest acceptable IRR .

CHAPTER 9 CASE

Making Norwich Tool's Lathe Investment Decision

The student is faced with a typical capital budgeting situation in Chapter 9's case. Norwich Tool must select one of two lathes that have different initial investments and cash inflow patterns. After calculating both unsophisticated and sophisticated capital budgeting techniques, the student must reevaluate the decision by taking into account the higher risk of one lathe.

a. Payback period

Lathe A:

$$\begin{aligned} \text{Years 1 - 4} &= \$644,000 \\ \text{Payback} &= 4 \text{ years} + (\$16,000 \div \$450,000) = 4.04 \text{ years} \end{aligned}$$

Lathe B:

$$\begin{aligned} \text{Years 1 - 3} &= \$304,000 \\ \text{Payback} &= 3 \text{ years} + (\$56,000 \div \$86,000) = 3.65 \text{ years} \end{aligned}$$

Lathe A will be rejected since the payback is longer than the 4-year maximum accepted, and lathe B is accepted because the project payback period is less than the 4-year payback cutoff.

b. (1) NPV

Year	Lathe A Cash Flow	PVIF _{13%}	PV	Lathe B Cash Flow	PVIF _{13%,t}	PV\
1	\$128,000	.885	\$113,280	\$ 88,000	.885	\$ 77,880
2	182,000	.783	142,506	120,000	.783	93,960
3	166,000	.693	115,038	96,000	.693	66,528
4	168,000	.613	102,984	86,000	.613	52,718
5	450,000	.543	<u>244,350</u>	207,000	.543	<u>112,401</u>
	PV =		<u>\$718,158</u>	PV =		<u>\$403,487</u>

$$\begin{aligned} \text{NPV}_A &= \$718,158 - \$660,000 \\ &= \$58,158 \end{aligned}$$

$$\text{Calculator solution: } \$58,132.89$$

$$\begin{aligned} \text{NPV}_B &= \$403,487 - \$360,000 \\ &= \$43,487 \end{aligned}$$

$$\text{Calculator solution: } \$43,483.25$$

(2) IRR

Lathe A:

$$\$0 = \frac{\$128,000}{(1 + \text{IRR})^1} + \frac{\$182,000}{(1 + \text{IRR})^2} + \frac{\$166,000}{(1 + \text{IRR})^3} + \frac{\$168,000}{(1 + \text{IRR})^4} + \frac{\$450,000}{(1 + \text{IRR})^5} - \$660,000$$

$$\text{IRR} = 16\%$$

$$\text{Calculator solution: } 15.95\%$$

Lathe B:

$$\$0 = \frac{\$88,000}{(1 + \text{IRR})^1} + \frac{\$120,000}{(1 + \text{IRR})^2} + \frac{\$96,000}{(1 + \text{IRR})^3} + \frac{\$86,000}{(1 + \text{IRR})^4} + \frac{\$207,000}{(1 + \text{IRR})^5} - \$360,000$$

$$\text{IRR} = 17\%$$

$$\text{Calculator solution: } 17.34\%$$

Part 3 Long-Term Investment Decisions

Under the NPV rule both lathes are acceptable since the NPVs for A and B is greater than zero. Lathe A ranks ahead of B since it has a larger NPV. The same accept decision applies to both projects with the IRR, since both IRRs are greater than the 13% cost of capital. However, the ranking reverses with the 17% IRR for B being greater than the 16% IRR for lathe A.

c. Summary

	<u>Lathe A</u>	<u>Lathe B</u>
Payback period	4.04 years	3.65 years
NPV	\$58,158	\$43,487
IRR	16%	17%

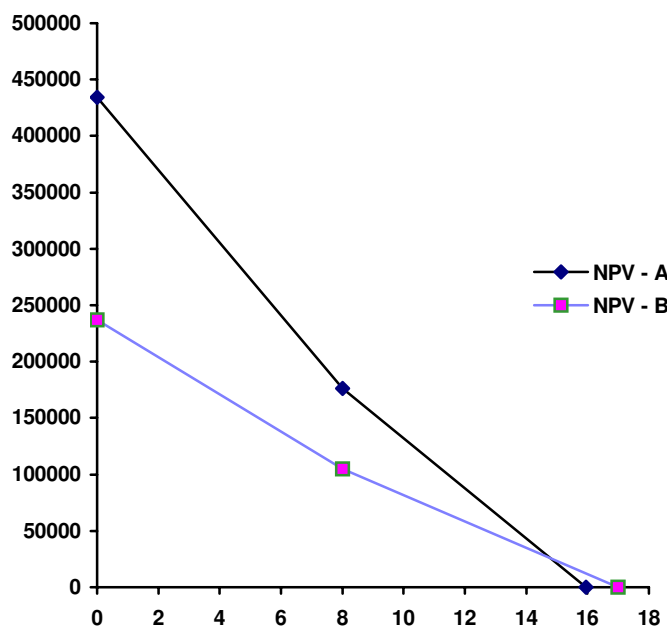
Both projects have positive NPVs and IRRs above the firm's cost of capital. Lathe A, however, exceeds the maximum payback period requirement. Because it is so close to the 4-year maximum and this is an unsophisticated capital budgeting technique, Lathe A should not be eliminated from consideration on this basis alone, particularly since it has a much higher NPV.

If the firm has unlimited funds, it should choose the project with the highest NPV, Lathe A, in order to maximize shareholder value. If the firm is subject to capital rationing, Lathe B, with its shorter payback period and higher IRR, should be chosen. The IRR considers the relative size of the investment, which is important in a capital rationing situation.

- d.** To create an NPV profile it is best to have at least 3 NPV data points. To create the third point an 8% discount rate was arbitrarily chosen. With the 8% rate the NPV for lathe A is \$176,077 and the NPV for lathe B is \$104,663

NPV

Lathe B is preferred over Lathe A based on the IRR. However, as can be seen in the NPV profile, to the left of the cross-over point of the two lines Lathe A is preferred. The underlying cause of this conflict in rankings arises from the reinvestment assumption of NPV versus IRR. NPV assumes cash flows are reinvested at the cost of capital, while the IRR has cash flows being reinvested at the IRR. The difference in these assumptions will point to the timing of the cash flows will point.



preferred over Lathe A. However, as can be seen in the NPV profile, to the left of the cross-over point of the two lines Lathe A is preferred. The underlying cause of this conflict in rankings arises from the reinvestment assumption of NPV versus IRR. NPV assumes cash flows are reinvested at the cost of capital, while the IRR has cash flows being reinvested at the IRR. The two rates and the timing of the cash flows will point to the timing of the cash flows will point.

