



Capital University of Science and Technology

Department of Computer Science

CS2053 – Discrete Structures

Course Title:	Discrete Structures (CS2053)
Pre-requisite(s):	None
Credit Hours:	3
Instructor(s):	
Textbook(s):	Title: Discrete Mathematics and Its Applications, 8 th edition; Author: Kenneth Rosen; McGraw-Hill
Reference Book(s):	Title: Essentials of Discrete Mathematics Author: David J. Hunter
Web Reference:	https://www.tutorialspoint.com/discrete_mathematics/index.htm

Course Introduction:

Discrete mathematics is mathematics that deals with discrete objects. Discrete objects are those which are separated from (not connected to/distinct from) each other. Integers (aka whole numbers), rational numbers (ones that can be expressed as the quotient of two integers), automobiles, houses, people etc. are all discrete objects. On the other hand, real numbers which include irrational as well as rational numbers are not discrete. In that sense they are not discrete. In this course we will be concerned with objects such as integers, propositions, sets, relations, and functions, which are all discrete. We are going to learn concepts associated with them, their properties, and relationships among them among others.

Course Objectives:

This course will lay the foundations for theoretical computer science. Basic mathematical concepts generally required for most computer science courses will be covered in the course. The course aims at developing precise and formal reasoning skills in students. Different ways of mathematical thinking will be explored i.e., Logical thinking, Relational thinking, Recursive thinking, Quantitative thinking, and Analytical thinking.

Course Learning Outcomes (CLOs):

At the end of this course, the students should be able to:

- CLO:1.** Describe propositional /predicate logic in terms of predicates, quantifiers, and logical connective. [C2-Understanding]
- CLO:2.** Explain properties of sets, functions, sequences, and summations. [C2-Understanding]
- CLO:3.** Solve counting problems and enumerate objects while performing combinatorial analysis. [C3-Application]
- CLO:4.** Use multiple discrete structures such as graphs, trees to analyze problems in real life. [C3-Application]



Capital University of Science and Technology

Department of Computer Science

CLOs – PLOs Mapping:

	CLO:1	CLO:2	CLO:3	CLO:4
PLO:1 (Academic Education)				
PLO:2 (Knowledge for Solving Computing Problems)	√	√		
PLO:3 (Problem Analysis)			√	√
PLO:4 (Design/Development of Solutions)				
PLO:5 (Modern Tool Usage)				

Course Contents:

Week	Contents
1	Propositional Logic (Negation, Conjunction, Disjunction, XOR), Truth Tables for logical connectives
2	Conditional Statements, Implication, Biconditionals, Propositional and Logical Equivalences, Constructing new logical Equivalences
3	Predicate Logic + Quantifiers (Universal and Existential), Nested Quantifiers, Order of Quantifiers, Translating Mathematical Statements
4	Rules of inference, building arguments using Inference rules, Introduction to proofs (Direct Proofs + Proof by contraposition)
5	Proof by contradiction + Examples on proofs, Sets (Properties) + types of sets + Cardinality of sets
6	Set Operations + Set identities and Introduction to Functions
7	Types of functions + Inverse and Composition of functions, Introduction to Sequences + Closed form of sequences
8	Summations, using tables to solve summations
Mid-Term Exam	



Capital University of Science and Technology

Department of Computer Science

9	The basics of Counting, The Pigeonhole Principle
10	Permutation and Combination, Generalized Permutation and Combination (with repetition)
11	Mathematical Induction (Summation Proofs), Induction (Divisibility Proofs + Inequality Proofs)
12	Induction (Set Theory Proofs) + Examples, Recursion Introduction + Tracing an Algorithm
13	Recursive Algorithms (Computing GCD, Factorial), Algorithms Introduction
14	Complexity of Algorithms, Computing Big – Oh of an Algorithm
15	Graphs Introduction + Types, Degree of Graphs (Directed + Undirected)
16	Connectivity of Graphs + Some Special Graphs, Euler Circuit + Euler Path

Grading Policy:

S. No	Grading	% Of Total Marks
1	Assignments	20
2	Quizzes	20
3	Mid-term Exam	20
4	Final Exam	40
	Total	100