CS231 – Discrete Mathematics (3 CH)

Course Code: CS231 Title: Discrete Mathematics Instructor: Mr. Salman Ashraf
Credit Hours: 3 (3-0) Lecture Hours: 3 Lab Hours: 0 Pre-Req: Nill Co-Req: Nill Knowledge Profile: WK2

Course Introduction

This course introduces the kind of mathematics especially helpful in computer science. The emphasis is on discrete objects such as sets, graphs and trees, and counting techniques that apply to such objects. Logic, analysis of algorithms, basic number theory and arithmetic algorithms are also covered.

Course Contents

- Propositional Logic, Connectives, Conditional Statements, Biconditionals, Predicate Logic
- Algorithm Analysis: Big O notation, Theorems, Application to common algorithms
- Integers and Algorithms: Number Theory, Residue Arithmetic, Integer Representations, Arithmetic Algorithms.
- Combinatorics: Sum and Product Rules, Pigeonhole Principle, Permutations, Combinations, Binomial Theorem, Generalized Combinations.
- Graph Theory: Types, Paths, Circuits, Euler Paths, Hamiltonian Paths, Shortest Paths, Isomorphism, Planar Graphs, Trees, Spanning Trees.

Mapping of CLOs and PLOs

Sr. No.	Course Learning Outcomes (CLOs) †	PLOs *	Blooms Taxonomy
CLO-1	Understand logical statements and follow basic mathematical arguments.	PLO1	C2 (Understand)
CLO-2	Understand commonly used discrete objects, basic combinatorics and basic number theory.	PLO1	C2 (Understand)
CLO-3	Understand and remember commonly used algorithms.	PLO1	C2 (Understand)
CLO-4	Analyze algorithms and compare their relative performance.	PLO2	C4 (Design)

† Please add the prefix "Upon successful completion of this course, the student will be able to"

* PLOs are for Engineering programs only

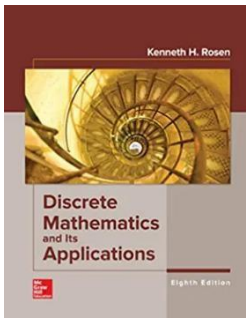
CLO Assessment Mechanism

Assessment Tools	CLO-1	CLO-2	CLO-3	CLO-4
Quizzes	-	**100%**	-	**100%**
Assignments	**100%**	-	**100%**	-
Midterm Exam	-	-	-	-
Final Exam	-	-	-	-

Overall Grading Policy

Assessment Items	Percentage
Quizzes (Announced + Surprise)	**20%**
Assignments	**10%**
Midterm Exam	**30%**
Final Exam	**40%**

Text and Reference Books

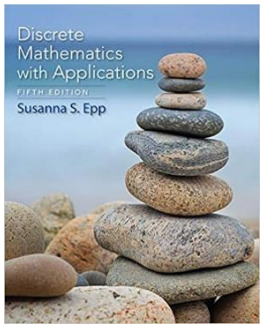


Textbook:

- Discrete Mathematics and Its Applications by K. Rosen, 8th Edition, ISBN 978-1259676512

Reference Books:

- S. Epp, "Discrete Mathematics with Applications", 5th Edition, ISBN 978-1337694193



Administrative Instructions

- According to the institute's policy, minimum attendance must be more than 80% for appearing in final examination.
- Assignments must be submitted as per instructions mentioned in the assignments.
- In any case, there will be no retake of (scheduled/surprise) quizzes.
- For queries, kindly follow the office hours to avoid any inconvenience.
- Your assignments will be checked for plagiarism (including from peers or the internet).

Lecture Breakdown

Week #	Topics
Week 01	Introduction, Discrete v. Continuous in Mathematics. Logic, Propositions, Conditionals.
Week 02	Biconditionals, Equivalence, Applications to Natural Language and System Specification. Predicates and Quantifiers
Week 03	Algorithms, Searching, Linear and Binary Search, Sorting, Bubble Sort, Insertion Sort, Algorithmic Efficiency
Week 04	Algorithmic Efficiency, Big O Notation Big O Notation, Theorems and Examples, Big O for Combinations of Functions,
Week 05	Complexity of Algorithms: Linear and Binary Search More Complexity, Miscellaneous Asymptotic Analysis Topics
Week 06	Counting, Product and Sum Rules, Counting Examples, Pigeonhole Principle,
Week 07	Generalized Pigeonhole Principle, Permutations and Combinations, Binomial Theorem and Identities
Week 08	Number Theory: Divisibility, Division Algorithm, Modular Arithmetic. Modular Arithmetic and Congruences. Prime Numbers, Fundamental Theorem of Arithmetic, GCD, LCM.
Week 09	Review of Number Theory, Algorithm for div and mod (Quotient and Remainder) Exam Review. Integer representations, Computing representations, Integer addition algorithm.
Week 10	Review of integer representations and addition, Integer multiplication algorithm, Exponentiation Algorithms. Graph Theory Introduction.
Week 11	Types of Graphs Paths and Circuits, Euler Circuits Euler Circuits and Paths
Week 12	Graph Isomorphism Shortest Path Problems and Dijkstra's Algorithm
Week 13	Dijkstra's Algorithm, Complexity, Hamiltonian Circuits, Traveling Salesman Problem Planar Graphs, K3,3, Euler's Formula.
Week 14	Trees: Definitions and basic properties Applications of Trees: Searching, Binary Search Trees
Week 15	Tree Traversal: In-order, Pre-order, Post-order, Applications to file systems, expressions. Spanning Trees, Construction ofspanning trees, Breadth First Search.