- e. On a theoretical basis Lathe A should be preferred because of its higher NPV and thus its known impact on shareholder wealth. On a practical perspective Lathe B may be selected due to its higher IRR and its faster payback. This difference results from managers' preference for evaluating decisions based on percent returns rather than dollar returns, and on the desire to get a return of cash flows as quickly as possible.

Principles of Managerial Finance Solution

Lawrence J. Gitman

CHAPTER 10

Risk and Refinements In Capital Budgeting

INSTRUCTOR'S RESOURCES

Overview

Chapters 8 and 9 developed the major decision-making aspects of capital budgeting. Cash flows and budgeting models have been integrated and discussed in providing the principles of capital budgeting. However, there are more complex issues beyond those presented. Chapter 10 expands capital budgeting to consider risk with such methods as sensitivity analysis, scenario analysis, and simulation. Capital budgeting techniques used to evaluate international projects, as well as the special risks multinational companies face, are also presented. Additionally, two basic risk-adjustment techniques are examined: certainty equivalents and risk-adjusted discount rates.

PMF DISK

PMF Tutor

A topic covered for this is risk-adjusted discount rates (RADRs).

PMF Problem-Solver: Capital Budgeting Techniques

This module allows the student to compare the annualized net present value of projects with unequal lives.

PMF Templates

No spreadsheet templates are provided for this chapter.

Study Guide

There are no particular *Study Guide* examples suggested for classroom presentation.

ANSWERS TO REVIEW QUESTIONS

- 10-1** There is usually a significant degree of uncertainty associated with capital budgeting projects. There is the usual business risk along with the fact that future cash flows are an estimate and do not represent exact values. This uncertainty exists for both independent and mutually exclusive projects. The risk associated with any single project has the capability to change the entire risk of the firm. The firm's assets are like a portfolio of assets. If an accepted capital budgeting project has a risk different from the average risk of the assets in the firm, it will cause a shift in the overall risk of the firm.
- 10-2** *Risk*, in terms of cash inflows from a project, is the variability of expected cash flows, hence the expected returns, of the given project. The breakeven cash inflow—the level of cash inflow necessary in order for the project to be acceptable—may be compared with the probability of that inflow occurring. When comparing two projects with the same breakeven cash inflows, the project with the higher probability of occurrence is less risky.
- 10-3**
- a. *Sensitivity analysis* uses a number of possible inputs (cash inflows) to assess their impact on the firm's return (NPV). In capital budgeting, the NPVs are estimated for the pessimistic, most likely, and optimistic cash flow estimates. By subtracting the pessimistic outcome NPV from the optimistic outcome NPV, a range of NPVs can be determined.
 - b. *Scenario analysis* is used to evaluate the impact on return of simultaneous changes in a number of variables, such as cash inflows, cash outflows, and the cost of capital, resulting from differing assumptions relative to economic and competitive conditions. These return estimates can be used to roughly assess the risk involved with respect to the level of inflation.
 - c. *Simulation* is a statistically based approach using random numbers to simulate various cash flows associated with the project, calculating the NPV or IRR on the basis of these cash flows, and then developing a probability distribution of each project's rate of returns based on NPV or IRR criterion.
- 10-4**
- a. *Multinational companies (MNCs)* must consider the effect of *exchange rate risk*, the risk that the exchange rate between the dollar and the currency in which the project's cash flows are denominated will reduce the project's future cash flows. If the value of the dollar depreciates relative to that currency, the market value of the project's cash flows will decrease as a result. Firms can use hedging to protect themselves against this risk in the short term; for the long term, financing the project using local currency can minimize this risk.
 - b. *Political risk*, the risk that a foreign government's actions will adversely affect the project, makes international projects particularly risky, because it cannot be predicted in advance. To take this risk into account, managers should either adjust expected cash flows or use risk-adjusted discount rates when performing the capital budgeting analysis. Adjustment of cash flows is the preferred method.
 - c. Tax laws differ from country to country. Because only after-tax cash flows are relevant for capital budgeting decisions, managers must account for all taxes paid to foreign governments and consider the effect of any foreign tax payments on the firm's U.S. tax liability.
 - d. *Transfer pricing* refers to the prices charged by a corporation's subsidiaries for goods and services traded between them; the prices are not set by the open market. In terms of capital budgeting

decisions, managers should be sure that transfer prices accurately reflect actual costs and incremental cash flows.

- e. MNCs cannot evaluate international capital projects from only a financial perspective. The *strategic viewpoint* often is the determining factor in deciding whether or not to undertake a project. In fact, a project that is less acceptable on a purely financial basis than another may be chosen for strategic reasons. Some reasons for MNC foreign investment include continued market access, the ability to compete with local companies, political and/or social reasons (for example, gaining favorable tax treatment in exchange for creating new jobs in a country), and achievement of a particular corporate objective such as obtaining a reliable source of raw materials.

10-5 *Risk-adjusted discount rates* reflect the return that must be earned on a given project in order to adequately compensate the firm's owners. The relationship between RADRs and the CAPM is a purely theoretical concept. The expression used to value the expected rate of return of a security k_i ($k_i = R_F + [b \times (k_m - R_F)]$) is rewritten substituting an asset for a security. Because real corporate assets are not traded in efficient markets and estimation of a market return, k_m , for a portfolio of such assets would be difficult, the CAPM is not used for real assets.

10-6 A firm whose stock is actively traded in security markets generally does not increase in value through diversification. Investors themselves can more efficiently diversify their portfolio by holding a variety of stocks. Since a firm is not rewarded for diversification, the risk of a capital budgeting project should be considered independently rather than in terms of their impact on the total portfolio of assets. In practice, management usually follows this approach and evaluates projects based on their total risk.

10-7 Yet RADRs are most often used in practice for two reasons: 1) financial decision makers prefer using rate of return-based criteria, and 2) they are easy to estimate and apply. In practice, risk is subjectively categorized into classes, each having a RADr assigned to it. Each project is then subjectively placed in the appropriate risk class.

