Type text here

This pdf version of presentation is only for the purpose of individualised and personal learning.

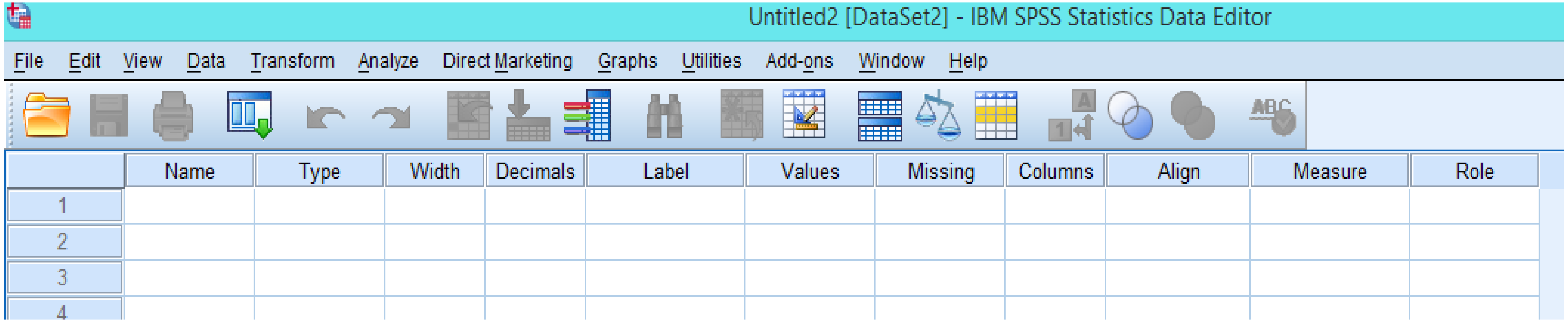
Data Analysis using SPSS

Introduction to SPSS

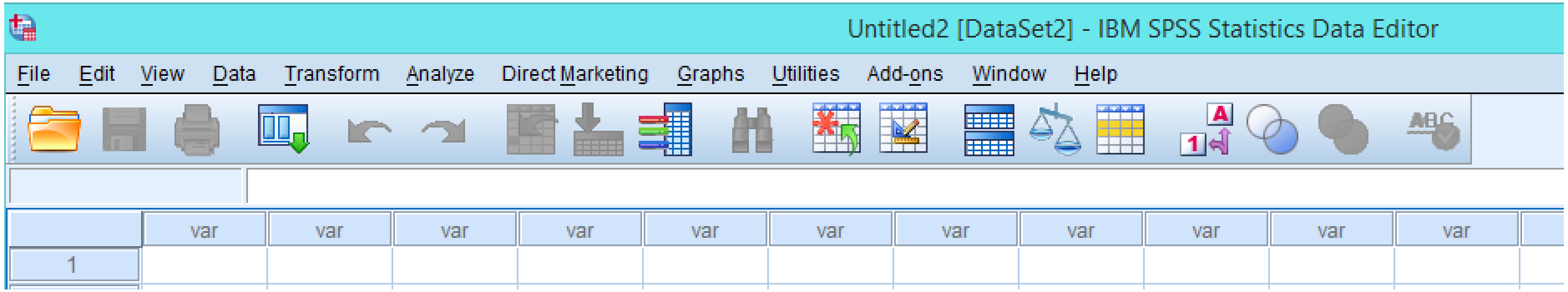
- How to get SPSS

https://www.ibm.com/us-en/marketplace/spss-statistics

- Free 14 days Trial
- **Data Entry**
  - Variable View

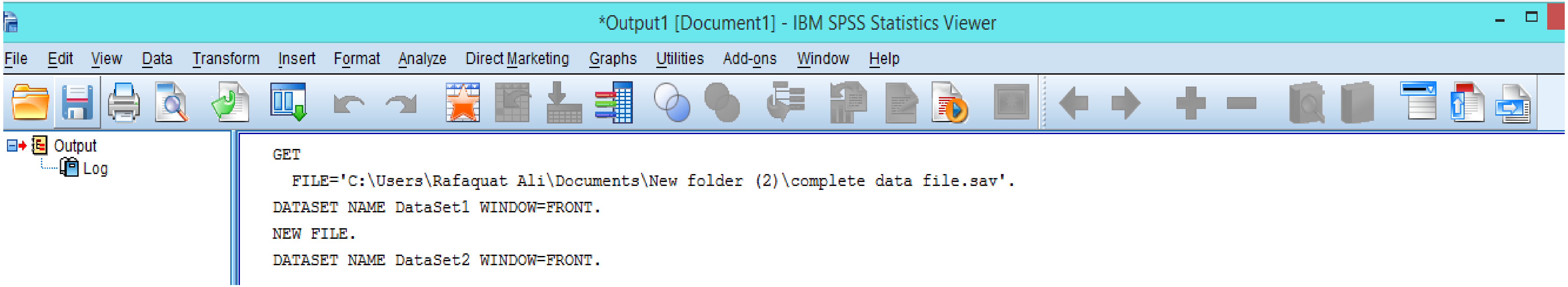


  - Data View



Data Entry (Cont..)

- Out Put View



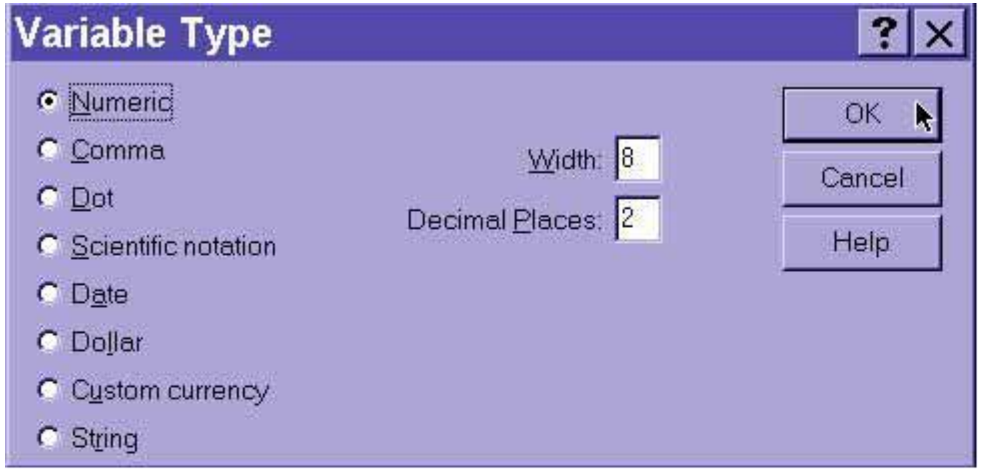
Data Entry (Cont..)

- **Name**

1. The name of each SPSS variable in a given file must be unique
2. it must start with a letter.
3. it may have up to 8 characters (including letters, numbers, and the underscore.
4. certain key words are reversed and may not be used as variable names, e.g., "compute", "sum", and so forth).
5. To change an existing name, click in the cell containing the name, highlight the part you want to change, and type in the replacement.
6. To create a new variable name, click in the first empty row under the name column and type a new (unique) variable name.

- **Type**

1. Two basic types of variables used are **numeric** and **string**.
2. Numeric variables may only have numbers assigned.
3. String variables may contain letters or numbers, but even if a string variable happens to contain only numbers, numeric operations on that variable will not be allowed (e.g., finding the mean, variance, standard deviation, etc...).
4. If you select a numeric variable, you can then click in the width box or the decimal box to change the default values of 8 characters reserved to displaying numbers with 2 decimal places.
5. For whole numbers, you can drop the decimals down to 0.

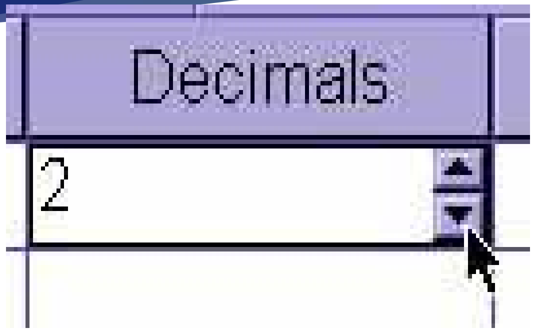


- **Width**

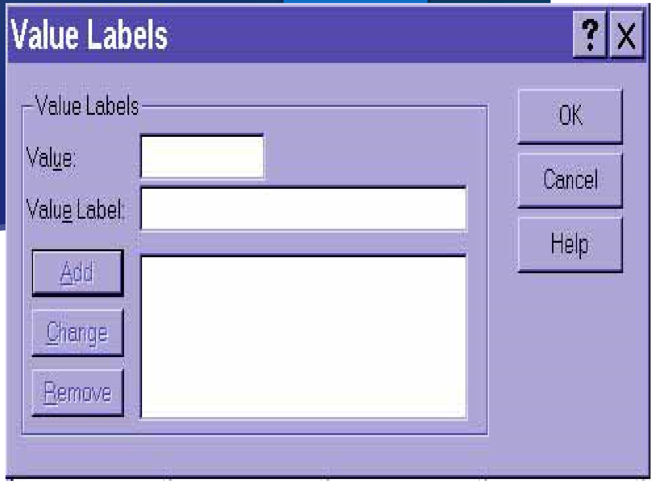
1. The width of a variable is the number of characters SPSS will allow to be entered for the variable. If it is a numerical value with decimals, this total width has to include a spot for each decimal, as well as one for the decimal point.
2. You can change a width by clicking in the width cell for the desired variable and typing a new number or you can use the arrow keys at the edge of the cell

- **Decimals**

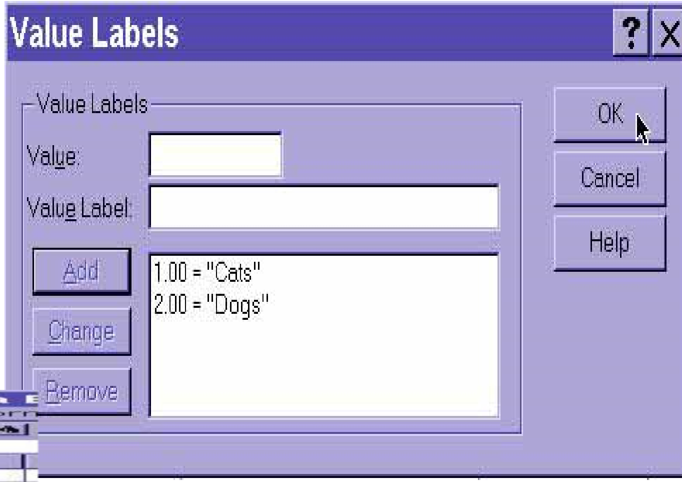
1. The decimals of a variable is the number of decimal places that SPSS will display.
2. If more decimals have been entered (or computed by SPSS), the additional information will be retained internally but not displayed on screen.
3. For whole numbers, you would reduce the number of decimals to zero.

