

Last Revised: August 2016

### COURSE INFORMATION

**Course Title:** Discrete Mathematics I **Course Number:** MACM 101 **Credits:** 3

**Total Weeks:** 14 (Fall, Spring)  
12 (Summer) **Total Hours:** 39 **Course Level:**  First Year  Second Year  
 New  Revised Course  
 Replacement Course

**Department:** Math/Statistics **Department Head:** G. Belchev **Former Course Code(s) and Number(s) (if applicable):** N/A

**Pre-requisites (If there are no prerequisites, type NONE):** PREC 12 and MATH 100 or MATH 120

**Co-requisite Statement (List if applicable or type NONE):** NONE

**Precluded Courses:** N/A

### COURSE DESCRIPTION

This course is an introduction to discrete mathematics. Students will examine some areas of mathematics that are frequently applicable to problems in computer science. Topics include logic and formal reasoning, sets, relations and functions, basic concepts of number theory, mathematical induction, enumeration, formal languages and automata, and graphs and trees.

### LEARNING OUTCOMES

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

1. Logic and Proofs:
  - a. Write English statements in symbolic form using logical connectives, predicates and quantifiers, and using truth tables and logic equivalence to determine the truth value of statements.
  - b. Use basic logical equivalence to determine if two statements are logically equivalent, prove further logic equivalences, simplify statements, and determine whether a statement is a tautology or a contradiction.
  - c. Symbolize simple verbal arguments and test their validity using truth tables, logic equivalence and the rules of inference.
  - d. Formulate short proofs using the methods of direct proof, proof by contraposition, proof by contradiction.
  - e. Understand how logic is used in the design of digital electronic circuits.
2. Sets:
  - a. Demonstrate a working knowledge of set notation and terminology such as set equality, subsets, proper subsets, empty set, power set, Cartesian product, union, intersection, complement, difference and symmetric difference.
  - b. Prove/disprove statements about sets using Venn-diagrams and logic.
3. Relations:
  - a. Understand binary relations and represent them by a set of ordered pairs, a matrix, a digraph and a point plot (graph).
  - b. Obtain new relations from given relations using set operations, composition and inverse.
  - c. Determine whether a relation is reflexive, symmetric, anti-symmetric, transitive, an equivalence relation or a partial order relation.
  - d. Identify the equivalence classes of an equivalence relation.

- e. Draw a Hasse diagram for a partial order relation.
4. Functions:
- a. Demonstrate an understanding of the concepts of function, domain, codomain, range using a variety of different functions.
  - b. Determine whether a function is injective, surjective, bijective, invertible.
  - c. Find the composite of functions and the inverse of a function.
  - d. Use bijection to determine the cardinality of a set, and to determine whether a set is countable or uncountable.
5. Induction and Recursion:
- a. Prove the truth of a statement using the principle of mathematical induction, including the strong form.
  - b. Use recursion to define functions, sequences, and sets and use induction to prove statements about them.
6. Integers:
- a. Prove statements involving divisibility, the fundamental theorem of arithmetic and prime numbers.
  - b. Represent natural numbers in various bases.
  - c. Calculate greatest common divisor (including with the Euclidean algorithm) and least common multiple.
  - d. Prove statements about congruence modulo  $m$  and solve linear congruences.
7. Counting
- a. Use the addition and multiplication rule, inclusion-exclusion, and tree diagrams to solve basic counting problems.
  - b. Solve counting problems involving permutations and combinations with or without repetition
  - c. Use the binomial theorem.
8. Finite Probability:
- a. Experiments, Outcomes, Sample space, Events, Probabilities, Properties of Probabilities.

**INSTRUCTION AND GRADING**

Instructional (Contact) Hours:

Type	Duration
Lecture	39
Seminars/Tutorials	
Laboratory	
Field Experience	
Other ( <i>specify</i> ):	
Total	39

**Grading System:** Letter Grades  Percentage  Pass/Fail  Satisfactory/Unsatisfactory  Other

**Specify passing grade:** 50%

**Evaluation Activities and Weighting** (total must equal 100%)

Assignments: 10% <i>Specify number of, variety, and nature of assignments:</i>	Lab Work: %	Participation: % <i>Specify nature of participation:</i>	Project: % <i>Specify nature of project:</i>
Quizzes/Test: 10%	Midterm Exams: 40%	Final Exam: 40%	Other: % <i>Specify:</i>

### TEXT(S) AND RESOURCE MATERIALS

Provide a full reference for each text and/or resource material and include whether required/not required.

Discrete Mathematics and Its Applications Latest edition, Kenneth H. Rosen, McGraw-Hill.

### COURSE TOPICS

List topics and sequence covered.

Week	Topic	Chapter
Week 1	Propositional logic, propositional equivalence	1.1, 1.3
Week 2	Arguments, rules of Inference, predicates, and quantifiers	1.6, 1.4
Week 3	Multiple quantifiers, arguments with quantified statements	1.5, 1.6
Week 4	Introduction to proofs	1.7
Week 5	Sets <b>MIDTERM 1</b>	2.1
Week 6	Set operations, Binary relations	2.2, 9.1, 9.3
Week 7	Properties of relations, equivalence relations, partial order relations	9.1, 9.5, 9.6
Week 8	Functions, cardinality of sets	2.3, 2.5
Week 9	Induction, recursive definitions	5.1, 5.2, 5.3
Week 10	Divisibility and modular arithmetic <b>MIDTERM 2</b>	4.1
Week 11	Modular arithmetic, representation of integers, primes Euclidean algorithm for finding GCD	4.1, 4.2, 4.3
Week 12	Solving congruences, basic counting techniques	4.4, 6.1
Week 13	Permutations and combination, Binomial theorem, Probability	6.3, 6.4

Week 14

**FINAL EXAM**

**NOTES**

1. Students are required to follow all College policies. Policies are available on the website at: [Coquitlam College Policies](#)
2. To find out how this course transfers, visit the BC Transfer Guide at: [bctransferguide.ca](http://bctransferguide.ca)