10-8 A comparison of NPVs of unequal-lived mutually exclusive projects is inappropriate because it may lead to an incorrect choice of projects. The annualized net present value converts the net present value of unequal-lived projects into an annual amount that can be used to select the best project. The expression used to calculate the ANPV follows:

$$ANPV = \frac{NPV_j}{PVIFA_{k\%, n_j}}$$

10-9 *Real Options* are opportunities embedded in real assets that are part of the capital budgeting process. Managers have the option of implementing some of these opportunities to alter the cash flow and risk of a given project. Examples of real options include:

Abandonment – the option to abandon or terminate a project prior to the end of its planned life.

Flexibility - the ability to adopt a project that permits flexibility in the firm's production process, such as be able to reconfigure a machine to accept various types of inputs.

Growth - the option to develop follow-on projects, expand markets, expand or retool plants, and so on that would not be possible without implementation the project that is being evaluated.

Timing - the ability to determine the exact timing of when various action of the project will be undertaken.

Part 3 Long-Term Investment Decisions

10-10 *Strategic NPV* incorporates the value of the real options associated with the project while *traditional NPV* includes only the identifiable relevant cash flows. Using strategic NPV could alter the final accept/reject decision. It is likely to lead to more accept decisions since the value of the options is added to the traditional NPV as shown in the following equation.

$$NPV_{\text{strategic}} = NPV_{\text{traditional}} + \text{Value of real options}$$

10-11 *Capital rationing* is a situation where a firm has only a limited amount of funds available for capital investments. In most cases, implementation of the acceptable projects would require more capital than is available. Capital rationing is common for a firm, since unfortunately most firms do not have sufficient capital available to invest in all acceptable projects. In theory, capital rationing should not exist because firms should accept all projects with positive NPVs or IRRs greater than the cost of capital. However, most firms operate with finite capital expenditure budgets and must select the best from all acceptable projects, taking into account the amount of new financing required to fund these projects.

10-12 The internal rate of return approach and the net present value approach to capital rationing both involve ranking projects on the basis of IRRs. Using the IRR approach, a cut-off rate and a budget constraint are imposed. The NPV first ranks projects by IRR and then takes into account the present value of the benefits from each project in order to determine the combination with the highest overall net present value. The benefit of the NPV approach is that it guarantees a maximum dollar return to the firm, whereas the IRR approach does not.

SOLUTIONS TO PROBLEMS**10-1 LG 1: Recognizing Risk****a. & b.**

<u>Project</u>	<u>Risk</u>	<u>Reason</u>
A	Low	the cash flows from the project can be easily determined since this expenditure consists strictly of outflows. The amount is also relatively small.
B	Medium	the competitive nature of the industry makes it so that Caradine will need to make this expenditure to remain competitive. The risk is only moderate since the firm already has clients in place to use the new technology.
C	Medium	Since the firm is only preparing a proposal; their commitment at this time is low. However, the \$450,000 is a large sum of money for the company and it will immediately become a sunk cost.
D	High	although this purchase is in the industry in which Caradine normally operates; they are encountering a large amount of risk. The large expenditure, the competitiveness of the industry, and the political and exchange risk of operating in a foreign country adds to the uncertainty.

NOTE: Other answers are possible depending on the assumptions a student may make. There is too little information given about the firm and industry to establish a definitive risk analysis.

10-2 LG 2: Breakeven Cash Flows

a. $\$35,000 = CF(PVIFA_{14\%,12})$
 $\$35,000 = CF(5.66)$
 $CF = \$6,183.75$
 Calculator solution: \$6,183.43

b. $\$35,000 = CF(PVIFA_{10\%,12})$
 $\$35,000 = CF(6.814)$
 $CF = \$5,136.48$
 Calculator solution: \$5,136.72

The required cash flow per year would decrease by \$1,047.27.

10-3 LG 2: Breakeven Cash Inflows and Risk

a.	Project X	Project Y
	$PV_n = PMT \times (PVIFA_{15\%,5 \text{ yrs.}})$	$PV_n = PMT \times (PVIFA_{15\%,5 \text{ yrs.}})$
	$PV_n = \$10,000 \times (3.352)$	$PV_n = \$15,000 \times (3.352)$
	$PV_n = \$33,520$	$PV_n = \$50,280$
	$NPV = PV_n - \text{Initial investment}$	$NPV = PV_n - \text{Initial investment}$
	$NPV = \$33,520 - \$30,000$	$NPV = \$50,280 - \$40,000$
	$NPV = \$3,520$	$NPV = \$10,280$
	Calculator solution: \$3,521.55	Calculator solution: \$10,282.33

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- b. Project X**
 $\$CF \times 3.352 = \$30,000$
 $\$CF = \$30,000 \div 3.352$
 $\$CF = \$8,949.88$
- Project Y**
 $\$CF \times 3.352 = \$40,000$
 $\$CF = \$40,000 \div 3.352$
 $\$CF = \$11,933.17$
- c. Project X**
 Probability = 60%
- Project Y**
 Probability = 25%
- d.** Project Y is more risky and has a higher potential NPV. Project X has less risk and less return while Project Y has more risk and more return, thus the risk-return trade-off.
- e.** Choose Project X to minimize losses; to achieve higher NPV, choose Project Y.

10-4 LG 2: Basic Sensitivity Analysis

- a.** Range A = $\$1,800 - \$200 = \$1,600$ Range B = $\$1,100 - \$900 = \$200$
- b.**
- | Outcome | NPV | | | |
|-------------|-------------|---------------------|-------------|---------------------|
| | Project A | | Project B | |
| | Table Value | Calculator Solution | Table Value | Calculator Solution |
| Pessimistic | - \$ 6,297 | - \$ 6,297.29 | - \$ 337 | - \$ 337.79 |
| Most likely | 514 | 513.56 | 514 | 513.56 |
| Optimistic | 7,325 | 7,324.41 | 1,365 | 1,364.92 |
| Range | \$13,622 | \$13,621.70 | \$1,702 | \$1,702.71 |
- c.** Since the initial investment of projects A and B are equal, the range of cash flows and the range of NPVs are consistent.
- d.** Project selection would depend upon the risk disposition of the management. (A is more risky than B but also has the possibility of a greater return.)