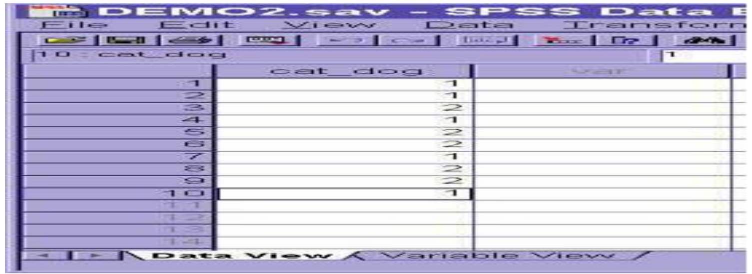


- **Label**
- The label of a variable is a string of text to identify in more detail what a variable represents.
- Unlike the name, the label is limited to 255 characters and may contain spaces and punctuation.
- For instance, if there is a variable for each question on a questionnaire, you would type the question as the variable label.



- **Values**
- For categorical data (discrete data of both nominal and ordinal levels of measurement), we need to know which numbers represent which categories. To indicate how these numbers are assigned, one can add labels to specific values by clicking on the ... box in the values cell
- Process: Clicking here opens up the Value Labels dialogue box.
  - Click in the Value field to type a specific numeric value
  - Click in the Label field to type the corresponding label
  - Click on the Add button to add this pair of value and label





- **Missing**
- We sometimes want to signal to SPSS that data should be treated as missing, even though there is some other numerical code recorded instead of the data actually being missing (in which case SPSS displays a single period -- this is also called SYSTEM MISSING data).
- In this example, after clicking on the ... button in the Missing cell, I declared "9", "99", and "999" all to be treated by SPSS as missing (i.e., these values will be ignored)

- **Columns**

1. The columns property tells SPSS how wide the column should be for each variable. Don't confuse this one with width, which indicates how many digits of the number will be displayed.
2. The column size indicates how much space is allocated rather than the degree to which it is filled.

- **Align**
- The alignment property indicates whether the information in the Data View should be left-justified, right-justified, or centered
  Measure
- The Measure property indicates the level of measurement. Since SPSS does not differentiate between interval and ratio levels of measurement, both of these quantitative variable types are lumped together as "scale". Nominal and ordinal levels of measurement, however, **are** differentiated

Screening Data

- Why Data Screening Important:

1. It can distort the analysis
2. It can lead wrong generalizations.

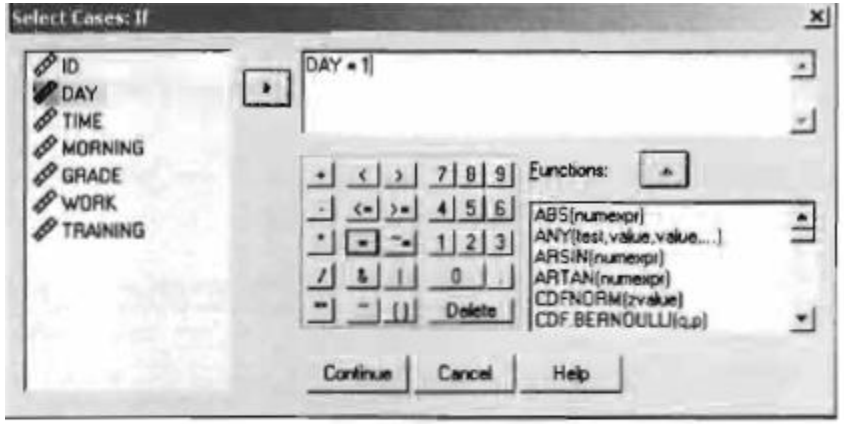
- It has two steps:
- • 1- Check the Data for possible Errors.
- • 2- Find and Correct Dara Entry errors

- 1- Procedure to Check the Data for possible Errors
- click **Analyse**,
- Click **Descriptive Statistics**,
- Click **Frequencies**.
- Choose variables desired to e.g. Religion, Education.
- Move these into the **Variable** box.
- Click S**tatistics and check for Minimum** and **Maximum**
- Click on **Continue** and then on **OK** .

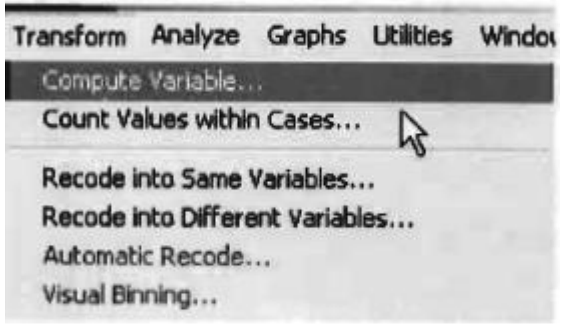
- Check for Minimum and Maximum Values
- Check Number of valid and missing Values
- In case any outliers and value than possible, We will proceed to second step: Find the Errors

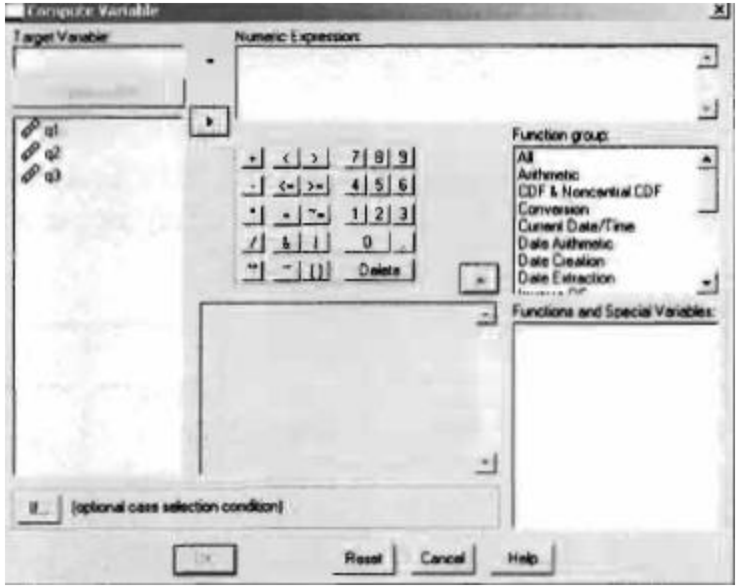
- Find and Correct Errors
- From Data menu, Sort Cases.
- Click variable that has an error (e.g. sex) and then on the arrow to move it into the Sort By box. Click on either ascending or descending (depending on whether you
- want the higher values at the top or the bottom). For sex, we want to
- fi nd the person with the value of 3, so we would choose descending.
- 3. Click on OK.

