

Mathematics, Statistics & Computer Science Department

COURSE NO./TITLE: MATH-270 DISCRETE MATHEMATICS  
CREDIT: 3

COURSE DESCRIPTION: Exploration of sets, relations, functions, formal logic, proof techniques, counting techniques, graphs, recurrence relations, and generating functions. Applications in mathematics and computer science. Prerequisites: MATH-153 or MATH-156

TEXTBOOK: Adopted F10: Johnsonbaugh's DISCRETE MATHEMATICS, 1<sup>st</sup> Ed.

COURSE OBJECTIVES: Upon successful completion of this course, the student will:

1. Have developed an understanding of combinatorial reasoning, including the ability to use various types of diagrams and fundamental counting principles to find numbers of outcomes and related probabilities, and the ability to use simulations to solve counting and probability problems.
2. Be able to understand and apply recursive methods to solve problems, including the use of finite differences.
3. Understand how graphs can model a variety of situations, including critical path analysis, graph coloring problems, minimal spanning trees, and bin-packing techniques.
4. Be able to analyze data and apply probability concepts to solve problems.
5. Be able to use mathematically correct terminology and notation and construct correct direct and indirect proofs.
6. Be able to express statements with the precision of formal logic.

COURSE OUTLINE:

1. An Introduction to Combinatorial Problems (objective 1)
  - a. Matching Problem
  - b. Knapsack Problem
2. Sets, Relations, and Functions (objectives 1, 4, and 5)
  - a. Set Operations
  - b. Equivalence Relations
  - c. Congruence
  - d. Partial Ordering Relations (if time permits)
  - e. Functions
  - f. Mathematical Induction
  - g. Applications
3. An introduction to Logic and Proof (objectives 2, 5, and 6)
  - a. Statements, Connectives, Quantifiers
  - b. Truth Tables
  - c. Logical Equivalence
  - d. Methods of Proof
    - i. Direct Proofs
    - ii. Proofs by Mathematical Induction
    - iii. Proofs by Contradiction, Counterexamples

- e. Applications: Recursive Definitions, Algorithms
- 4. Counting Techniques (objectives 1, 4, and 5)
  - a. Fundamental Principles
    - i. Multiplication Principle
    - ii. Pigeonhole Principle
    - iii. Addition Principle
  - b. Pascal's Triangle and the Binomial Theorem
  - c. Permutation and Combinations
  - d. Arrangements and Selections with Repetitions
  - e. Basics of Probability; Probability of Permutations and Combinations
  - f. Principle of Inclusion-Exclusion
- 5. Graphs (objectives 3 and 5)
  - a. Graphs and Their Representations
  - b. Paths and Circuits
  - c. Shortest Paths and Distance
  - d. Graph Colorings
  - e. Directed Graphs and Multigraphs
  - f. Trees and Associated Algorithms (i.e., Spanning Trees-Greedy Algorithm)
- 6. Recurrence Relations and Generating Functions (objective 2)
  - a. Recurrence Relations
  - b. Method of Iteration
- 7. RSA Method (if time permits) (objective 4)
  - a. Error Correcting Codes
  - b. RSA Method