10-5 LG 4: Sensitivity Analysis

- a.** Range P = $\$1,000 - \$500 = \$500$
 Range Q = $\$1,200 - \$400 = \$800$
- b.**
- | Outcome | NPV | | | |
|-------------|-------------|---------------------|-------------|---------------------|
| | Project A | | Project B | |
| | Table Value | Calculator Solution | Table Value | Calculator Solution |
| Pessimistic | \$73 | \$ 72.28 | -\$ 542 | -\$ 542.17 |
| Most likely | 1,609 | 1,608.43 | 1,609 | 1,608.43 |
| Optimistic | 3,145 | 3,144.57 | 4,374 | 4,373.48 |
- c.** Range P = $\$3,145 - \$73 = \$3,072$ (Calculator solution: \$3,072.29)
 Range Q = $\$4,374 - (-\$542) = \$4,916$ (Calculator solution: \$4,915.65)

Each computer has the same most likely result. Computer Q has both a greater potential loss and a greater potential return. Therefore, the decision will depend on the risk disposition of management.

10-6 LG 2: Simulation

- a. Ogden Corporation could use a computer simulation to generate the respective profitability distributions through the generation of random numbers. By tying various cash flow assumptions together into a mathematical model and repeating the process numerous times, a probability distribution of project returns can be developed. The process of generating random numbers and using the probability distributions for cash inflows and outflows allows values for each of the variables to be determined. The use of the computer also allows for more sophisticated simulation using components of cash inflows and outflows. Substitution of these values into the mathematical model yields the NPV. The key lies in formulating a mathematical model that truly reflects existing relationships.
- b. The advantages to computer simulations include the decision maker's ability to view a continuum of risk-return trade-offs instead of a single-point estimate. The computer simulation, however, is not feasible for risk analysis.

10-7 LG 4: Risk-Adjusted Discount Rates-Basic

a. Project E:

$$PV_n = \$6,000 \times (PVIFA_{15\%,4})$$

$$PV_n = \$6,000 \times 2.855$$

$$PV_n = \$17,130$$

$$NPV = \$17,130 - \$15,000$$

$$NPV = \$2,130$$

$$\text{Calculator solution: } \$2,129.87$$

Project F: Year	CF	PVIF _{15%,n}	PV
1	\$6,000	.870	\$5,220
2	4,000	.756	3,024
3	5,000	.658	3,290
4	2,000	.572	1,144
			<u>\$12,678</u>

$$NPV = \$12,678 - \$11,000$$

$$NPV = \$1,678$$

$$\text{Calculator solution: } \$1,673.05$$

Project G: Year	CF	PVIF _{15%,n}	PV
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Part 3 Long-Term Investment Decisions

1	\$ 4,000	.870	\$3,480
2	6,000	.756	4,536
3	8,000	.658	5,264
4	12,000	.572	<u>6,864</u>
			\$20,144

$$\text{NPV} = \$20,144 - \$19,000$$

$$\text{NPV} = \$1,144$$

Calculator solution: \$1,136.29

Project E, with the highest NPV, is preferred.

b. $\text{RADR}_E = .10 + (1.80 \times (.15 - .10)) = .19$
 $\text{RADR}_F = .10 + (1.00 \times (.15 - .10)) = .15$
 $\text{RADR}_G = -.10 + (0.60 \times (.15 - .10)) = .13$

c. Project E: $\$6,000 \times (2.639) = \$15,834$
 $\text{NPV} = \$15,834 - \$15,000$
 $\text{NPV} = \$834$
 Calculator solution: \$831.51

Project F: Same as in **a.**, \$1,678 (Calculator solution: \$1,673.05)

Project G: Year	CF	PVIF _{13%,n}	PV
1	\$ 4,000	.885	\$ 3,540
2	6,000	.783	4,698
3	8,000	.693	5,544
4	12,000	.613	<u>7,356</u>
			\$ 21,138

$$\text{NPV} = \$21,138 - \$19,000$$

$$\text{NPV} = \$2,138$$

Calculator solution: \$2,142.93

<u>Rank:</u>	<u>Project</u>
1	G
2	F
3	E

- d.** After adjusting the discount rate, even though all projects are still acceptable, the ranking changes. Project G has the highest NPV and should be chosen.

10-8 LG 4: Risk-adjusted Discount rates-Tabular

a. $\text{NPV}_A = (\$7,000 \times 3.993) - \$20,000$
 $\text{NPV}_A = \$7,951$ (Use 8% rate)
 Calculator solution: \$ 7,948.97

$$NPV_B = (\$10,000 \times 3.443) - \$30,000$$

$$NPV_B = \$4,330 \text{ (Use 14\% rate)}$$

Calculator solution: \$ 4,330.81

Project A, with the higher NPV, should be chosen.

- b. Project A is preferable to Project B, since the net present value of A is greater than the net present value of B.

10-9 LG 4: Risk-adjusted Rates of Return using CAPM

a. $k_X = 7\% + 1.2(12\% - 7\%) = 7\% + 6\% = 13\%$

$$k_Y = 7\% + 1.4(12\% - 7\%) = 7\% + 7\% = 14\%$$

$$NPV_X = \$30,000(PVIFA_{13\%,4}) - \$70,000$$

$$NPV_X = \$30,000(2.974) - \$70,000$$

$$NPV_X = \$89,220 - \$70,000 = \$19,220$$

$$NPV_Y = \$22,000(PVIF_{14\%,1}) + \$32,000(PVIF_{14\%,2}) + \$38,000(PVIF_{14\%,3}) + \$46,000(PVIF_{14\%,4}) - \$70,000$$

$$NPV_Y = \$22,000(.877) + \$32,000(.769) + \$38,000(.675) + \$46,000(.592) - \$70,000$$

$$NPV_Y = \$19,294 + \$24,608 + \$25,650 + \$27,232 - 70,000 = \$26,784$$

- b. The RADR approach prefers Y over X. The RADR approach combines the risk adjustment and the time adjustment in a single value. The RADR approach is most often used in business.

10-10 LG 4: Risk Classes and RADR

a.

Project X: Year	CF	PVIF _{22%,n}	PV
1	\$80,000	.820	\$65,600
2	70,000	.672	47,040
3	60,000	.551	33,060
4	60,000	.451	27,060
5	60,000	.370	22,200
			<u>\$194,960</u>

$$NPV = \$194,960 - \$180,000$$

$$NPV = \$14,960$$

Calculator solution: \$14,930.45

Project Y: Year	CF	PVIF _{13%,n}	PV
1	\$50,000	.885	\$ 44,250
2	60,000	.783	46,980
3	70,000	.693	48,510
4	80,000	.613	49,040
5	90,000	.543	48,870
			<u>\$237,650</u>

$$NPV = \$237,650 - \$235,000$$

$$NPV = \$2,650$$

Calculator solution: \$2,663.99

Part 3 Long-Term Investment Decisions

Project Z: Year	CF	PVIFA _{15%,5}	PV
1	\$90,000		
2	\$90,000		
3	\$90,000	3.352	\$ 301,680
4	\$90,000		
5	\$90,000		

$$\text{NPV} = \$ 301,680 - \$ 310,000$$

$$\text{NPV} = - \$ 8,320$$

$$\text{Calculator solution: } -\$8,306.04$$

- b. Projects X and Y are acceptable with positive NPV's, while Project Z with a negative NPV is not. Project X with the highest NPV should be undertaken.

