

# Common Course Outline

## MATH 243

### Discrete Mathematics

4 Credits

## Community College of Baltimore County

### Description

**MATH 243 – Discrete Mathematics** introduces students 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 are presented proofs and expected to understand them and construct some proofs of their own.

### 4 Credits

**Prerequisite:** MATH 165 with a grade of “C” or better or a satisfactory score on the placement exam.

### Overall Course Objectives

Upon successfully completing this course students will be able to:

1. perform set operations and show the relationships between number systems;
2. evaluate, compose, compare, and contrast functions, relations, recursion and algorithms;
3. assess the validity of logical expressions and discuss ethics associated with validity encountered in other disciplines (fallacies, arguments, ...);
4. apply the basic combinatorics formulas to counting problems;
5. compare and contrast algorithm complexity for common functions and relations;
6. construct and explain some basic proofs;
7. perform proofs using induction;
8. apply the concept of graphs, trees, paths, and circuits to a variety of global and real world situations;
9. represent networks and relationships through the use of graphs and trees;
10. perform and evaluate search problems and sorting algorithms;
11. examine the mathematical contributions made by people from diverse cultures and their cultural significance throughout history using credible sources;
12. articulate a solution to mathematical problems when working collaboratively in small groups;
13. find, evaluate, use, and cite appropriate academic resources when completing their written assignments; and

14. use appropriate technology to the solution of mathematical problems.

### **Major Topics**

- I. Logic and Proofs
  - A. Propositions
  - B. Logical Equivalence and their Ethical Considerations
  - C. Quantifiers
  - D. Proofs
  - E. Mathematical Induction
- II. Language of Mathematics
  - A. Sets
  - B. Sequences and Strings
  - C. Relations
  - D. Equivalence Relation
  - 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
  - I. Topographical Applications in a Global and Diverse Community
- VII. Sorting and Searching techniques
  - A. Bubble Search
  - B. Binary Search
  - C. Selection Sort
  - D. Heapsort
  - E. Quicksort

## **Course Requirements**

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

### **Grading/exams**

- At least two exams (30% applications based)
- Written or oral presentation of project (10% of final grade)

Written Assignments: Students are required to use appropriate academic resources. Multiple assignments will infuse CCBC General Education Program objectives; at least one assignment worth a minimum 10% of the total course grade will allow students to demonstrate at least 5 of the 7 General Education Program outcomes.

### **Other Course Information**

This course is an approved General Education course in the Mathematics category. Please refer to the current CCBC Catalog for General Education course criteria and outcomes.

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