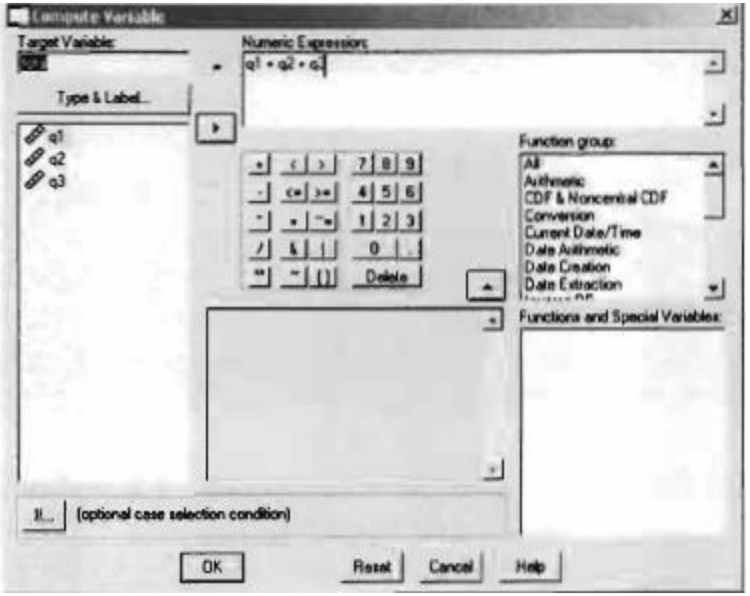
Transformation of Data



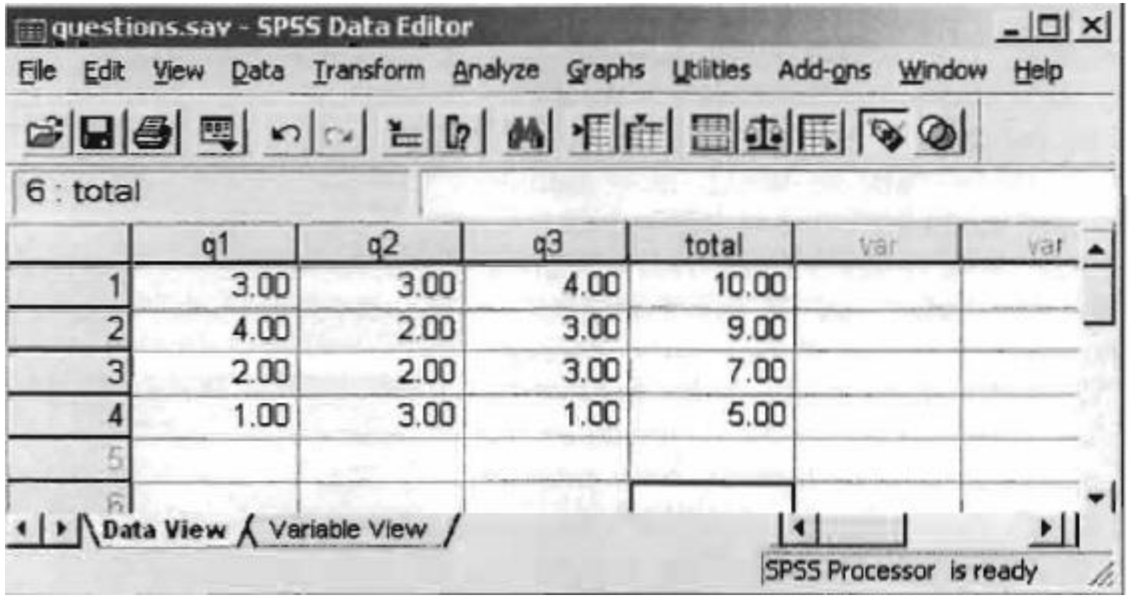
Compute Variable



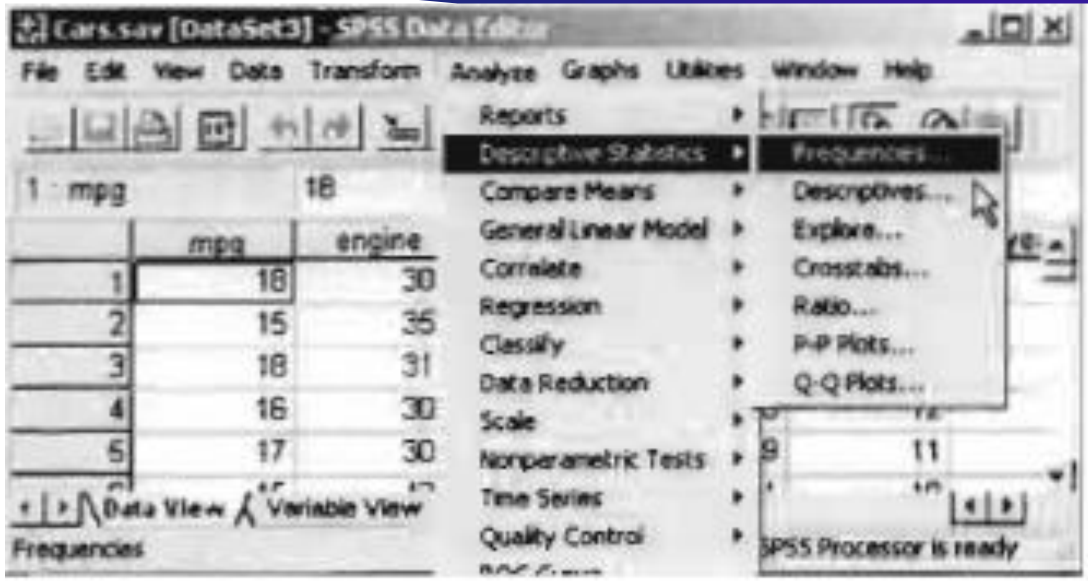


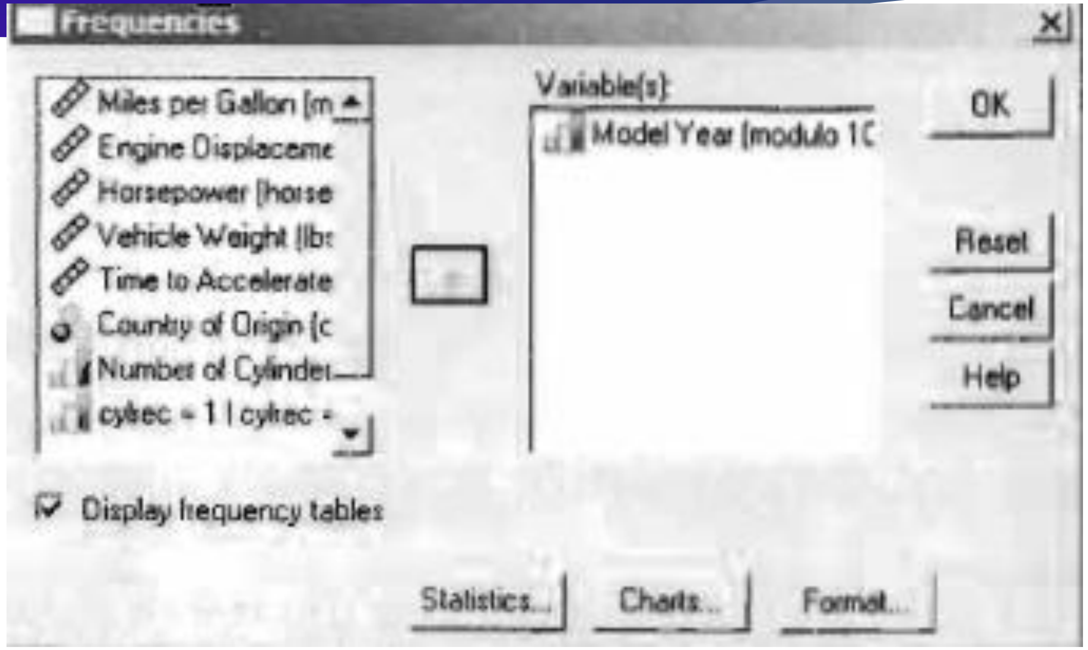


Compute Variable

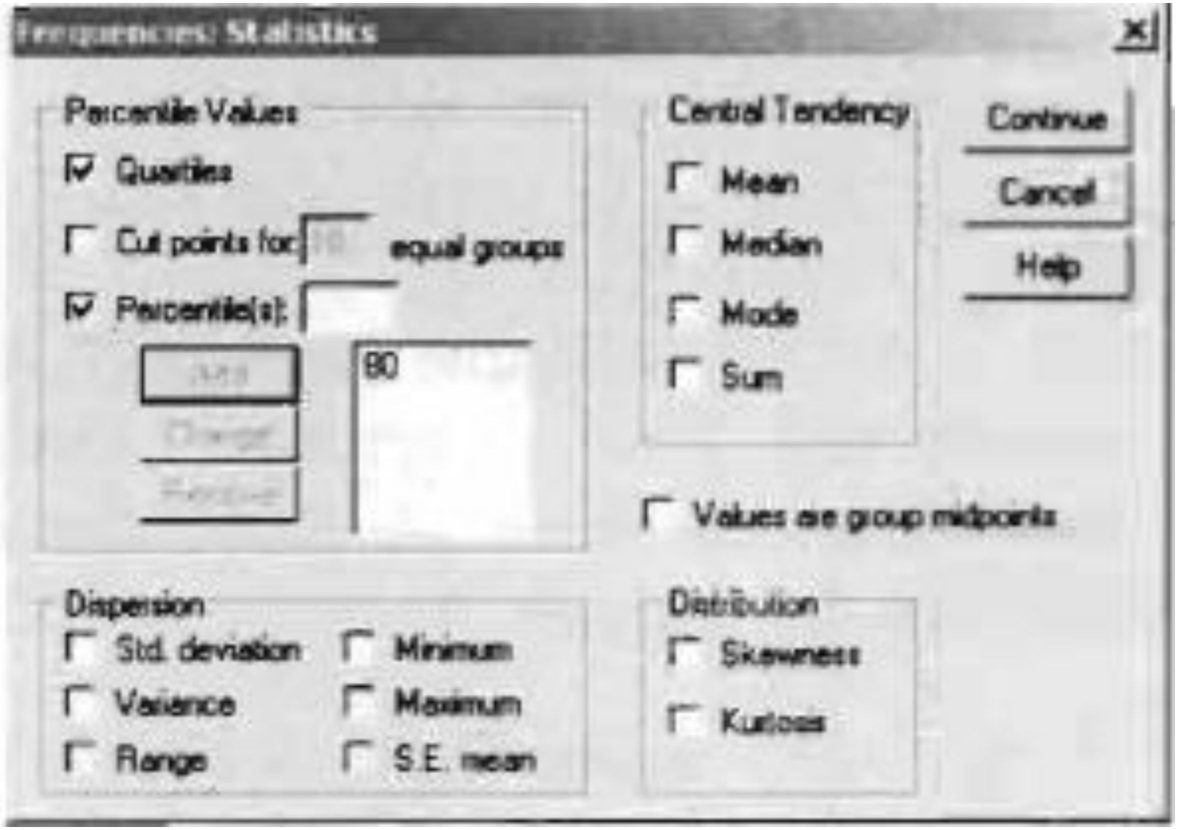


Descriptive Statistics in SPSS

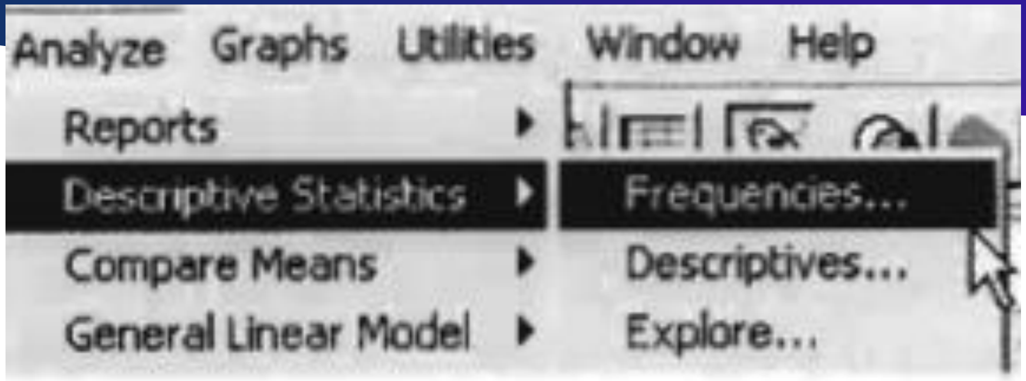


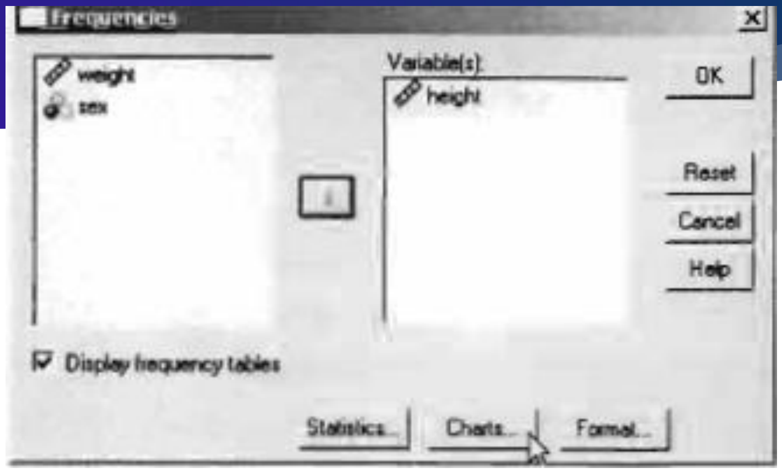


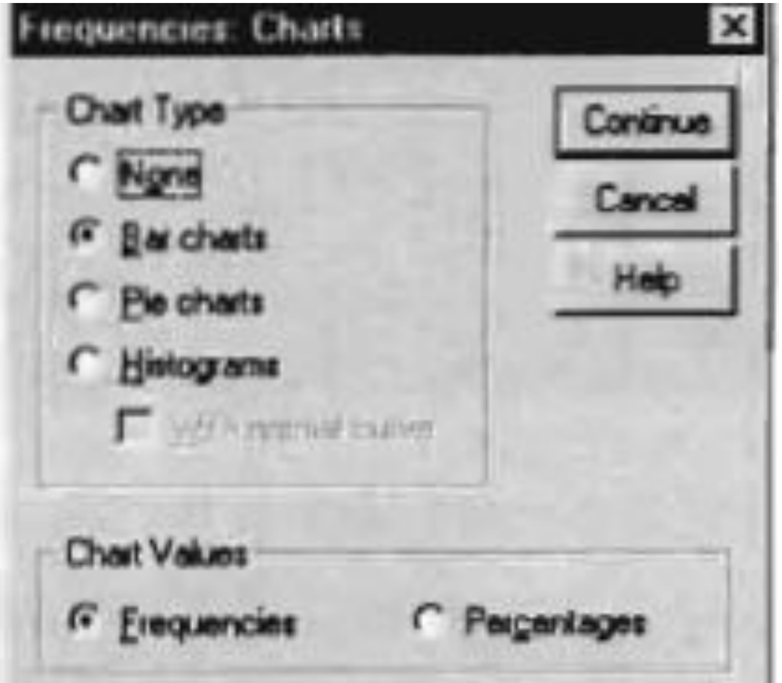
Descriptive Statistics in SPSS

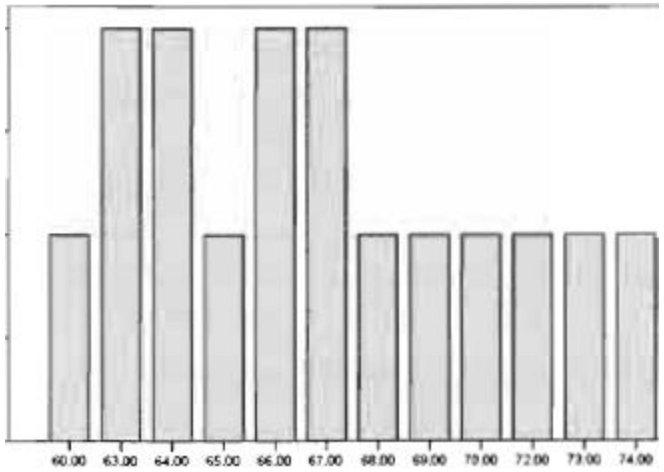


Graphing Data in SPSS

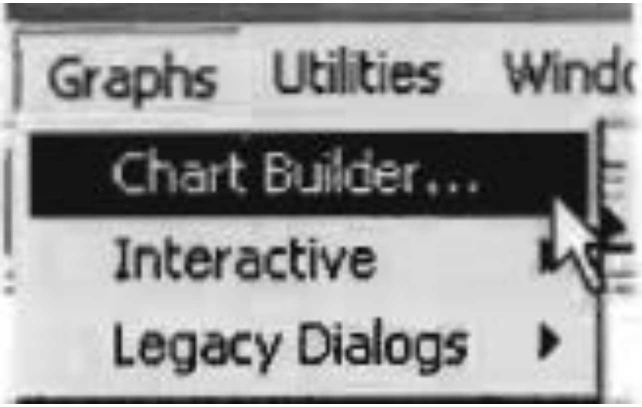


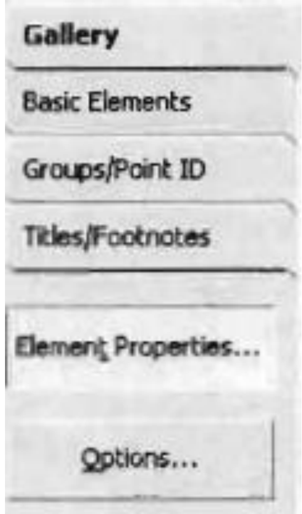


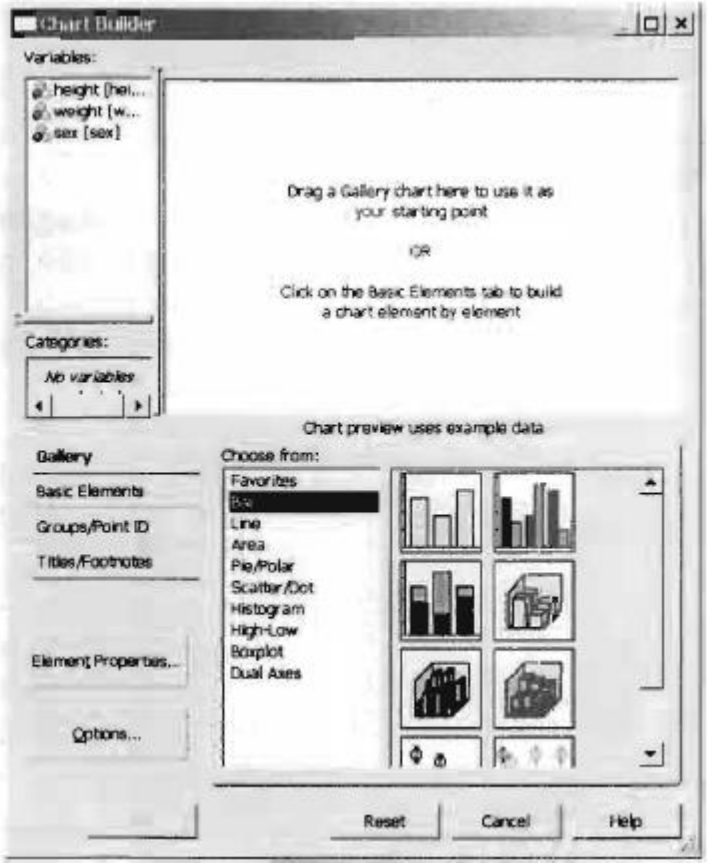


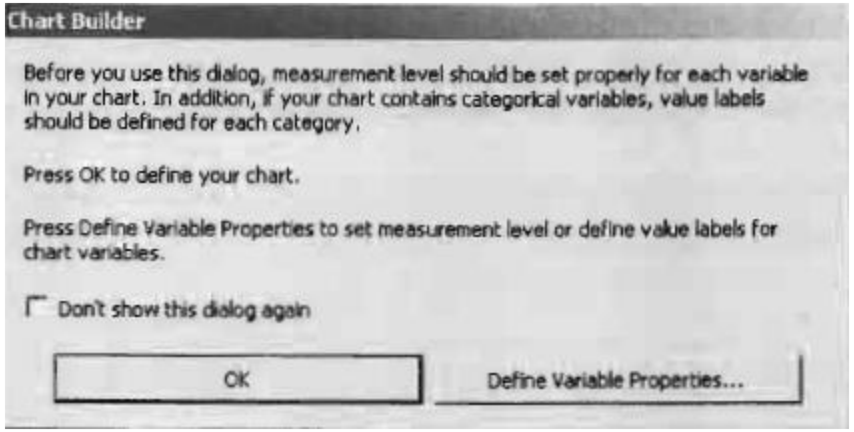


Graphing Data in SPSS









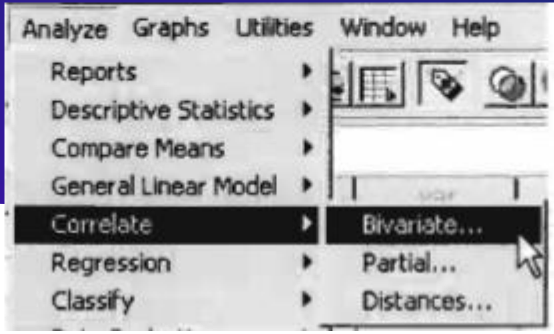
Reliability of a scale

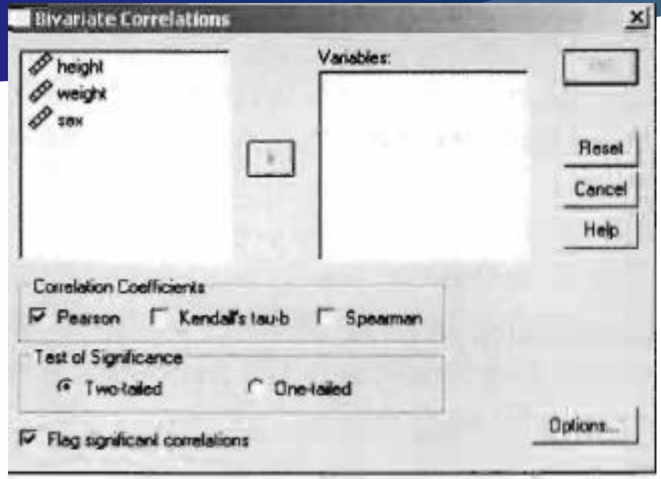
1. Select analyse,
2. select Scale
3. Select Reliability Analysis.
4. Click on items that make up the scale and transfer these into box marked Items.
5. Select Model Alpha
6. Type the name of the scale in Scale label box.
7. Click on the Statistics button.