10-11 LG 5: Unequal Lives–ANPV Approach**a. Machine A**

$$\text{PV}_n = \text{PMT} \times (\text{PVIFA}_{12\%,6 \text{ yrs.}})$$

$$\text{PV}_n = \$12,000 \times (4.111)$$

$$\text{PV}_n = \$49,332$$

$$\text{NPV} = \text{PV}_n - \text{Initial investment}$$

$$\text{NPV} = \$ 49,332 - \$ 92,000$$

$$\text{NPV} = - \$ 42,668$$

$$\text{Calculator solution: } - \$ 42,663.11$$

Machine B

Year	CF	PVIFA _{12%,n}	PV
1	\$10,000	.893	\$ 8,930
2	20,000	.797	15,940
3	30,000	.712	21,360
4	40,000	.636	25,440
			<u>\$ 71,670</u>

$$\text{NPV} = \$71,670 - \$65,000$$

$$\text{NPV} = \$6,670$$

$$\text{Calculator solution: } \$6,646.58$$

Machine C

$$\text{PV}_n = \text{PMT} \times (\text{PVIFA}_{12\%,5 \text{ yrs.}})$$

$$\text{PV}_n = \$ 30,000 \times 3.605$$

$$\text{PV}_n = \$ 108,150$$

$$\text{NPV} = \text{PV}_n - \text{Initial investment}$$

$$\text{NPV} = \$ 108,150 - \$ 100,500$$

$$\text{NPV} = \$ 7,650$$

$$\text{Calculator solution: } \$ 7,643.29$$

Rank	Project
1	C
2	B
3	A

(Note that A is not acceptable and could be rejected without any additional analysis.)

$$\text{b. Annualized NPV (ANPV}_j) = \frac{\text{NPV}_j}{\text{PVIFA}_{k\%, n_j}}$$

Machine A:

$$\text{ANPV} = -\$42,668 \div 4.111 \text{ (12\%, 6 years)}$$

$$\text{ANPV} = -\$10,378$$

Machine B:

$$\text{ANPV} = \$6,670 \div 3.037 \text{ (12\%, 4 years)}$$

$$\text{ANPV} = \$2,196$$

Machine C

$$\text{ANPV} = \$7,650 \div 3.605 \text{ (12\%, 5 years)}$$

$$\text{ANPV} = \$2,122$$

<u>Rank</u>	<u>Project</u>
1	B
2	C
3	A

- c. Machine B should be acquired since it offers the highest ANPV. Not considering the difference in project lives resulted in a different ranking based in part on C's NPV calculations.

10-12 LG 5: Unequal Lives–ANPV Approach

a. Project X

Year	CF	PVIF _{14%, n}	PV
1	\$17,000	.877	\$14,909
2	25,000	.769	19,225
3	33,000	.675	22,275
4	41,000	.592	<u>24,272</u>
			\$80,681

$$\text{NPV} = \$80,681 - \$78,000$$

$$\text{NPV} = \$2,681$$

$$\text{Calculator solution: } \$2,698.32$$

Part 3 Long-Term Investment Decisions**Project Y**

Year	CF	PVIF _{14%,n}	PV
1	\$ 28,000	.877	\$ 24,556
2	38,000	.769	<u>29,222</u>
			\$ 53,778

$$\text{NPV} = \$53,778 - \$52,000$$

$$\text{NPV} = \$1,778$$

Calculator solution: \$1,801.17

Project Z

$$\text{PV}_n = \text{PMT} \times (\text{PVIFA}_{14\%,8 \text{ yrs.}})$$

$$\text{PV}_n = \$15,000 \times 4.639$$

$$\text{PV}_n = \$69,585$$

$$\text{NPV} = \text{PV}_n - \text{Initial investment}$$

$$\text{NPV} = \$69,585 - \$66,000$$

$$\text{NPV} = \$3,585$$

Calculator solution: \$3,582.96

<u>Rank</u>	<u>Project</u>
1	Z
2	X
3	Y

b.
$$\text{Annualized NPV (ANPV}_j) = \frac{\text{NPV}_j}{\text{PVIFA}_{k\%, n_j}}$$

Project X

$$\text{ANPV} = \$2,681 \div 2.914 (14\%, 4 \text{ yrs.})$$

$$\text{ANPV} = \$920.04$$

Project Y

$$\text{ANPV} = \$1,778 \div 1.647 (14\%, 2 \text{ yrs.})$$

$$\text{ANPV} = \$1,079.54$$

Project Z

$$\text{ANPV} = \$3,585 \div 4.639 (14\%, 8 \text{ yrs.})$$

$$\text{ANPV} = \$772.80$$

<u>Rank</u>	<u>Project</u>
1	Y
2	X
3	Z

- c.** Project Y should be accepted. The results in **a** and **b** show the difference in NPV when differing lives are considered.

10-13 LG 5: Unequal Lives—ANPV Approach**a. Sell**

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Year	CF	PVIF _{12%,n}	PV
1	\$ 200,000	.893	\$ 178,600
2	250,000	.797	199,250
			<u>\$ 377,850</u>

NPV = \$377,850 - \$200,000

NPV = \$177,850

Calculator solution: \$177,786.90

License

Year	CF	PVIF _{12%,n}	PV
1	\$ 250,000	.893	\$ 223,250
2	100,000	.797	79,700
3	80,000	.712	56,960
4	60,000	.636	38,160
5	40,000	.567	22,680
			<u>\$ 420,750</u>

NPV = \$420,750 - \$200,000

NPV = \$220,750

Calculator solution: \$220,704.25

Manufacture

Year	CF	PVIF _{12%,n}	PV
1	\$ 200,000	.893	\$ 178,600
2	250,000	.797	199,250
3	200,000	.712	142,400
4	200,000	.636	127,200
5	200,000	.567	113,400
6	200,000	.507	101,400
			<u>\$ 862,250</u>

NPV = \$862,250 - \$450,000

NPV = \$412,250

Calculator solution: \$412,141.16

Rank	Alternative
1	Manufacture
2	License
3	Sell

b.
$$\text{Annualized NPV (ANPV}_j) = \frac{\text{NPV}_j}{\text{PVIFA}_{k\%, n_j}}$$

Sell

ANPV = \$177,850 ÷ 1.690 (12%, 2yrs.)

