SUNY OLD WESTBURY

Department of Mathematics and Computer & Information Science

DISCRETE MATHEMATICS MA3030

Departmental Syllabus

TEXTBOOK: Discrete Mathematics: An Introduction to Mathematical Reasoning, 5th edition, by Susanna Epp, Cengage Learning;, 2019.

Prerequisite: A grade of C or higher in Precalculus, MA2090

COURSE DESCRIPTION: An introduction to discrete mathematical structures. Topics include propositional and predicate logic, set theory, relations and functions, induction and recursion, algorithms and number theory, and graphs and trees.

COURSE OBJECTIVES: This course is designed to provide the mathematical foundations for upper level computer science and mathematics courses. Students should learn the essentials of discrete mathematical structures and how to think and reason mathematically. To accomplish these objectives, the course emphasizes mathematical reasoning and problem solving techniques. After successful completion of the course students should be able to communicate ideas mathematically and solve problems using the mathematical tools learned. The main topics we cover are:

- Symbolic logic. Students will learn how to construct truth tables for compound statements, how to use rules of inference, and how to construct two column proofs. Direct proof, indirect proof, and proofs by cases will be covered.

- Basic set theory. The notation of common set operations will be covered, and students will transition from the rigid two-column style into a more fluid text-based construction of proofs, while still maintaining the same rigor.

- Relations and functions. Specifically, equivalence relations, injective functions, and surjective functions will be defined. Students will learn how to prove a given relation/function satisfies these definitions, and will also be expected to construct abstract proofs regarding these definitions that do not rely on explicit examples.

- Sequences and Proof by Induction. After learning the notation of sequences, both explicitly defined and recursively defined, students learn the format of proof by induction. Both weak and strong induction are covered, as is proof by infinite descent/the well-ordering principle.

• An introduction to Graph Theory, including several important algorithms on graphs. Fleury's, Prim's, and Dijkstra's algorithms are covered.

COURSE LEARNING OUTCOMES:

Students will demonstrate mathematical skills and quantitative reasoning, including the ability to

- interpret and draw inferences from appropriate mathematical models such as formulas, graphs, and logic;
- represent mathematical information symbolically, visually, numerically, or verbally as appropriate; and
- employ quantitative methods which includes knowledge and ability in the areas of arithmetic, algebra, set theory and geometry and proof to solve problems.

COURSE EVALUATION & GRADING: Your grade will be based on exams, quizzes, class work, and homework. There will be in class cumulative final exam. The grading scale is as follows:

A = [94, 100]	**B** $^{+}$ = [87, 89]	**C** $^{+}$ = [77, 79]	**D** $^{+}$ = [67, 69]	
A$^{\sim}$ = [90, 93]	**B** = [84, 86]	**C** = [74, 76]	**D** = [64, 66]	**F** = [0, 59]
	B $^{\sim}$ = [80, 83]	**C** $^{\sim}$ = [70, 73]	**D** $^{\sim}$ = [60, 63]	

TUTORIAL: Drop-in tutorial is available in the Mathematics Learning Center during the Fall and Spring semesters.

ACCOMMODATIONS FOR STUDENTS WITH SPECIAL NEEDS: If you have or suspect you may have a physical, psychological, medical or learning disability that may impact your course work, please contact The Office of Services for Students with Disabilities (OSSD), Office NAB room 2064, Phone: 516-876-3009. All support services are free and all contacts with the OSSD are strictly confidential.

TOPICS TO BE COVERED

Textbook **Discrete Mathematics: An Introduction to Mathematical Reasoning**, by Susanna Epp, Cengage Learning, 2019.

THE LOGIC OF COMPOUND STATEMENTS

Introduction to Sets
Logical Form and Logical Equivalence
Conditional Statements
Valid and Invalid Arguments

THE LOGIC OF QUANTIFIED STATEMENTS

Predicates and Quantified Statements I
Predicates and Quantified Statements II
Statements with Multiple Quantifiers

ELEMENTARY NUMBER THEORY AND METHODS OF PROOF

Direct Proof and Counterexample I: Introduction
Direct Proof and Counterexample II: Rational Numbers
Direct Proof and Counterexample III: Divisibility
Direct Proof and Counterexample IV: Division into Cases and the Quotient-Remainder Theorem
Indirect Argument: Contradiction and Contraposition

SEQUENCES, MATHEMATICAL INDUCTION, AND RECURSION

Sequences
Mathematical Induction I
Mathematical Induction II
Defining Sequences Recursively
Solving Recurrence Relations by Iteration

SET THEORY

Set Theory: Definitions and the Element Method of Proof
Properties of Sets
Disproofs and Algebraic Proofs

FUNCTIONS

Functions Defined on General Sets
One-to-one, Onto, Inverse Functions
Composition of Functions

RELATIONS

Relations on Sets

Nov 2024

Reflexivity, Symmetry, and Transitivity
Equivalence Relations

GRAPHS AND TREES

Graphs: An Introduction
Trails, Paths, and Circuits
Matrix Representations of Graphs
Isomorphisms of Graphs
Trees: Examples and Basic Properties
Rooted Trees