8. In the Descriptive section, select Item, Scale, and Scale if item deleted. In the Inter-Item section,
9. Tick Correlations.
10. Tick Continue
11. Tick OK

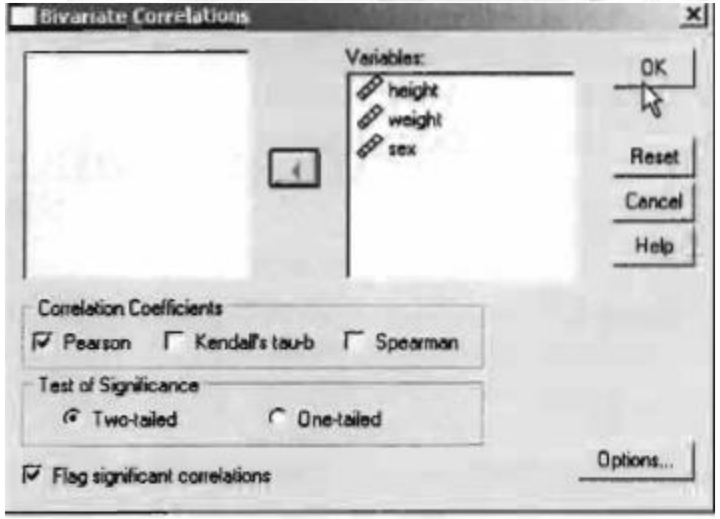
INTERPRETING RELIABILITY OUTPUT

- Check the **Inter-Item Correlation there should be all values positive for** items measuring the same factor .
- Check the **Cronbach's Alpha** value in table. Values above 0.7 are considered acceptable.
- Column headed **Alpha if Item Deleted** shows the impact of removing an item. You can remove item that shows an increase in alpha value on removal to increase overall reliability of scale.
- If there are less than 10 items in a scale, then may report mean inter-item correlation value. (Reference Pallant, 2011)

Correlation







- **Pearson and Spearman rho**
- click **Analyze**,
- **Click Correlate**, then **Bivariate**.
- Select and move two variables into **Variables box**
- **Pearson** box is the default option. If you require

Spearman rho (the non-parametric, you can select that.

- Click **Options** button require **Missing Values**, **Exclude**

cases pairwise, you can get means and standard deviations as well.