ANPV = \$105,236.69

License

ANPV = \$220,750 ÷ 3.605 (12%, 5yrs.)

ANPV = \$61,234.40

Manufacture

ANPV = \$412,250 ÷ 4.111 (12%, 6 yrs.)

Part 3 Long-Term Investment Decisions

$$ANPV = \$100,279.74$$

<u>Rank</u>	<u>Alternative</u>
1	Sell
2	Manufacture
3	License

- c. Comparing projects of unequal lives gives an advantage to those projects that generate cash flows over the longer period. ANPV adjusts for the differences in the length of the projects and allows selection of the optimal project.

10-14 LG 6: Real Options and the Strategic NPV

- a. Value of real options = value of abandonment + value of expansion + value of delay
Value of real options = $(.25 \times \$1,200) + (.30 \times \$3,000) + (.10 \times \$10,000)$
Value of real options = $\$300 + \$900 + \$1,000$
Value of real options = $\$2,200$

$$NPV_{\text{strategic}} = NPV_{\text{traditional}} + \text{Value of real options}$$
$$NPV_{\text{strategic}} = -1,700 + 2,200 = \$500$$

- b. Due to the added value from the options Rene should recommend acceptance of the capital expenditures for the equipment.
- c. In general this problem illustrates that by recognizing the value of real options a project that would otherwise be unacceptable ($NPV_{\text{traditional}} < 0$) could be acceptable ($NPV_{\text{strategic}} > 0$). It is thus important that management identify and incorporate real options into the NPV process.

10-15 LG 6: Capital Rationing-IRR and NPV Approaches

- a. Rank by IRR

<u>Project</u>	<u>IRR</u>	<u>Initial investment</u>	<u>Total Investment</u>
F	23%	\$ 2,500,000	\$ 2,500,000
E	22	800,000	3,300,000
G	20	1,200,000	4,500,000
C	19		
B	18		
A	17		
D	16		

Projects F, E, and G require a total investment of \$4,500,000 and provide a total present value of \$5,200,000, and therefore a net present value of \$700,000.

- b. Rank by NPV ($NPV = PV - \text{Initial investment}$)

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<u>Project</u>	<u>NPV</u>	<u>Initial investment</u>
F	\$500,000	\$2,500,000
A	400,000	5,000,000
C	300,000	2,000,000
B	300,000	800,000
D	100,000	1,500,000
G	100,000	1,200,000
E	100,000	800,000

Project A can be eliminated because, while it has an acceptable NPV, its initial investment exceeds the capital budget. Projects F and C require a total initial investment of \$4,500,000 and provide a total present value of \$5,300,000 and a net present value of \$800,000. However, the best option is to choose Projects B, F, and G, which also use the entire capital budget and provide an NPV of \$900,000.

- c. The internal rate of return approach uses the entire \$4,500,000 capital budget but provides \$200,000 less present value (\$5,400,000 - \$5,200,000) than the NPV approach. Since the NPV approach maximizes shareholder wealth, it is the superior method.
- d. The firm should implement Projects B, F, and G, as explained in part c.

10-16 LG 6: Capital Rationing-NPV Approach

a.

<u>Project</u>	<u>PV</u>
A	\$ 384,000
B	210,000
C	125,000
D	990,000
E	570,000
F	150,000
G	960,000

- b. The optimal group of projects is Projects C, F, and G, resulting in a total net present value of \$235,000.

Chapter 10 Case**Evaluating Cherone Equipment's Risky Plans for Increasing Its Production Capacity**

a. (1)

Plan X

Year	CF	PVIF _{12%,n}	PV
1	\$ 470,000	.893	\$ 419,710
2	610,000	.797	486,170
3	950,000	.712	676,400
4	970,000	.636	616,920
5	1,500,000	.567	<u>850,500</u>
			\$3,049,700

$$\text{NPV} = \$3,049,700 - \$2,700,000$$

$$\text{NPV} = \$349,700$$

Calculator solution: \$349,700

Plan Y

Year	CF	PVIF _{12%,n}	PV
1	\$ 380,000	.893	\$ 339,340
2	700,000	.797	557,900
3	800,000	.712	569,600
4	600,000	.636	381,600
5	1,200,000	.567	<u>680,400</u>
			\$2,528,840

$$\text{NPV} = \$2,528,840 - \$2,100,000$$

$$\text{NPV} = \$428,840$$

Calculator solution: \$428,968.70

(2) Using a financial calculator the IRRs are:

$$\text{IRR}_X = 16.22\%$$

$$\text{IRR}_Y = 18.82\%$$

Both NPV and IRR favor selection of project Y. The NPV is larger by \$79,140 (\$428,840 - \$349,700) and the IRR is 2.6% higher.

b.

Plan X

Year	CF	PVIF _{13%,n}	PV
1	\$ 470,000	.885	\$ 415,950
2	610,000	.783	477,630
3	950,000	.693	658,350
4	970,000	.613	594,610
5	1,500,000	.543	814,500
			<u>\$2,961,040</u>

$$\text{NPV} = \$2,961,040 - \$2,700,000$$

$$\text{NPV} = \$261,040$$

Calculator solution: \$261,040

Plan Y

Year	CF	PVIF _{15%,n}	PV
1	\$ 380,000	.870	\$ 330,600
2	700,000	.756	529,200
3	800,000	.658	526,400
4	600,000	.572	343,200
5	1,200,000	.497	596,400
			<u>\$2,325,800</u>

$$\text{NPV} = \$2,325,800 - \$2,100,000$$

$$\text{NPV} = \$225,800$$

Calculator solution: \$225,412.37

The RADR NPV favors selection of project X.

