Spring 2022

MATH 301
INTRODUCTION TO DISCRETE MATHEMATICS (3)

Course Description: Symbolic logic, sets and relations, algorithms, mathematical induction, recurrence relations, trees and other graphs. Additional topics chosen from algebraic systems, networks, automata. Pre: One semester of calculus from mathematics department; or consent. Recommended: one semester programming.

Possible Texts:
K. Rosen, *Discrete Mathematics and Its Applications*, Random House.
R. P. Grimaldi, *Discrete and Combinatorial Mathematics*, Addison-Wesley.
Lovasz, Pelikan, Vesztergombi, *Discrete Mathematics and Beyond*, Springer.

Topics:

(1) **Fundamentals of Logic and Sets.** Logic, Propositional Equivalences, Predicates and Quantifiers, Sets, Set Operations, Functions, Sequences.
(2) **Algorithms.** Algorithms, Complexity, Integer Algorithms, Matrices.
(3) **Mathematical Reasoning.** Proofs, Mathematical Induction, Recursive Definitions and Algorithms.
(4) **Counting.** Rules of Sum and Product, Pigeonhole Principle, Permutations, Combinations, Discrete Probability.
(5) **Advanced Counting.** Recurrence Relations, Divide-and-conquer Relations, Inclusion-Exclusion.
(6) **Relation Algorithms.** Relations, n-ary Relations, Representing Relations, Closures, Equivalence Relations, Partial Orders.
(7) **Graphs.** Graphs, Representing Graphs, Graph Isomorphism, Connectivity, Euler and Hamilton Paths, Shortest Paths, Planar Graphs, Graph Coloring.
(8) **Trees.** Trees, Applications, Tree Traversal, Trees and Sorting, Spanning Trees, Minimal Spanning Trees.

Student learning outcomes: Upon successful completion, the student will have a working knowledge of discrete mathematics. The student will be able to apply this to problems involving counting, inductive reasoning and analysis of algorithmic complexity.
Program objectives: Discrete mathematics provides a foundation for understanding advanced computer science. In particular the analysis of program correctness, termination and complexity.