Click **Continue, OK, and see the ouput.**

Interpreting Correlation

- The correlation coefficient can range from - 1.0 or +1.0. to 0.0,
- 0.00 represenat weak relationship
- +1 or -1 represenat strong relationship.
- Correlations greater than 0.7 are considered strong
- Correlations less than 0.3 are considered weak.
- Correlationsb between 0 .3 and 0.7 are considered moderate.
- A very small correlation can be significant.
- (Reference Cronk, 2008)

Correlations

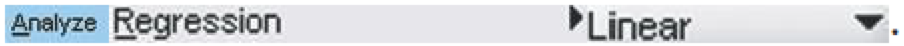
		height	weight	sex
height	Pearson Correlation	1	.806**	-.644**
	Sig. (2-tailed)		.000	.007
	N	16	16	16
weight	Pearson Correlation	.806**	1	-.968**
	Sig. (2-tailed)	.000		.000
	N	16	16	16
sex	Pearson Correlation	-.644**	-.968**	1
	Sig. (2-tailed)	.007	.000	
	N	16	16	16

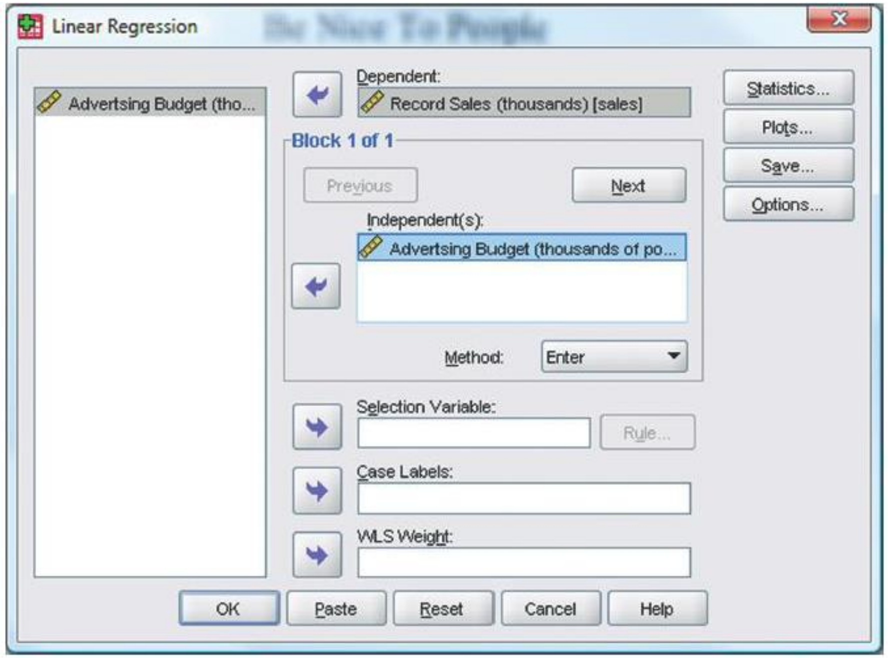
** Correlation is significant at the 0.01 level (2-tailed).

Regression in SPSS

- Simple Linear Regression involve the prediction of one variable from another variable.
- Steps in SPSS- Analyse---Regression– Linear—Enter independent and Dependent variables in relevant variable boxes and click ok.
- Assumptions of Simple Linear regression

1. Assumption is there that both variables are interval or ratio scales.
2. It is assumes that dependent and independent variables are normally distributed.
3. Independent and dependent variables have linear relationship





Interpreting Simple Linear Regression SPSS Output

1. R Square (called the coeflicient of determination) gives you the proportion of the variance of your dependent variable (WEIGHT) that can be explained by variation in your independent variable (HEIGHT). Thus, 64. 9% of the variation in weight can be explained.
2. The second part of the output that we are interested in is the ANOVA summary able, as shown above. The important number here is the significance level in the rightmost column. If that value is less Than .05, then we have a significant Linear regression. Ii it is larger than .05, we do not.

3. (Example From Book of Brian C. Cronk, how to use SPSS A STEP BY Step Guide ---------)

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.806[a]	.649	.624	16.14801

a. Predictors: (Constant), height

ANOVA[b]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	6760.323	1	6760.323	25.926	.000[a]
	Residual	3650.614	14	260.758		
	Total	10410.938	15			

a. Predictors: (Constant), HEIGHT

b. Dependent Variable: WEIGHT

Interpreting Simple Linear Regression SPSS Output

3- Regression Equation is Y'=a + bX .
Y= dependent variable OR predicted values or dependent variables).
a= Constant in table
B= 5.434, independent variable).
Thus, our prediction equation for the example above
is WEIGHT' : -234.681+ 5.434(HEIGHT).

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	-234.681	71.552		-3.280	.005
	height	5.434	1.067	.806	5.092	.000

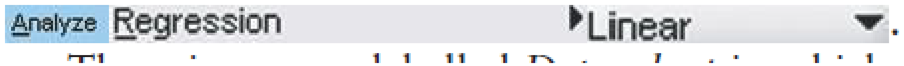
a. Dependent Variable: weight

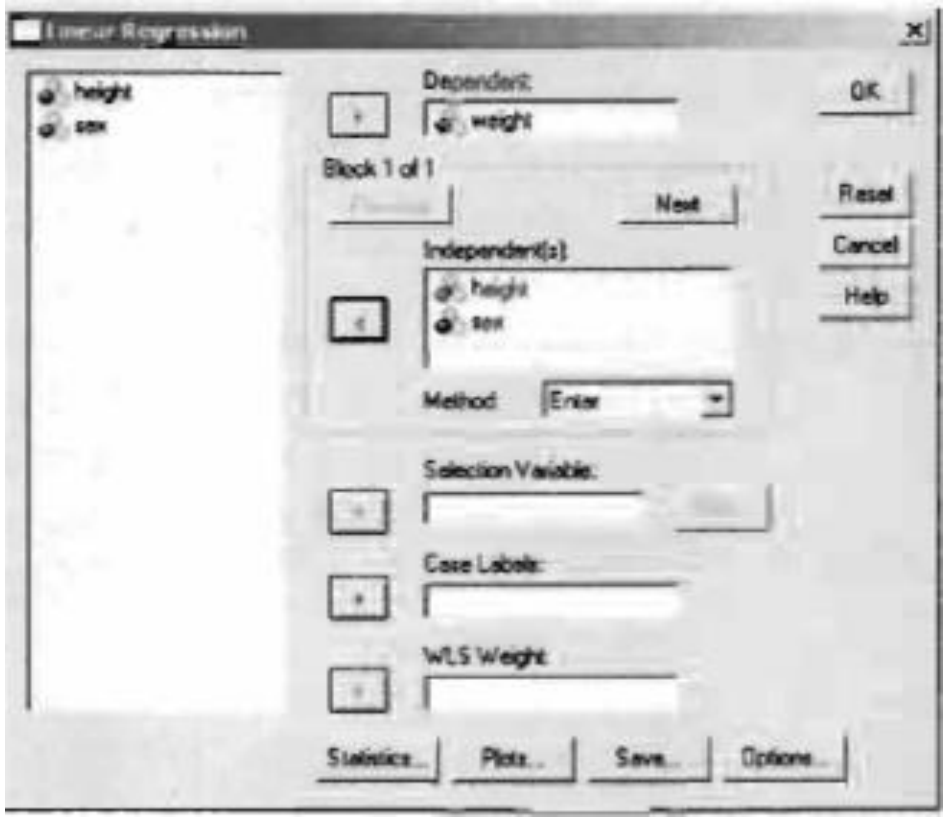
(Example From Book of Brian C. Cronk, how to use SPSS A STEP BY Step Guide ---------)

Multiple Regression in SPSS

- Multiple Linear Regression involve the prediction of one variable from many other variables.
- Steps in SPSS- Analyse---Regression– Linear—Enter independent and Dependent variables in relevant variable boxes , choose method Enter and click ok.
- Assumptions of Simple Linear regression

1. Assumption is there that both variables are interval or ration scales.
2. It is assumes that dependent and independent variables are normally distributed.
3. Independent and dependent variables have linear relationship





Interpreting Simple Linear Regression SPSS Output

1. R Square (called the coeflicient of determination) gives you the proportion of the variance of your dependent variable (WEIGHT) that can be explained by variations in independent variable (HEIGHT) and Gender. Thus, 99.3 % of the variation in weight can be explained by height and gender.
2. The second part of the output that we are interested in is the ANOVA summary able, as shown above. The important number here is the significance level in the rightmost column. If that value is less Than .05, then we have a significant Linear regression. Ii it is larger than .05, we do not.

3. (Example From Book of Brian C. Cronk, how to use SPSS A STEP BY Step Guide ---------)

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.997[a]	.993	.992	2.29571

a. Predictors: (Constant), sex, height

ANOVA[b]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	10342.424	2	5171.212	981.202	.000[a]
	Residual	68.514	13	5.270		
	Total	10410.938	15			

a. Predictors: (Constant), sex, height

b. Dependent Variable: weight

Interpreting Multiple Linear Regression SPSS Output

3- Regression Equation is Y'=a + b1X1+ b2X2 .
Y= weight=dependent variable OR predicted va
or dependent variables).
a= Constant in table
B1= 2.101, independent variable Height
B2=-39.133 independend variable gender. It is Negative because Male was coded as 01 and Female was coded as 02).
Thus, our prediction equation for the example above
is WEIGHT' : 47.138-39.133(Sex)+2.101(height).

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients		
		B	Std. Error	Beta	t	Sig.
1	(Constant)	47.138	14.843		3.176	.007
	height	2.101	.198	.312	10.588	.000
	sex	-39.133	1.501	-.767	-26.071	.000

a. Dependent Variable: weight

(Example From Book of Brian C. Cronk, how to use SPSS A STEP BY Step Guide ---------)

Factor Analysis

- Factor analysis is an approach to reduce sufficient and large number of variables and items into manageable and meaningful few variables. The research generally use this technique to reduce a questionnaire having many variables and items into few groups of variables.
- The factors or variables have meaningful names and the relate to each other. The relationship between different factors or variables can range from −1.0 through 0.0 to +1.0. Similar variables and factors correlate to each other more than no similar ones.

Howitt, Dennis and Cramer, Duncan (2011) have suggested following steps for Factor Analysis

Data
- Name the variables in Variable View of the Data Editor.
- Enter the data under the appropriate variable names in Data View of the Data Editor.

Analysis
- Select ‘Analyze’, ‘Dimension on Reduction’ and ‘Factor . . .’.
- Move the variables to be analysed to the ‘Variables:’ box.

2
- Select ‘Descriptives . . .’, ‘Univariate descriptives’ and ‘Continue’.
- Select ‘Extraction . . .’, ‘Method’ of extraction if different from principal components, ‘Scree test’ and ‘Continue’.

3
- Select ‘Rotation . . .’, method of rotation and ‘Continue’.
- Select ‘Options . . .’, ‘Sorted by size’ and ‘Continue’.

Output
- The analysis may not complete if any variable has no variance and if the number of iterations needed is greater than the default of 25. Adjust analysis accordingly.
- Check the sample size in the ‘Descriptive Statistics’ table.

2
- Check the meaning of the variables correlating most highly on the rotated factors to determine the meaning of the factors.

3
- You may need to redo the analysis on the basis of your judgement of how many factors should be extracted. This judgement is dependent on the outcome of the Scree test.

