COQUITLAM COLLEGE
Established 1982

COURSE OUTLINE

Last Revised: November 2021 **Last Reviewed:** January 2022

COURSE INFORMATION

Course Title: Discrete Mathematics II **Course Number:** MACM 201 **Credits:** 3

Total Weeks: 14 (Fall, Spring)
12 (Summer)

Total Hours: 39

Course Level: ☐ First Year ☒ Second Year
☐ New ☐ Revised Course
☐ Replacement Course

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

Pre-requisites (If there are no prerequisites, type NONE): MACM 101 with a minimum grade of "C"

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

Precluded Courses: N/A

COURSE DESCRIPTION

A continuation of MACM 101. Topics covered include inclusion-exclusion, generating functions and recurrence relations, graphs and trees.

LEARNING OUTCOMES

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

Inclusion-Exclusion:

- Apply the inclusion-exclusion principle to problems with more than two sets.
- Use the principle of inclusion-exclusion to solve counting problems modeled after the problem of finding the number of integer solutions of a linear equation with constraints.
- Solve counting problems modeled after the number of onto functions from one finite set to another.
- Count the number of derangements of a set and solve counting problems based on this principle.
- Generating Functions:
- Derive generating functions for a sequence.
- Use ordinary and exponential generating functions to solve counting problems.

Recurrence Relations:

- Develop a recurrence relation to model a problem.
- Solve recurrence relations iteratively.
- Solve linear homogeneous recurrence relations with constant coefficients of second order.
- Verify solutions to linear nonhomogeneous recurrence relations.
- Use a generating function to solve a recurrence relation.
- Determine the big-O of divide-and-conquer recurrence algorithms such as the binary search.

Graphs:

- Represent a graph as an adjacency matrix or incidence matrix.
- Determine whether a pair of graphs is isomorphic.
- Demonstrate an understanding of connected, simple path, weighted graph, circuit, subgraph, complement, cut vertices, cut edges and degree of a vertex.
- Determine whether a graph has an Euler path or circuit.
- Determine whether a graph has a Hamiltonian path or cycle.

- Model and solve problems with a graph.
- Use Dijkstra's algorithm to find the shortest path between pairs of vertices in a weighted graph.
- Determine whether a graph is planar.
- Understand the chromatic polynomial of a graph.

Trees:

- Demonstrate an understanding of the terminology of rooted trees and m-ary trees.
- Form a binary search tree using a recursive algorithm and analyze the algorithm.
- Model a problem using a decision tree.
- Construct a binary tree which represents a given prefix coding scheme.
- Find the word represented by a bit string given a coding sequence.
- Demonstrate an understanding of a Huffman tree.
- Demonstrate an understanding of three algorithms for traversing all vertices of an ordered rooted tree (preorder, in-order and post-order traversal).
- Represent a complicated expression using a binary tree and write the expression in prefix, postfix or infix notation.
- Evaluate a prefix, postfix or infix expression.
- Demonstrate an understanding of several sorting algorithms and their complexity (bubble sort, merge sort, selection sort and quick sort).
- Find all the non-isomorphic spanning trees of a graph.
- Use a depth-first or breadth-first search to produce a spanning tree.
- Use Prim's or Kruskal's algorithm to construct a minimum spanning tree for a weighted graph

INSTRUCTION AND GRADING

Instructional (Contact) Hours:

Type	Duration
Lecture	39
Seminars/Tutorials	
Laboratory	
Field Experience	
Other (*specify):*	
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: 15% *Specify number of, variety, and nature of assignments:*	Lab Work: %	Participation: % *Specify nature of participation:*	Project: % *Specify nature of project:*
Quizzes/Test: %	2 Midterm Exams: %50	Final Exam: 35%	Other: %

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), by Kenneth H. Rosen, McGraw-Hill.
Discrete mathematics An Applied Introduction. (Latest edition), R. Grimaldi.

COURSE TOPICS

List topics and sequence covered.

Week	Course
Week 1	Graph Theory Definitions Subgraphs, Complements
Week 2	Graph Isomorphisms, Vertex Degree: Euler Trails and Circuits Planar Graphs
Week 3	Hamilton Paths and Cycles Graph coloring (optional)
Week 4	Advanced Probability, Review of Finite Probability Conditional Probability, Discrete Random Variables
Week 5	Inclusion-Exclusion, The Principle of Inclusion-Exclusion
Week 6	Generalized Inclusion-Exclusion Derangements
Week 7	Advanced Enumeration Introduction to Generating Functions Calculational Techniques Partitions of Integers **MID-TERM EXAM**
Week 8	Recurrence Relations, First-Order Linear Recurrence Relations Second-Order Linear Homogeneous
Week 10	Recurrence Relations with Constant Coefficients, Nonhomogeneous Recurrence Relations The Method of Generating Functions
Week 11	Optimization and Matching, Review of Trees
Week 12	Dijkstra's Shortest-Path Algorithm Minimum Spanning Trees: Kruskal's Algorithm
Week 13	Prim's Algorithms Matching Theory (optional)
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