Ranking			
Plan	NPV	IRR	RADRs
X	2	2	1
Y	1	1	2

- c. Both NPV and IRR achieved the same relative rankings. However, making risk adjustments through the RADRs caused the ranking to reverse from the non-risk adjusted results. The final choice would be to select Plan X since it ranks first using the risk-adjusted method.

d. **Plan X**

$$\text{Value of real options} = .25 \times \$100,000 = \$25,000$$

$$\text{NPV}_{\text{strategic}} = \text{NPV}_{\text{traditional}} + \text{Value of real options}$$

$$\text{NPV}_{\text{strategic}} = \$261,040 + \$25,000 = \$286,040$$

Plan Y

$$\text{Value of real options} = .20 \times \$500,000 = \$100,000$$

$$\text{NPV}_{\text{strategic}} = \text{NPV}_{\text{traditional}} + \text{Value of real options}$$

$$\text{NPV}_{\text{strategic}} = \$225,412 + \$100,000 = \$328,412$$

- e. The addition of the value added by the existence of real options the ordering of the projects is reversed. Project Y is now favored over project X using the RADR NPV for the traditional NPV.
- f. Capital rationing could change the selection of the plan. Since Plan Y requires only \$2,100,000 and Plan X requires \$2,700,000, if the firm's capital budget was less than the amount needed to invest in project X, the firm would be forced to take Y to maximize shareholders' wealth subject to the budget constraint.

INTEGRATIVE CASE 3

LASTING IMPRESSIONS COMPANY

Integrative Case III involves a complete long-term investment decision. The Lasting Impressions Company is a commercial printer faced with a replacement decision in which two mutually exclusive projects have been proposed. The data for each press have been designed to result in conflicting rankings when considering the NPV and IRR decision techniques. The case tests the students' understanding of the techniques as well as the qualitative aspects of risk and return decision-making.

a. (1) Calculation of initial investment for Lasting Impressions Company:

	<u>Press A</u>	<u>Press B</u>
Installed cost of new press =		
Cost of new press	\$830,000	\$640,000
+ Installation costs	<u>40,000</u>	<u>20,000</u>
Total cost-new press	\$870,000	\$660,000
- After-tax proceeds-sale of old asset =		
Proceeds from sale of old press	420,000	420,000
+ Tax on sale of old press*	<u>121,600</u>	<u>121,600</u>
Total proceeds-sale of old press	(298,400)	(298,400)
+ Change in net working capital"	<u>90,400</u>	<u>0</u>
Initial investment	<u>\$662,000</u>	<u>\$361,600</u>

* Sale price	\$420,000
- <u>Book value</u>	<u>116,000</u>
Gain	\$304,000
x Tax rate (40%)	121,600

$$\text{Book value} = \$400,000 - [(.20 + .32 + .19) \times \$400,000] = \$116,000$$

**Cash	\$ 25,400
Accounts receivable	120,000
Inventory	<u>(20,000)</u>
Increase in current assets	\$125,400
Increase in current liabilities	<u>(35,000)</u>
Increase in net working capital	\$ 90,400

Part 3 Long-Term Investment Decisions

(2) Depreciation

Press A	Cost	Rate	Depreciation
1	\$870,000	.20	\$ 174,000
2	870,000	.32	278,400
3	870,000	.19	165,300
4	870,000	.12	104,400
5	870,000	.12	104,400
6	870,000	.05	<u>43,500</u>
			\$ 870,000

Press B	Cost	Rate	Depreciation
1	\$660,000	.20	\$132,000
2	660,000	.32	211,200
3	660,000	.19	125,400
4	660,000	.12	79,200
5	660,000	.12	79,200
6	660,000	.05	<u>33,000</u>
			\$ 660,000

Existing Press	Cost	Rate	Depreciation
1	\$400,000	.12 (Yr. 4)	\$ 48,000
2	400,000	.12 (Yr. 5)	48,000
3	400,000	.05 (Yr. 6)	20,000
4	0	0	0
5	0	0	0
6.,	0	0	<u>0</u>
			\$116,000

Year	and Taxes	Depreciation	before Taxes	after Taxes	Cash Flow
1	\$ 120,000	\$ 48,000	\$ 72,000	\$ 43,200	\$ 91,200
2	120,000	48,000	72,000	43,200	91,200
3	120,000	20,000	100,000	60,000	80,000
4	120,000	0	120,000	72,000	72,000
5	120,000	0	120,000	72,000	72,000
6	0	0	0	0	0

Press A Earnings Before
Depreciation

Year	and Taxes	Depreciation	Earnings Incremental Before Taxes	Earnings After Taxes	Cash Flow	Old Cash Flow	Cash
Flow							
1	\$ 250,000	\$ 174,000	\$ 76,000	\$ 45,600	\$ 219,000	\$ 91,200	\$ 128,400
2	270,000	278,400	- 8,400	- 5,040	273,360	91,200	182,160
3	300,000	165,300	134,700	80,820	246,120	80,000	166,120
4	330,000	104,400	225,600	135,360	239,760	72,000	167,760
5	370,000	104,400	265,600	159,360	263,760	72,000	191,760
6	0	43,500	- 43,500	- 26,100	17,400	0	17,400

Press B Earnings Before
Depreciation
Incremental

Year	and Taxes	Depreciation	Earnings Before Taxes	Earnings After Taxes	Cash Flow	Old Cash Flow	Cash
Flow							
1	\$ 210,000	\$ 132,000	\$ 78,000	\$ 46,800	\$ 178,800	\$ 91,200	\$ 87,600
2	210,000	211,200	- 1,200	- 720	210,480	91,200	119,280
3	210,000	125,400	84,600	50,760	176,160	80,000	96,160
4	210,000	79,200	130,800	78,480	157,680	72,000	85,680
5	210,000	79,200	130,800	78,480	157,680	72,000	85,680
6	0	33,000	- 33,000	- 19,800	13,200	0	13,200

(3) Terminal cash flow:

	<u>Press A</u>	<u>Press B</u>
After-tax proceeds-sale of new press =		
Proceeds on sale of new press	\$ 400,000	\$ 330,000
Tax on sale of new press*	<u>(142,600)</u>	<u>(118,800)</u>
Total proceeds-new press	\$257,400	\$211,200
- After-tax proceeds-sale of old press =		
Proceeds on sale of old press	(150,000)	(150,000)
+ Tax on sale of old press**	<u>60,000</u>	<u>60,000</u>
Total proceeds-old press	(90,000)	(90,000)
+ Change in net working capital	<u>90,400</u>	<u>0</u>
Terminal cash flow	<u>\$257,800</u>	<u>\$121,200</u>

*** Press A**

Sale price	\$400,000
Less: Book value (Yr. 6)	<u>43,500</u>
Gain	\$356,500
Tax rate	<u>x .40</u>
Tax	\$142,600

