CAMOSUN COLLEGE
School of Arts & Science
Department of Mathematics & Statistics

MATH-126-001
Basic Discrete Mathematics
Winter 2018

COURSE OUTLINE

The course description is online @ http://camosun.ca/learn/calendar/current/web/math.html

Ω *Please note: This outline will not be kept indefinitely. It is recommended students keep this outline for their records, especially to assist in transfer credit to post-secondary institutions.*

1. Instructor Information

(a)	**Instructor**	George Ballinger	
(b)	**Office hours**	See below	
(c)	**Location**	E256	
(d)	**Phone**	250-370-3116	**Alternative:**
(e)	**E-mail**	ballinger@camosun.bc.ca	
(f)	**Website**	georgeballinger.ca	

2. Intended Learning Outcomes

Upon completion of this course the student will be able to:

1. Establish the equivalence of compound propositions using truth tables and basic laws of logic.
2. Use rules of inference to determine the validity of arguments.
3. Translate English statements into quantified logic statements and vice versa.
4. Prove statements using direct and indirect proofs and ordinary and strong mathematical induction.
5. Prove set equivalences using membership, basic set identities and logical equivalences.
6. Determine whether functions are surjective, injective or bijective.
7. Compare the cardinality of finite and infinite sets through the use of bijections and distinguish between countable and uncountable sets.
8. Describe the growth of functions using big-O, big-Omega and big-Theta notation.
9. Solve problems using the fundamental concepts of number theory and perform simple proofs involving divisibility, prime factorization and congruences.
10. Use the Euclidean algorithm to find greatest common divisors and use other algorithms to convert numbers between different bases.
11. Define functions and sequences recursively.
12. Use permutations and combinations to solve counting and probability problems, including those in which repetition is allowed.
13. Apply the pigeonhole principle to solve counting problems.
14. Prove identities involving the binomial theorem using both algebraic and combinatorial arguments.
15. Model counting problems using recurrence relations.
16. Solve divide and conquer recurrence relations for n=bk and give big-O estimates for increasing functions.
17. Identify and describe different types of graphs and their connectivity.

3. Required Materials

(a) Texts

SEE BELOW

(b) Other

4. Course Content and Schedule

(Can include: Class hours, Lab hours, Out of Class Requirements and/or Dates for quizzes, exams, lecture, labs, seminars, practicums, etc.)

SEE BELOW

5. Basis of Student Assessment (Weighting)

(Should be directly linked to learning outcomes.)

(a) Assignments

SEE BELOW

(b) Quizzes

(c) Exams

(d) Other (e.g. Project, Attendance, Group Work)

6. Grading System

| X | Standard Grading System (GPA) |

| | Competency Based Grading System |

7. Recommended Materials to Assist Students to Succeed Throughout the Course

SEE BELOW

8. College Supports, Services and Policies

Immediate, Urgent, or Emergency Support

If you or someone you know requires immediate, urgent, or emergency support (e.g. illness, injury, thoughts of suicide, sexual assault, etc.), **SEEK HELP**. Resource contacts @

http://camosun.ca/about/mental-health/emergency.html or http://camosun.ca/services/sexual-violence/get-support.html#urgent

College Services

Camosun offers a variety of health and academic support services, including counselling, dental, disability resource centre, help centre, learning skills, sexual violence support & education, library, and writing centre. For more information on each of these services, visit the **STUDENT SERVICES** link on the College website at http://camosun.ca/

College Policies

Camosun strives to provide clear, transparent, and easily accessible policies that exemplify the college's commitment to life-changing learning. It is the student's responsibility to become familiar with the content of College policies. Policies are available on the College website at http://camosun.ca/about/policies/. Education and academic policies include, but are not limited to, Academic Progress, Admission, Course Withdrawals, Standards for Awarding Credentials, Involuntary Health and Safety Leave of Absence, Prior Learning Assessment, Medical/Compassionate Withdrawal, Sexual Violence and Misconduct, Student Ancillary Fees, Student Appeals, Student Conduct, and Student Penalties and Fines.

A. GRADING SYSTEMS *http://camosun.ca/about/policies/index.html*

The following two grading systems are used at Camosun College:

1. Standard Grading System (GPA)

Percentage	Grade	Description	Grade Point Equivalency
90-100	A+		9
85-89	A		8
80-84	A-		7
77-79	B+		6
73-76	B		5
70-72	B-		4
65-69	C+		3
60-64	C		2
50-59	D		1
0-49	F	Minimum level has not been achieved.	0

2. Competency Based Grading System (Non GPA)

This grading system is based on satisfactory acquisition of defined skills or successful completion of the course learning outcomes

Grade	Description
COM	The student has met the goals, criteria, or competencies established for this course, practicum or field placement.
DST	The student has met and exceeded, above and beyond expectation, the goals, criteria, or competencies established for this course, practicum or field placement.
NC	The student has not met the goals, criteria or competencies established for this course, practicum or field placement.