FIGURE 30.2 SPSS Statistics steps for exploratory factor analysis

Factor Analysis

- Further Reading
- Following sources are recommended to fully understand the concept of factor analysis

1. https://www.statisticssolutions.com/factor-analysis-2/
2. https://www.youtube.com/watch?v=BgM17vPAQFo
3. https://www.spss-tutorials.com/spss-factor-analysis-tutorial/
4. https://www.discoveringstatistics.com/repository/factor.pdf

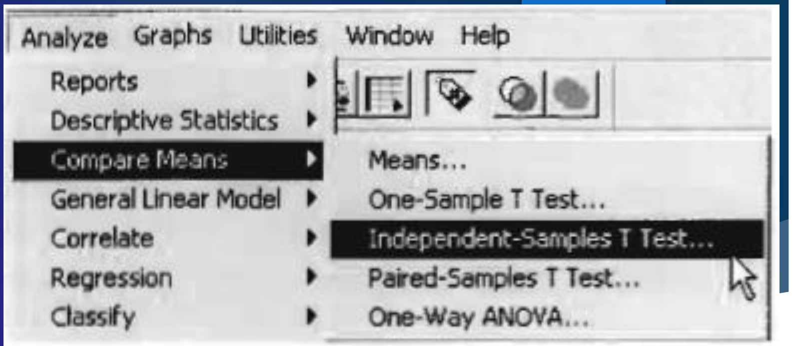
Comparison of Means in SPSS

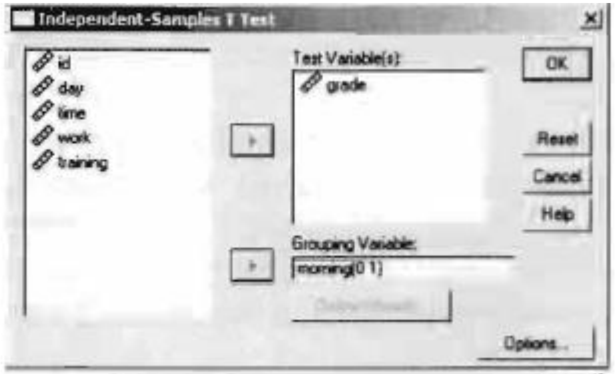
- Independent-sample T-test

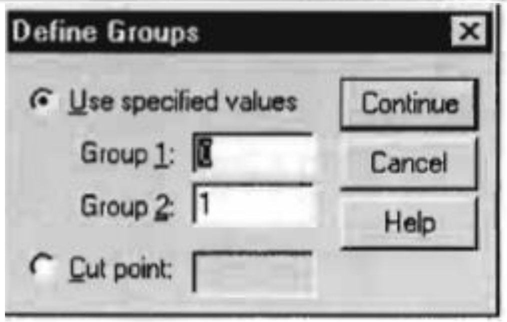
This test used to estimate the significant difference between means of two simples. The two samples are from two randomly assigned groups.

- Assumptions of Independent sample T-test
- The two groups under comparisons should be independent from each other .
- There should be preferably normally distributed scores from both groups.
- The dependent variable should be in interval or ratio scale.
- The independent variable be discrete.

Comparison of Means in SPSS







- Independent-sample T-test
- Analyze,
- Compare Means,
- Independent-Samples
- Now you will see main dialog box. Transfer dependent variable(s into the Test Variable(s)
- Transfers independent variable into define groups according to their coding.
- Tick continue and ok

Comparison of Means in SPSS

- Interpreting Independent Sample T-Test
- This test confirms inequality of means.

A significant test will confirm that two means are significantly different.

- Mention the direction of difference, T-value and alph level.

Group Statistics

	group	N	Mean	Std Deviation	Std Error Mean
score	Control	4	41 0000	4.24264	2 12132
	Experimental	3	33 3333	2 08167	1 20185

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	Sig	t	df	Sig (2-tailed)	Mean Difference	Std Error Difference	Lower	Upper
score	Equal variances assumed	5.058	.074	2.835	5	.036	7 66667	2.70391	.71605	14.61728
	Equal variances not assumed			3.144	4.534	.029	7.66667	2 43812	1.20060	14.13273

Example from Brian C, Cronk book "Test Results shows that means of experimental and control groups differ significantly (t-5) = 2.835, p < .05). The mean of the experimental group was significantly less (m = 33.333,s d:2.08) than the mean score of the control group(m: 41.000s, d : 4.24)."

Comparison of Means in SPSS

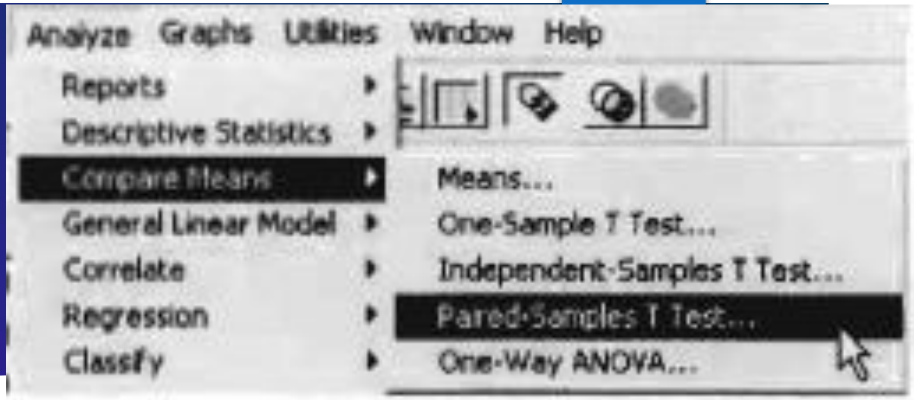
- Paired-Sample/s T-Test

The paired-sample/s test (also called a dependent/ test) is used to identify the significant differences between two scores of related samples. Usually , it is used to compare performance or difference in a sample's pre-test and post-test scores.

- Assumptions:

1. It is assumed that variables are atleast interval or ratio
2. The variable frequencies are normally distributed.
3. The same scale is used to measure variables in pre-test and post-test.

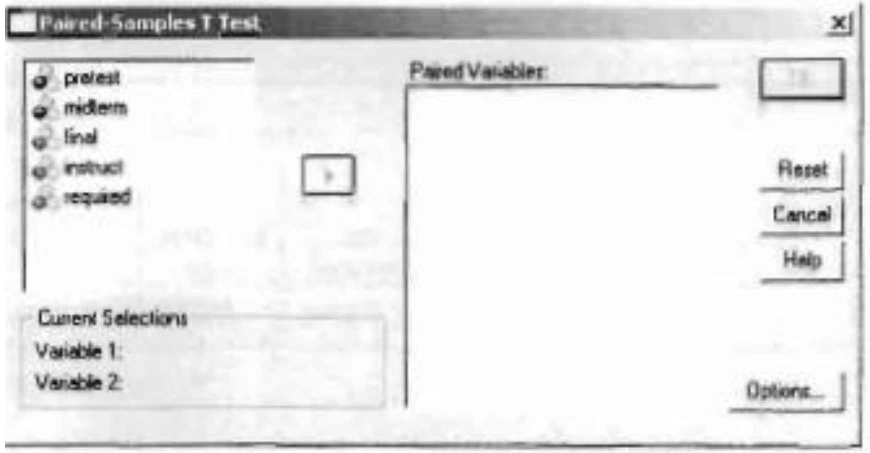
Comparison of Means in SPSS

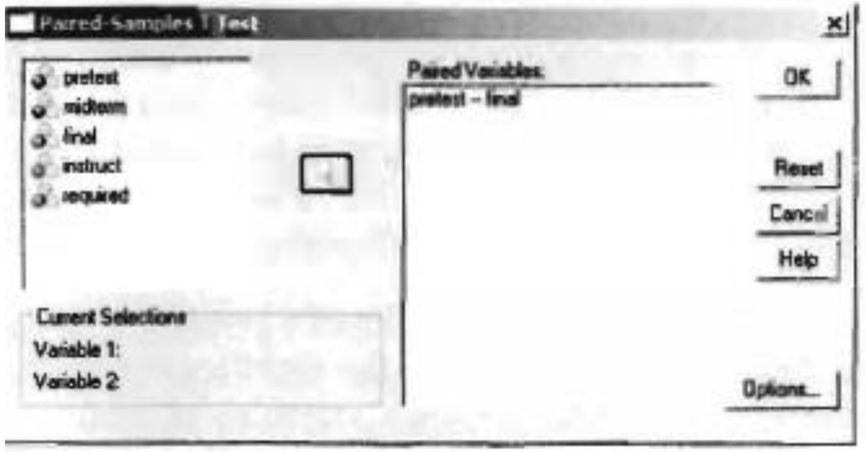


- Running Paired-Sample/s T-Test in SPSS
- click **Analyse**,
- Click **Compare Means**
- **Click Paired Samples T test.**
- Tick the two variables and move these variables in

paired variables box.

- Click **OK**





Comparison of Means in SPSS

- Interpreting Paired-Sample/s T-Test in SPSS
- (Example from the Book of Pallant, J. 2011)
- Determine Overall Significance
- Determine Difference between means
- A paired-samples t-test was conducted to evaluate the impact of ????????/. There was significant decrease/decrease in scores from Pre-test (*M* =??, *SD* = ????) to post-test (*M* =??, *SD* = ????), *t* (???) , *p* <. 0005 (two-tailed). The mean decrease/increase in scores was ???/?.

Paired Samples Statistics

		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	fear of stats time1	40.17	30	5.16	.94
	fear of stats time2	37.50	30	5.15	.94

Paired Samples Test

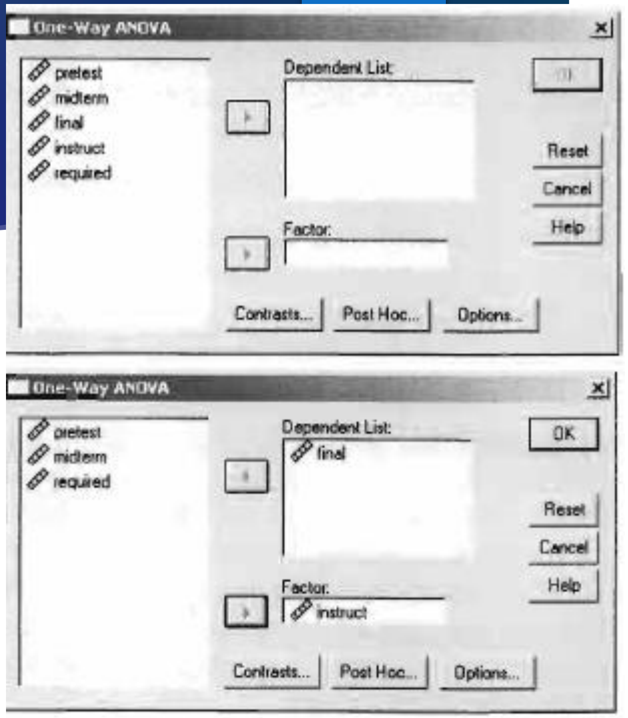
		Paired Differences					t	df	Sig. (2-tailed)
					95% Confidence Interval of the Difference				
		Mean	Std. Deviation	Std. Error Mean	Lower	Upper			
Pair 1	fear of stats time1 - fear of stats time2	2.67	2.71	.49	1.66	3.68	5.394	29	.000