Press B

Sale price	\$330,000
Less: Book value (Yr. 6)	<u>33,000</u>
Gain	\$297,000
Tax rate	<u>x .40</u>
Tax	\$118,800

** Sale price	\$150,000
Less: Book value (Yr. 6)	<u>0</u>
Gain	\$150,000
Tax rate	<u>x .40</u>
Tax	\$ 60,000

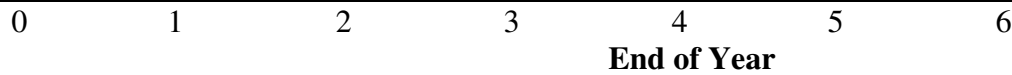
	<u>Press A</u>	<u>Press B</u>
Initial Investment	\$662,000	\$361,600
<u>Year</u>	<u>Cash Inflows</u>	
1	\$128,400	\$ 87,600
2	182,160	119,280
3	166,120	96,160
4	167,760	85,680
5*	449,560	206,880

* Year 5	<u>Press A</u>	<u>Press B</u>
Operating cash flow	\$191,760	\$ 85,680
Terminal cash inflow	<u>257,800</u>	<u>121,200</u>
Total	\$449,560	\$206,880

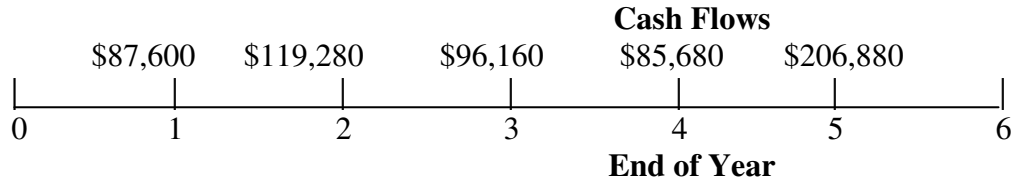
b.**Press A**

Cash Flows					
\$128,400	\$182,160	\$166,120	\$167,760	\$449,560	

Part 3 Long-Term Investment Decisions



Press B



c Relevant cash flow

Year	Cumulative Cash Flows	
	Press A	Press B
1	\$ 128,400	\$ 87,600
2	310,560	206,880
3	476,680	303,040
4	644,440	388,720
5	1,094,000	595,600

(1) Press A: 4 years + $[(662,000 - 644,440) \div 191,760]$
 Payback = 4 + $(17,560 \div 191,760)$
 Payback = 4.09 years

Press B: 3 years + $[(361,600 - 303,040) \div 85,680]$
 Payback = 3 + $(58,560 \div 85,680)$
 Payback = 3.68 years

(2) Press A:

Year	Cash Flow	PVIF _{14%,t}	PV
1	\$ 128,400	.877	\$ 112,607
2	182,160	.769	140,081
3	166,120	.675	112,131
4	167,760	.592	99,314
5	449,560	.519	233,322
			<u>\$ 697,455</u>

Net present value = \$697,455 - \$662,000

Net present value = \$35,455

Calculator solution: \$35,738.83

Press B:

Year	Cash Flow	PVIF _{14%,t}	PV
1	\$ 87,600	.877	\$ 76,825
2	119,280	.769	91,726
3	96,160	.675	64,908
4	85,680	.592	50,723
5	206,880	.519	107,371
			<u>\$391,553</u>

Net present value = \$391,553 - \$361,600

Net present value = \$29,953

Calculator solution: \$30,105.89

(3) Internal rate of return:

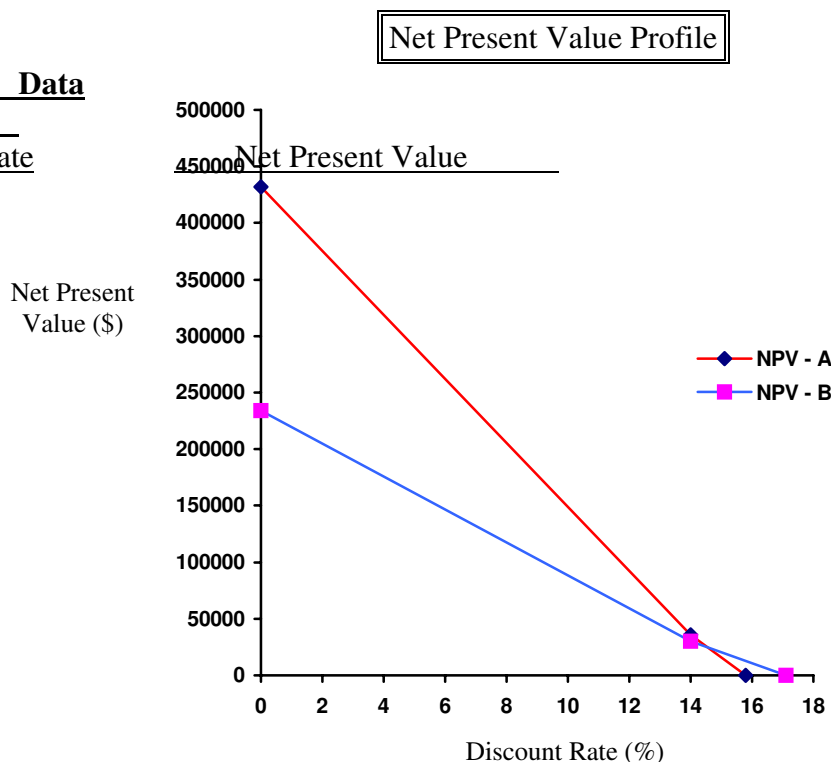
Press A: 15.8%

Press B: 17.1%

d.

Profile **Data**

Discount rate



for Net Present Value

	<u>Press A</u>	
0%	\$ 432,000	\$ 234,000
14%	35,455	29,953
15.8%	0	-
17.1%	-	0

When the cost of capital is below approximately 15 percent, Press A is preferred over Press B, while at costs greater than 15 percent, Press B is preferred. Since the firm's cost of capital is 14 percent, conflicting rankings exist. Press A has a higher value and is therefore preferred over Press B using NPV, whereas Press B's IRR of 17.1 percent causes it to be preferred over Press A, whose IRR is 15.8 percent using this measure.

- e. (1) If the firm has unlimited funds, Press A is preferred.
(2) If the firm is subject to capital rationing, Press B may be preferred.
- f. The risk would need to be measured by a quantitative technique such as certainty equivalents or risk-adjusted discount rates. The resultant net present value could then be compared to Press B and a decision made.