The Islamia University of Bahawalpur
Department of Computer Science & IT

Program: BIT2 M-B, BSIT2nd –E   Course Title: Discrete Structure (DS)
Lecture Time: Mon/Tue 8:30am-11:00am   Credit hour: 3

Instructor:

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- office hours: Monday 1:00-3:00pm

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Course description

The purpose of this course is to understand and use (abstract) discrete structures that are backbones of computer science. In particular, this class is meant to introduce logic, proofs, sets, relations, functions, counting, and probability, with an emphasis on applications in computer science.

Course Learning Objective (CLO): Discrete Structure (DS) course makes students of undergraduate level familiar

1. To express statements with the precision of formal logic, to analyze arguments to test their validity,
2. To apply the basic properties and operations related to sets and the basic properties and operations related to relations and function,
3. To define terms recursively,

4. To prove a formula using mathematical induction, to prove statements using direct and indirect methods,
5. To compute probability of simple and conditional events,
6. To illustrate the basic definitions of graph theory and properties of graphs and to relate each major topic in Discrete Structure to an application area in computing.

Prerequisites:
  2 years of high school algebra.

Reference material/Textbook:
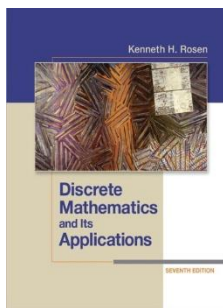
1. **Kenneth Rosen. [Discrete Mathematics and Its Applications](link), 7th Edition , McGraw Hill Publishing Co., 2012.**
2. **Virtual Univesrity handouts**

Tentative Course Content/ Syllabus

- **Logic:** propositional logic, logical equivalence, predicates & quantifiers, and logical reasoning.
- **Sets:** basics, set operations
- **Functions:** one-to-one, onto, inverse, composition, graphs
- **Integers:** greatest common divisor, Euclidean algorithm.
- **Sequences and Summations**
- **Mathematical reasoning:** Proof strategies, Mathematical Induction, Recursive definitions, Structural Induction
- **Counting:** basic rules, Pigeon hall principle, Permutations and combinations, Binomial coefficients and Pascal triangle.
- **Probability:** Discrete probability. Expected values and variance.
- **Relations:** properties, Combining relations, Closures, Equivalence, partial ordering
- **Graphs** , directed, undirected graphs.

Tentative Lectures (Covering 16 weeks)

Lectures	Topic(s)	Readings	Assignments
1.	**Administrivia, Propositional logic.**	**Section 1.1.**	.
2.	**Propositional logic.**	**Sections 1.1-3.**	Homework assigment 1 MCQs sets
3.	**Predicate logic.**	**Sections 1.4.**	Quiz:1
4.	**Predicate logic.**	**Sections 1.4.**	Homework assigment 2 PPT
5.	**Predicate logic. Formal and informal proofs**	**Sections 1.5.**	
6.	**Rules of Inference introduction**	**Sections 1.6**	Homework assigment 3
7.	**Sets and set operations**	**Sections 2.1-2.**	Assignment Set 13 questions
8.	**Sets and set operations (cont.), Functions**	**Sections 2.1-3.**	Homework assigment 4: LAB vector
9.	**Functions II.**	**Sections 2.1-3.**	.
10.	**Sequences and summations**	**Sections 2.4.**	Homework assigment 5
11.	**Cardinality of sets Countable and uncountable sets.**	**Sections 2.5.**	. Quiz 2
12.	**Matrices. Integers and division**	**Sections 2.6., 4.3.**	Homework assigment 6
13.	**Complexity Analysis: The Growth of Function.**	**section 3.2**	.
14.	**Integers and divisions. Congruency. CS applications.**	**Sections 4.3., 4.5.**	.
15.	**Integers: Applications, base**	**Section 4.2.,**	Homework assigment

	conversions. Mathematical induction.	**4.5.**	7
16.	**Counting: basic counting rules.**	**Sections 6.1-2.**	Homework assigment 8 PPT
	Midterm exam	**Chapters 1,2,4,5 and 6.1.**	.
17.	**Counting: permutations, combinations: Introduction**	**Chapter 6**	.
18.	**Counting: advanced counting methods. Probability**	**Sections 6.3-5; Chpater 7**	Homework assigment 9
19.	**Probabilities.**	**Chapter 7**	Quiz3
20.	**Probabilities: Bayes theorem, Bernoulli trial, Random variables, Expected value.**	**Chapter 7**	Homework assigment 10
21.	**Probabilities: expected value**	**Chapters 7.1-3**	.
22.	**Relations II.**	**Chapter 9.1-3.**	Homework assigment 11
23.	**Relations III**	**Chapters 9.1-3.**	.
24.	**Relations IV. Graphs**	**Chapter 9.1-6.**	Homework assigment 12
25.	**Graphs: graph types, graph properties**	**Chapter 10.**	.
26.	**Graphs: Connectivity,**	**Chapter 10.**	.
27.	**Trees**	**Chapter 11.1-2**	Homework Assignment 13
28.	**Tree Traversal**	**Chapter 11.3**	
29.	**Tree spanning**	**Chapter 11.4.**	

30.	**Modeling computation** **Languages and Grammars**	**Chapter 13.1-2**	Quiz4
31.	**Modeling computation** **State machines**	**Chapter 13.3**	Homework Assignment14 Presentation:PPT
32.	**Modeling computation** **Turing machine**	**Chapter 13.5**	
	Final exam		.

Teaching Methodology:

Lectures, Written Assignments, Practical Labs, Presentations

Course Assessment The mid exam for the course as of IUB academic calendar is on, April 24, 2020 at 10:00-11:50am. The exam is a closed book, cumulative exam. Please bring your own calculator. You may need it to complete the solution for some of the counting problems.

- Please note that all problems in the homework assignments are from the 7th edition of the textbook.
- Homework assignment:
  - Homework assignment 1
  - Homework assignment 2
  - Homework assignment 3
  - Homework assignment 4
  - Homework assignment 5
  - Homework assignment 6
  - Homework assignment 7
  - Homework assignment 8
  - Homework assignment 9
  - Homework assignment 10
  - Homework assignment 11
  - Homework assignment 12
  - Homework assignment   14
  - Homework assignment   15
- Quiz/Presentation (online/video based and in class room)

- o [Quiz 1](#) Sets
- o [Quiz 2](#) Functions and Logic
- o [Quiz 3](#) Mathematical Induction/Relations
- o [Quiz 4](#) probability/computation/Trees/Graphs

Grading Scheme

- Lectures participation/Homework assignments/Quiz/Attendance   **20%** (point based)
- Mid/Final Exams   **30/50%**

Homeworks

There will be weekly homework assignments. The assignments are due at the beginning of the class on the day specified on the assignment. In general, no extensions will be granted.

Additional Student Resources
https://www.mheducation.com/highered/contact.html

Academic Integrity Honesty

All the work/surgeries in this course should be done independently. Collaborations on group based homeworks are allowed. Cheating and any other antiintellectual behavior or plagiarism, including giving your work to someone else, will be dealt with severely. If you feel you may have violated the rules speak to us as soon as possible.

Please make sure you read, understand and abide by the Academic Integrity Code for the DCS & IT, Islamia Univesrity of Bahawalpur.