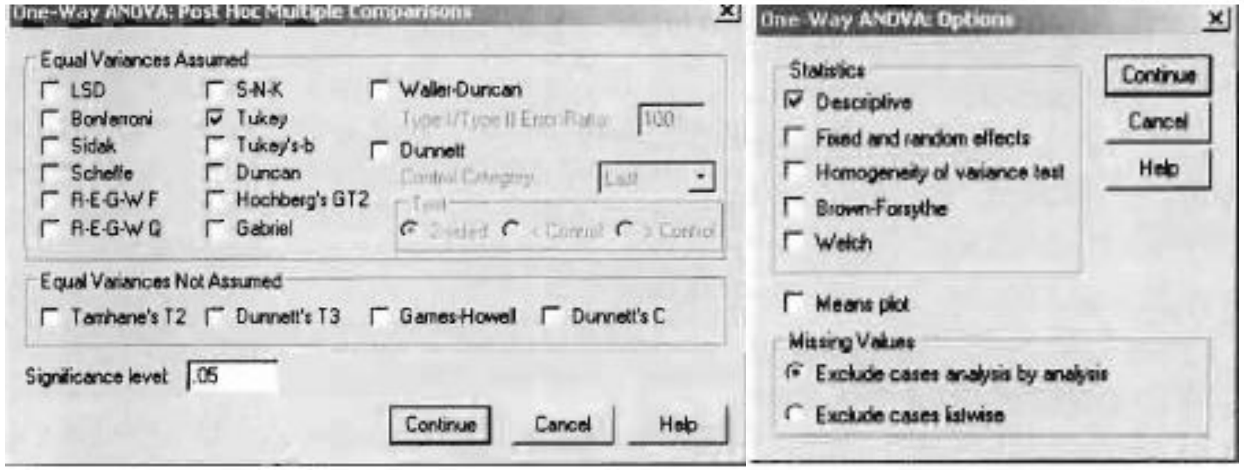
ANOVA Tests in SPSS

- If we have one independent (grouping) variable which has three or more levels (groups), and there is one dependent continuous variable, then we will use One-way between-groups ANOVA. Here one way indicates that there is only one independent variable and between groups label indicated that these groups have different participants.
- Assumptions of ONE WAY ANOVA

1. It is assumed that there is one independent and one dependent variable .
2. Participant in groups are different from each other.
3. Dependent variable is at least interval or ratio scale.
4. Dependent variable is normally distributed.

- Click on Analyze,
- Click Compare Means
- Select One-way ANOVA.
- Transfer dependent variable into dependent list and independent variable into categorical variable list
- Click the Options button
- Tick Descriptive, Homogeneity of variance test, Brown-Forsythe, Welch and Means Plot.
- Click Continue.
- Click on Post Hoc.
- Tick Tukey.
- Click k Continue and OK





- Interpreting One Way ANOVA
- Describe
- value of F,
- the degrees of freedom
- significance level.
- If significant ANOVA , then see Post hoc test results
- (Example from Brian C. Cronk (2008)

Descriptives

final

	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean Lower Bound	95% Confidence Interval for Mean Upper Bound	Minimum	Maximum
1.00	7	79.5714	7.95523	3.00680	72.2141	86.9288	69.00	89.00
2.00	7	86.4286	10.92180	4.12805	76.3276	96.5296	69.00	100.00
3.00	7	92.4286	5.50325	2.08003	87.3389	97.5182	83.00	100.00
Total	21	86.1429	9.63476	2.10248	81.7572	90.5285	69.00	100.00

ANOVA

final

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	579.429	2	289.714	4.083	.034
Within Groups	1277.143	18	70.952		
Total	1856.571	20			

Multiple Comparisons

Dependent Variable: FINAL

Tukey HSD

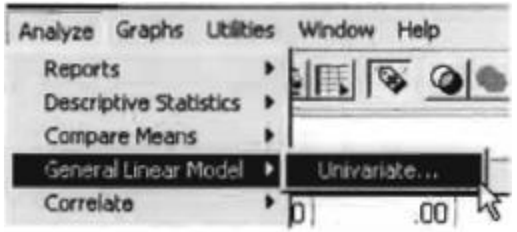
(I) INSTRUCT	(J) INSTRUCT	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval Lower Bound	95% Confidence Interval Upper Bound
1.00	2.00	-6.8571	4.502	.304	-18.3482	4.6339
	3.00	-12.8571*	4.502	.027	-24.3482	-1.3661
2.00	1.00	6.8571	4.502	.304	-4.6339	18.3482
	3.00	-6.0000	4.502	.396	-17.4911	5.4911
3.00	1.00	12.8571*	4.502	.027	1.3661	24.3482
	2.00	6.0000	4.502	.396	-5.4911	17.4911

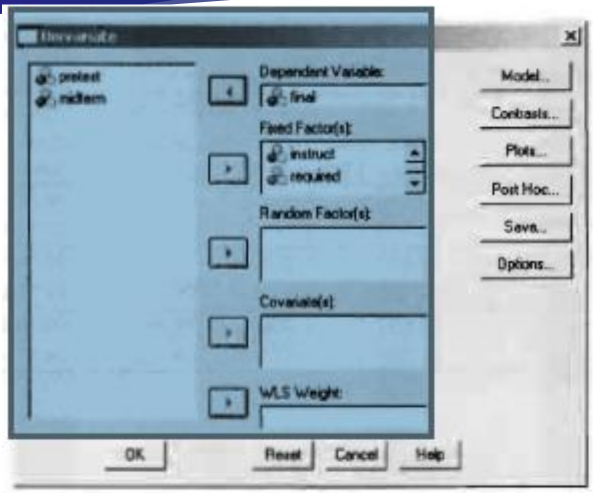
*. The mean difference is significant at the .05 level.

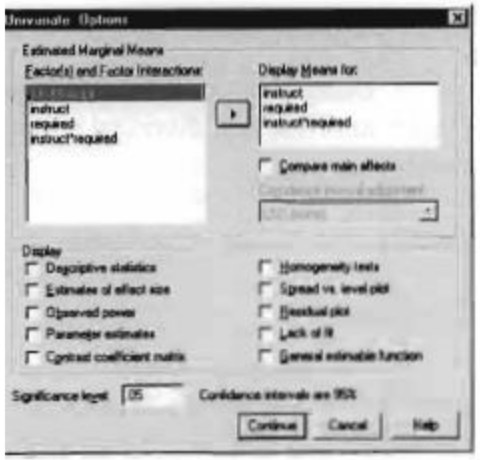
We computed a one-way ANOVA comparing the final exam scores of participants who took a course from one of three different instructors. A significant difference was found among the instructors ($F(2,18) = 4.08$, $p < .05$). **Tukey's *HSD*** was used to determine the nature of the differences between the instructors. This analysis revealed that students who had Instructor 1 scored lower ($m = 79.57$, $sd = 7.96$) than students who had Instructor 3 ($m = 92.43$, $sd = 5.50$). Students who had Instructor 2 ($m = 86.43$, $sd = 10.92$) were not significantly different from either of the other two groups.

- Factorial ANOVA
- If we have more than one independent variable Example (grouping variable) experimental and control group and time as pre-test and post test then we use factorial ANOVA.

Running Factorial ANOVA







Non-Parametric Tests in SPSS

- It is useful to use Non-parametric test if:

1. Dependent variable is not interval or ratio.
2. The dependent variable is not normally distributed.
3. Data involves only frequency counts.
4. Chi-square Goodness of Fit

Non-Parametric Tests in SPSS

- Chi-square Goodness of Fit
- It is used to infer that whether the sample proportion values match the Theoretical values.
- Assumptions

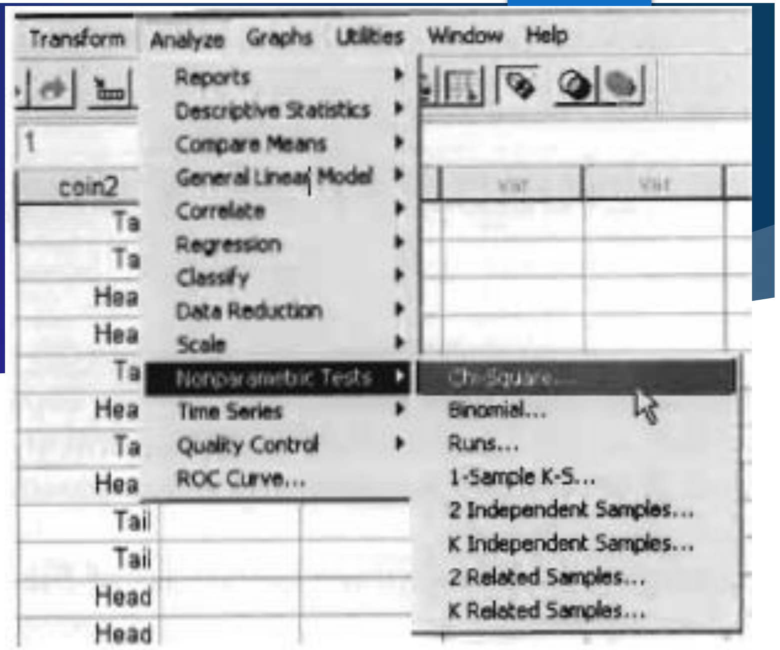
1. No assumption about the shape of distribution is here.
2. There is at least expected frequency of one for each category.
3. 20 percent of all categories do not have expected frequency less than 5

- Running Chi-square Goodness of Fit

click Analyze ----- Nonparametric Tests ----Chi-Square

Transfer the variable Test Variable List------ Click OK

(Example from Brian C. Cronk (2008)



A chi-square goodness of fit test was calculated comparing the frequency of occurrence of each value of a die. It was hypothesized that each value would occur an equal number of times. Significant deviation from the hypothesized values was found ($\chi^2(5) = 25.48, p < .05$)

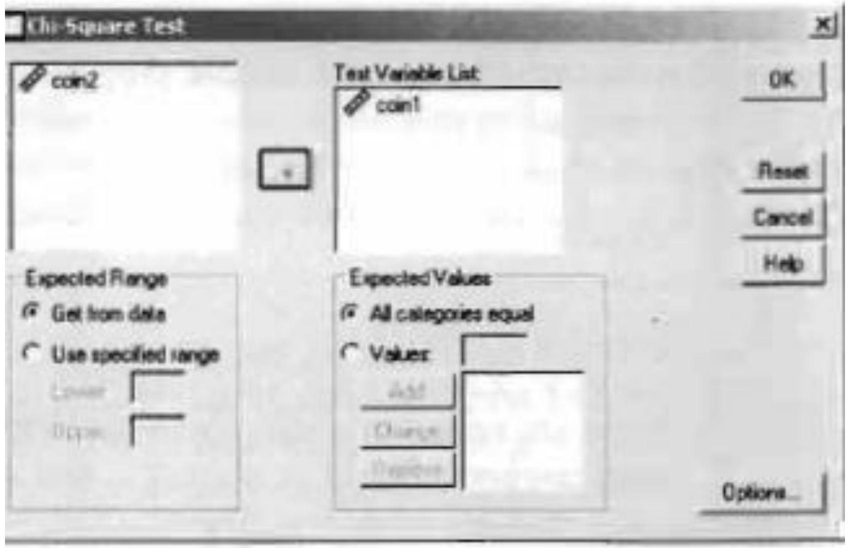
COIN1

	Observed N	Expected N	Residual
Head	11	10.0	1.0
Tail	9	10.0	-1.0
Total	20		

Test Statistics

	coin1
Chi-Square[a]	.200
df	1
Asymp. Sig.	.655

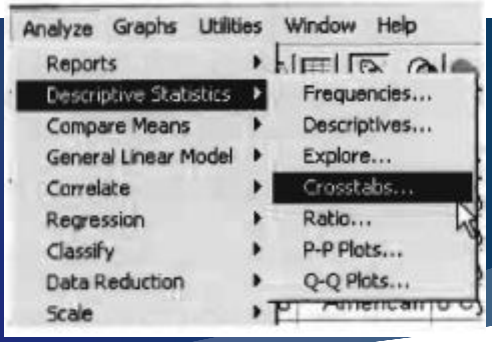
a. 0 cells (.0%) have expected frequencies less than 5. The minimum expected cell frequency is 10.0.