B. Temporary Grades

Temporary grades are assigned for specific circumstances and will convert to a final grade according to the grading scheme being used in the course. See Grading Policy at http://camosun.ca/about/policies/index.html for information on conversion to final grades, and for additional information on student record and transcript notations.

Temporary Grade	Description
I	*Incomplete*: A temporary grade assigned when the requirements of a course have not yet been completed due to hardship or extenuating circumstances, such as illness or death in the family.
IP	*In progress*: A temporary grade assigned for courses that are designed to have an anticipated enrollment that extends beyond one term. No more than two IP grades will be assigned for the same course.
CW	*Compulsory Withdrawal*: A temporary grade assigned by a Dean when an instructor, after documenting the prescriptive strategies applied and consulting with peers, deems that a student is unsafe to self or others and must be removed from the lab, practicum, worksite, or field placement.

Mathematics 126
Basic Discrete Mathematics
Winter, 2018

Instructor: George Ballinger
Office: Ewing 256
E-mail: ballinger@camosun.bc.ca
Website: georgeballinger.ca   (click the MATH 126 link for course information)
Telephone: 250-370-3116
Timetable:

Time	Monday	Tuesday	Wednesday	Thursday	Friday
8:30 am – 9:20 am					
9:30 am – 10:20 am	MATH 101-002 Room Y217	MATH 101-002 Room Y217	MATH 101-002 Room Y217	MATH 101-002 Room Y217	MATH 101-002 Room Y217
10:30 am – 11:20 am	MATH 101-003 Room Y217	MATH 101-003 Room Y217	MATH 101-003 Room Y217	MATH 101-003 Room Y217	MATH 101-003 Room Y217
11:30 am – 12:20 pm	Office Hour E256	Office Hour E256	Office Hour E256	Office Hour E256	Office Hour E256
12:30 pm – 1:20 pm					
1:30 pm – 2:20 pm					
2:30 pm – 3:20 pm	MATH 126-001 Room Y227	MATH 126-001 Room Y219	MATH 126-001 Room Y219	MATH 126-001 Room Y219	
3:30 pm – 4:20 pm		A&S Chairs Meeting			
4:30 pm – 5:20 pm					

Important Dates:

January 8	First day of class
January 22	Fee deadline
February 12	Family Day (no class)
February 13-16	Reading Break (no class)
March 14	Withdrawal deadline
March 30	Good Friday (no class)
April 2	Easter Monday (no class)
April 13	Last day of class
April 16-21, 23-24	Final exam period

Calendar Description: This course, which primarily targets mathematics and computer science students, provides an introduction to discrete mathematics. Topics include logic, proof techniques including mathematical induction, basic set theory, functions, cardinality of sets, asymptotic notation, properties of integers, permutations and combinations, pigeonhole principle, recursive definitions, divide and conquer recurrence relations and a brief introduction to graphs. [3 Credits]

(Source: Camosun College Calendar camosun.ca/learn/calendar/current/web/math.html#MATH126)

Prerequisites: C in MATH 100 or MATH 125.

|	
Transfer:	MATH 126 transfers to UVic's MATH 122 "Logic and Foundations" course, which is a prerequisite for several UVic courses and a requirement of many UVic major programs including:

UVic Courses
MATH 212 - Introduction to Algebra
MATH 222 - Discrete and Combinatorial Mathematics
MATH 236 - Introduction to Real Analysis
CSC 225 - Algorithms and Data Structures 1

UVic Programs	
Astronomy (recommended)	Financial Mathematics & Economics
Computer Science	Mathematics
Computer Science & Geography [Geomatics]	Mathematics & Chemistry
Computer Science & Health Information Science	Mathematics & Computer Science
Computer Science & Music	Mathematics & Physics
Computer Science & Physics	Mathematics & Statistics
Computer Science & Psychology	Software Engineering
Computer Science & Statistics	Statistics (honours)
Computer Science & Visual Arts	

Textbook: K.H. Rosen, *Discrete Mathematics and Its Applications*, Seventh Edition, McGraw-Hill, 2012.

Course Content:

Chapters and Sections
1. The Foundations: Logic and Proofs
   - 1.1 Propositional Logic
   - 1.2 Applications of Propositional Logic
   - 1.3 Propositional Equivalences
   - 1.4 Predicates and Quantifiers
   - 1.5 Nested Quantifiers
   - 1.6 Rules of Inference
   - 1.7 Introduction to Proofs
   - 1.8 Proof Methods and Strategy
2. Basic Structures: Sets, Functions, Sequences, Sums, and Matrices
   - 2.1 Sets
   - 2.2 Set Operations
   - 2.3 Functions
   - 2.4 Sequences and Summations
   - 2.5 Cardinality of Sets
3. Algorithms
   - 3.2 The Growth of Functions
4. Number Theory and Cryptography
   - 4.1 Divisibility and Modular Arithmetic
   - 4.2 Integer Representations and Algorithms
   - 4.3 Primes and Greatest Common Divisors
5. Induction and Recursion
   - 5.1 Mathematical Induction
   - 5.2 Strong Induction and Well-Ordering
   - 5.3 Recursive Definitions and Structural Induction
6. Counting
   - 6.1 The Basics of Counting
   - 6.2 The Pigeonhole Principle
   - 6.3 Permutations and Combinations
   - 6.4 Binomial Coefficients and Identities
   - 6.5 Generalized Permutations and Combinations
7. Discrete Probability
   - 7.1 An Introduction to Discrete Probability
8. Advanced Counting Techniques
   - 8.1 Applications of Recurrence Relations
   - 8.3 Divide-and-Conquer Algorithms and Recurrence Relations
   - 8.5 Inclusion-Exclusion
10. Graphs
   - 10.1 Graphs and Graph Models
   - 10.2 Graph Terminology and Special Types of Graphs
   - 10.4 Connectivity
   - 10.5 Euler and Hamilton Paths
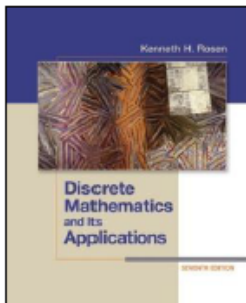
Learning Outcomes:	The Intended Learning Outcomes for this course, as approved by the Education Council, are as follows. Upon successful completion of this course a student will be able to:

1. Establish the equivalence of compound propositions using truth tables and basic laws of logic.
2. Use rules of inference to determine the validity of arguments.
3. Translate English statements into quantified logic statements and vice versa.
4. Prove statements using direct and indirect proofs and ordinary and strong mathematical induction.
5. Prove set equivalences using membership, basic set identities and logical equivalences.
6. Determine whether functions are surjective, injective or bijective.
7. Compare the cardinality of finite and infinite sets through the use of bijections and distinguish between countable and uncountable sets.
8. Describe the growth of functions using big-O, big-Omega and big-Theta notation.
9. Solve problems using the fundamental concepts of number theory and perform simple proofs involving divisibility, prime factorization and congruences.
10. Use the Euclidean algorithm to find greatest common divisors and use other algorithms to convert numbers between different bases.
11. Define functions and sequences recursively.
12. Use permutations and combinations to solve counting and probability problems, including those in which repetition is allowed.
13. Apply the pigeonhole principle to solve counting problems.
14. Prove identities involving the binomial theorem using both algebraic and combinatorial arguments.
15. Model counting problems using recurrence relations.
16. Solve divide and conquer recurrence relations for $n=b^k$ and give big-O estimates for increasing functions.
17. Identify and describe different types of graphs and their connectivity.

A&S Math Lab:	Ewing 224: This drop-in centre is freely available for your use to work on math homework and to seek help from the instructional assistant (see hours posted on door or online at camosun.ca/services/help-centres/#MATH).
Support and Services:	There are a variety of services available that can assist you throughout your learning. For more information please see camosun.ca/services.
Academic Integrity:	The Department of Mathematics and Statistics has prepared a handout called *Student Guidelines for Academic Integrity* to help you interpret college policies involving student conduct, academic dishonesty, plagiarism, etc. It is your responsibility to become familiar with the contents of the document and the college policies it references.
Calculator Policy:	As per department policy, the only calculator permitted for use on tests and the final exam is the Sharp EL-531 (or EL-510R) scientific calculator. No other calculator or any other electronic device including cell phones, electronic translators, smartwatches, iPods, etc. is allowed.
Homework:	There will be periodic assignments to be handed in for marking. Collaboration with your classmates is permitted, but you must submit your own work. LATE ASSIGNMENTS WILL NOT BE ACCEPTED.
Tests:	If you miss a test for a legitimate reason such as illness, accident or family affliction, you should notify me as soon as possible and provide supporting documentation. There will be no "make-up" tests. In the event of an excused absence, the mark from your final exam or relevant subset thereof will replace your test mark.

Final Exam: A comprehensive, 3-hour final exam will take place during the final exam period of April 16-21, 23-24. The specific date, time, and location will be announced on or about February 23. You must write the final exam at the scheduled time as per Camosun College's policy on final examinations. See camosun.ca/learn/calendar/current/procedures.html#academic.

Grade Calculation: The final grade will be calculated according to the following breakdown:

Assignments: 15%*
Term Tests: 35%
Final Exam: 50%

* *Note:* The lowest assignment mark will be dropped when calculating the assignment average. This allows you to miss one assignment without penalty.

Grade Scale: Final letter grades are assigned as follows:

0-49	50-59	60-64	65-69	70-72	73-76	77-79	80-84	85-89	90-100
F	D	C	C+	B−	B	B+	A−	A	A+

For information on Camosun College's grading policy, see policy E-1.5 on the webpage camosun.ca/about/policies/policies.html#education.