Lecture Contact Hours: 48-54; Outside-of-Class Hours: 96-108; Total Student Learning Hours: 144-162

CUYAMACA COLLEGE
COURSE OUTLINE OF RECORD

Mathematics 245 – Discrete Mathematics

3 hours lecture, 3 units

Catalog Description
Introduction to discrete mathematics. Includes basic logic, methods of proof, sequences, elementary number theory, basic set theory, elementary counting techniques, relations, and recurrence relations.

Prerequisite
"C" grade or higher or "Pass" in MATH C2220 (formerly MATH 280) or equivalent

Entrance Skills
Without the following skills, competencies and/or knowledge, students entering this course will be highly unlikely to succeed:
1) Identify the properties of the integers including commutativity, associativity, identities and inverses.
2) Understand simple mathematical proofs.
3) Solve polynomial equations and systems of linear equations.
4) Find the general terms of sequences.
5) Work with sigma notation and determine whether an infinite series converges or diverges.
6) Simplify rational and polynomial function forms.
7) Identify the properties associated with the derivative and anti-derivative of a function.
8) Classify functions according to continuity and differentiability.

Course Content
1) Formal logic including statements, symbolic representation, tautologies, propositional logic, quantifiers, predicates, and validity, predicate logic, and logic programming;
2) Proofs, recursion, and analysis of algorithms including proof techniques, proof by induction, proof of correctness programming, recursive definitions, recurrence relations, and analysis of algorithms;
3) Sets, combinatorics, probability, and number theory including counting, principle of inclusion and exclusion; Pigeonhole Principle, permutations and combinations, and Binomial Theorem;
4) Relations, functions, and matrices including relations and databases, modular arithmetic;
5) Graphs and trees including graphs and their representations, trees and their representations, decision trees, and Huffman Codes;
6) Graph algorithms including directed graphs and binary relations; Warshall's algorithm, Euler Path and Hamiltonian Circuit, shortest path and minimal spanning tree, traversal algorithms, and articulation points and computer networks;
7) Boolean algebra and computer logic including Boolean algebra structure, logic networks, and minimization; and
8) Modeling arithmetic, computation, and languages including algebraic structures, finite-state machines, and formal languages.

Course Objectives
Students will be able to:
1) Use recursion to analyze algorithms and programs;
2) Write proofs using symbolic logic and Boolean Algebra;
3) Use sets to solve problems in combinatorics and probability theory;
4) Apply matrices to analyze graphs and trees; and

5) Use finite state machines to model computer operations.

Method of Evaluation
A grading system will be established by the instructor and implemented uniformly. Grades will be based on demonstrated proficiency in subject matter determined by multiple measurements for evaluation, one of which must be essay exams, skills demonstration or, where appropriate, the symbol system.
1) Independent and/or group exploration activities which measure students' ability to: select and apply appropriate methods of proof writing to a wide variety of problems requiring the use of elementary number theory, set theory, or elementary counting techniques.
2) Quizzes and exams (including a comprehensive in-class final exam) which measure students' ability to identify, select, and apply the methods and skills required to: simplify and evaluate basic logic statements; solve problems requiring elementary counting techniques; solve problems involving recursion and recurrence relations; and write proofs involving elementary number theory and/or set theory.
3) Homework assignments in which students identify the proof methods and techniques required to write proofs involving elementary number theory, set theory, and counting techniques; apply counting principals to problem solving; solve problems involving recursion and recurrence relations (including the use of technology in conjunction with elementary programming techniques); and analyze discrete mathematical relations.

Special Materials Required of Student
Graphing calculator

Minimum Instructional Facilities
1) Smart classroom with writing boards covering three walls, overhead projector, graphing utility overhead viewing panels, projection screen
2) Access to Math Lab

Method of Instruction
1) Lecture and discussion
2) Teamwork
3) Projects including written essay

Out-of-Class Assignments
1) Reading: Lecture notes; assigned textbook sections explaining mathematical concepts and procedures; instructional materials provided by the instructor; worked example sets; reference materials for mathematical symbols and notation; supplemental explanations from approved online resources; and documentation for graphing calculators or mathematical software.
2) Writing / Problem Solving: Problem sets requiring clear, step-by-step demonstration of reasoning using correct mathematical notation; written explanations supporting solutions and justifying methods; error analysis and revision of incorrect or incomplete work; solution summaries explaining conceptual understanding; problem-based learning tasks requiring application of multiple skills; written responses to mathematical prompts or inquiry problems; and organized documentation of problem-solving strategies used in individual or group assignments.
3) Other: Online homework assignments or quizzes using learning platforms; collaborative problem solving using shared documents or discussion boards; graph construction by hand and with technology; review and annotation of instructor feedback to revise and resubmit work; preparation for exams through practice tests and concept reviews; mathematical modeling activities using real-world data; use of graphing calculators or math software to explore and verify solutions; and completion of study logs, learning reflections, or structured practice plans to build mastery.

Texts and References

1) Required (representative example): Epp, Susanna. *Discrete Mathematics with Applications*. 5th edition. Cengage, 2020.
2) Supplemental: None

Student Learning Outcomes

Upon successful completion of this course, students will be able to:

1) Use recursion to analyze algorithms and programs.
2) Write proofs using symbolic logic and Boolean Algebra.
3) Use finite state machines to model computer operations.

*For the complete list of **learning objectives**, please see the **Course Objectives** section