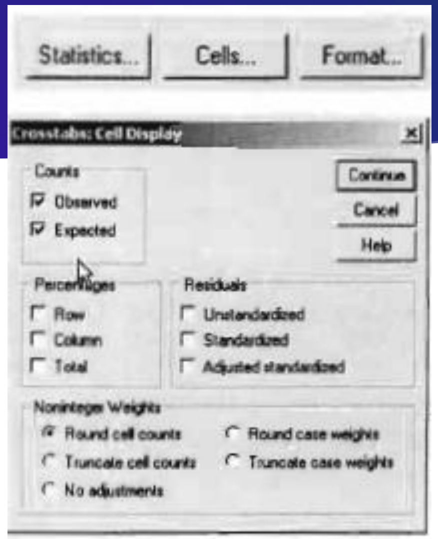


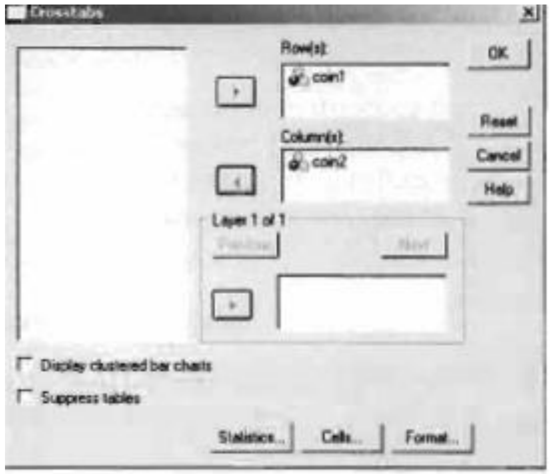
- The chi-square test of independence
- If we have conditions to apply non-parametric tests and we two independent variables, we ascertain the their significant independence of each other by chi-square test of independence. This is non-parametric version of interaction/factorial ANOVA.
- Assumptions

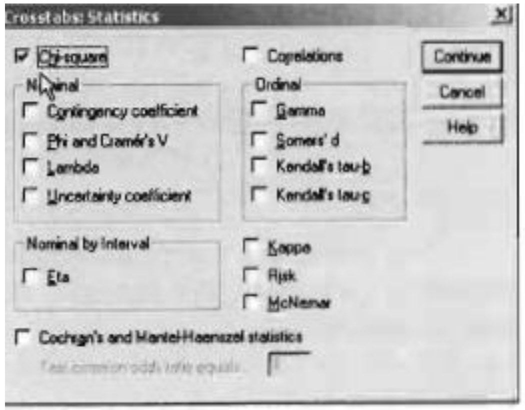
1. No assumption about the shape of distribution is here.
2. There is at least expected frequency of one for each category.
3. 20 percent of all categories do not have expected frequency less than 5

- Running chi-square test of independence
- Analyse ----- Descriptive Statistics----- crosstabs – Enter relevant variables as rows and columns…Tick statistics ----Tick Chi-square box--- click continue …. ok









- Interpreting output of chi-square test of independence in SPSSA chi-squarete test of indepenece was calcualted to compare the frequncies of (?? Dependent variable) in (???? Levels of independent vaarible. There was signiifcnat interaction
- (Example from Brian C. Cronk (2008)
- For more examples see
- https://www.spss-tutorials.com/chi-square-independence-test/
- https://stattrek.com/chi-square-test/independence.aspx
- https://www.khanacademy.org/math/ap-statistics/chi-square-tests/chi-square-tests-two-way-tables/v/chi-square-test-association-independence

COIN1 * COIN2 Crosstabulation

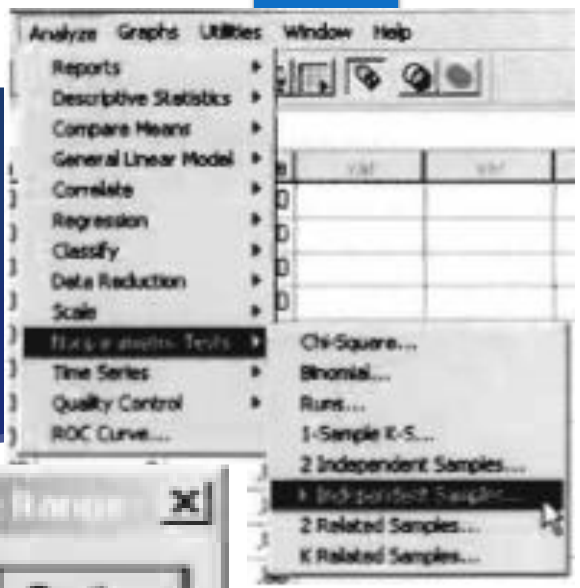
			COIN2		
			Head	Tail	Total
COIN1	Head	Count	7	4	11
		Expected Count	6.1	5.0	11.0
	Tail	Count	4	5	9
		Expected Count	5.0	4.1	9.0
Total		Count	11	9	20
		Expected Count	11.0	9.0	20.0

Chi-Square Tests

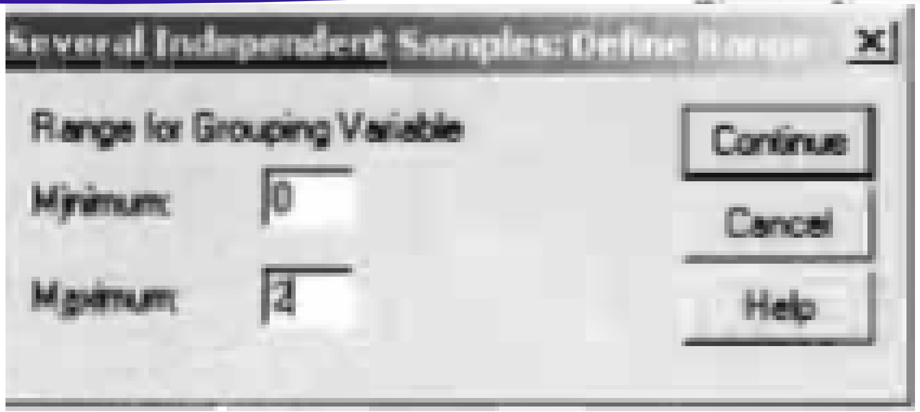
	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	.737[b]	1	.391		
Continuity Correction[a]	.165	1	.684		
Likelihood Ratio	.740	1	.390		
Fisher's Exact Test				.653	.342
Linear-by-Linear Association	.700	1	.403		
N of Valid Cases	20				

a. Computed only for a 2x2 table

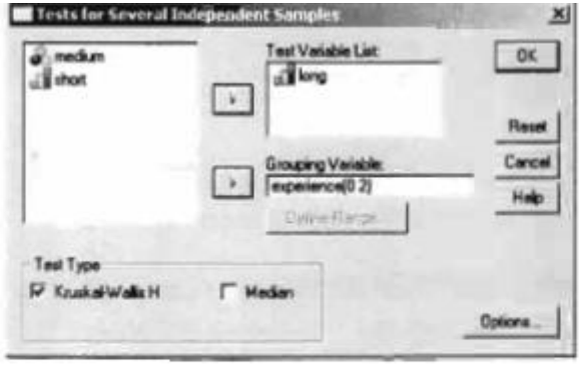
b. 3 cells (75.0%) have expected count less than 5. The minimum expected count is 4.05.



- Kruskal-Wallis II Test
- If we wan ascertain that whether different samples came from the same population then we will use this test. In other way if want to conduct ANOVA but our data is not normal and fail to fulfil assumption of ANOVA, we can use this test instead of ANOVA.



- Running Kruskal-Wallis II Test
- Analyze, ---Nonparametric Test---- K Independent sample
- Enter the independent variable and test variables in relavant boxes.---click OK.



- Interpreting Kruskal-Wallis H Test
- (Example from Brian C. Cronk (2008)

Ranks

	experience	N	Mean Rank
long	.00	4	10.50
	1.00	4	6.50
	2.00	4	2.50
	Total	12	

Test Statistics[a,b]

	long
Chi-Square	9.846
df	2
Asymp. Sig.	.007

a. Kruskal Wallis Test

b. Grouping Variable: experience

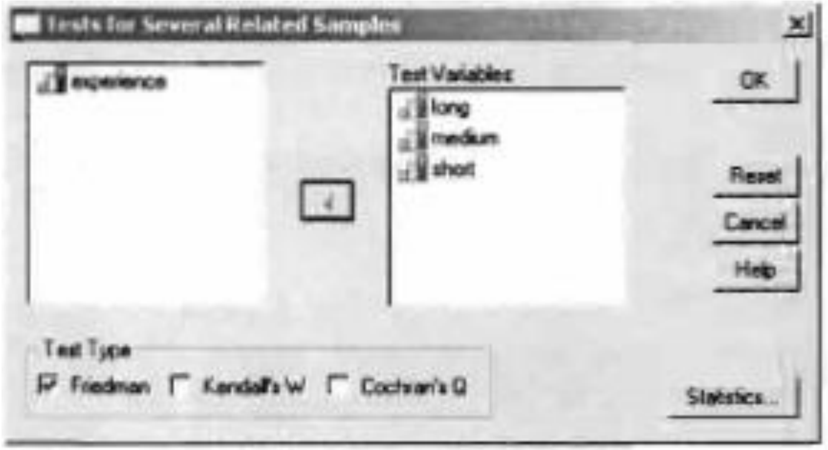
A Kruskal-Wallis test was conducted comparing the outcome of a long distance race for runners with varying levels of experience. A significan result was found ($H(2) = 9.85$, $p < .01$), indicating that the groups differec from each other. Runners with no experience averaged a placement of 10.50 while runners with some experience averaged 6.50 and runners with a lot o experience averaged 2.50. The more experience the runners had, the bette they performed.

- Friedman Test

If we are unable to fulfil the assumptions of repeated measures ANOVA, then we can opt for its non-parametric version The Friedman Test.

- Running The Friedman Test:

Analyze,---Non-parametric Tests----K Related Samples transfer independent variables in Test variable box…and dependent in depend bok…click ok



- Interpreting Friedman Test
- (Example from Brian C. Cronk (2008)

Ranks

	Mean Rank
LONG	2.00
MEDIUM	2.04
SHORT	1.96

Test Statistics[a]

N	12
Chi-Square	.049
df	2
Asymp. Sig.	.976

a. Friedman Test

A Friedman test was conducted comparing the average place in a race of runners for short-distance, medium-distance, and long-distance races. A significant difference was found ($\chi^2(2) = 0.057$, $p < .05$). The length of the race significantly affects the results of the race.