

Common Course Outline

MATH 243

Discrete Mathematics

4 Semester Hours

The Community College of Baltimore County

Description

Students will be introduced to the theoretical tools for describing algorithmic operations.

Topics include set theory, the number system, the nature of proofs, recursion, formal logic, proof by induction, combinatorics, recurrence relations, graph theory, search problems, finite state automata, grammars, and languages. Students will be presented proofs and be expected to understand them and construct some proofs of their own. Prerequisites: Math 165.

Overall Course Objectives

Upon successfully completing the course students will be able to:

1. Perform set operations and show the relationships between number systems. (I, V, 1, 2, 5)
2. Evaluate, compose, compare, and contrast functions, relations, recursion and algorithms. (I, 2, 6, 7)
3. Assess the validity of logical expressions. (I, 2, 3, 7)
4. Apply the basic combinatorics formulas to counting problems. (I, IV, 1, 2, 4)
5. Compare and contrast algorithm complexity for common algorithms. (III, VI, 1, 2)
6. Construct and explain some basic proofs. (II, III, IV, V, 2, 3, 5)
7. Perform proofs using induction. (II, III, IV, V, 2, 3, 5)
8. Apply the concept of graphs, trees, paths, and circuits to real world situations. (V, 5, 6, 7)
9. Represent networks and relationships through the use of graphs and trees. (V, 5, 6, 7)
10. Perform and evaluate search problems and sorting algorithms. (IV, 3, 4)
11. [Examine the mathematical contributions made by people from diverse cultures throughout history.](#) (V, 5)
12. [Articulate a solution to mathematical problems.](#) (II, 2)
13. Apply appropriate technology to the solution of mathematical problems. (IV, 4, 5).

Major Topics

I. Logic and Proofs

- A. Propositions
- B. Logical Equivalence
- C. Quantifiers
- D. Proofs
- E. Mathematical Induction

II. Language of Mathematics

- A. Sets
- B. Sequences and Strings
- C. Relations
- D. Equivalence Relations
- E. Functions

III. Algorithms

- A. Notation for Algorithms
- B. Recursive Algorithms
- C. Complexity of Algorithms

IV. Counting Methods

- A. Basic Principles
- B. Permutations and Combinations
- C. Binomial Theorem
- D. Algorithms for Generating Permutations and Combinations

V. Recurrence Relations

- A. Solving Recurrence Relations
- B. Analysis of Algorithms

VI. Graph Theory

- A. Representation of Graphs
- B. Paths and Circuits
- C. Hamiltonian Circuits
- D. Weighted Graphs and Applications
- E. Shortest-Path Algorithms
- F. Structure and Principles of Trees
- G. Spanning Trees, Binary Trees
- H. Decision Trees

VII. Sorting and Searching techniques

- A. Bubble Search
- B. Binary Search
- C. Selection Sort
- D. Heapsort
- E. Quicksort

VIII. Automata, Grammars, and Languages (*optional*)

- A. Finite State Machines
- B. Finite State Automata
- C. Languages and Grammars
- D. Nondeterministic Finite State Automata

Course Requirements (General Education Goal #VII)

Students will be given opportunity to collaborate via group work and/or oral presentation of problem solutions. There will be multiple opportunities for the instructor to assess student progress in the course through classwork and/or homework.

Grading: Grading procedures will be determined by the individual faculty member but will include the following:

1. Two exams (30% applications based)
2. Oral presentation of homework solutions

Individual faculty members may include additional course objectives, major topics, and other course requirements to the minimum expectations stated in the Common Course Outline.

The Community College of Baltimore County is committed to providing a high-quality learning experience that results in growth in knowledge, attitudes, and skills necessary to function successfully as a transfer student, in a career and as a citizen. To accomplish this goal, we maintain high academic standards and expect students to accept responsibility for their individual growth by attending classes, completing all homework and other assignments, participating in class activities and preparing for tests.

We take seriously our responsibility to maintain high-quality programs and will periodically ask you to participate in assessment activities to determine whether our students are attaining the knowledge, attitudes and skills appropriate to various courses and programs. The assessment activities may take many different forms such as surveys, standardized or faculty-developed tests, discussion groups or portfolio evaluations. We ask that you take these activities seriously so that we can obtain valid data to use for the continuous improvements of CCBC's course and programs.

Date revised: 05/17/00
Updated: 03.05.07