

# MATH 2305: Discrete Mathematics

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# **1 Logic and Proofs**

**1.1 Propositional Logic**

**1.2 Propositional Equivalences**

**1.3 Predicates and Quantifiers**

**1.4 Nested Quantifiers**

**1.5 Rules of Inference**

**1.6 Introduction to Proofs**

**1.7 Proof Methods and Strategy**

## **2 Sets, Functions, Sequences, Sums, and Matrices**

### **2.1 Sets**

### **2.2 Set Operations**

### **2.3 Functions**

### **2.4 Sequences and Summations**

# **3 Algorithms**

## **3.1 Algorithms**

# **4    Number Theory and Cryptography**

**4.1   Divisibility and Modular Arithmetic**

**4.2   Integer Representation and Algorithms**

**4.3   Primes and Greatest Common Divisors**

**4.4   Solving Congruences**

# **5 Induction and Recursion**

## **5.1 Mathematical Induction**

## **5.2 Strong Induction and Well-Ordering**

## **5.3 Recursive Definitions and Structural Induction**

## **5.4 Recursive Algorithms**

# 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**

## **8.2   Inclusion-Exclusion**

# **9 Relations**

## **9.1 Relations and Their Properties**

# **10    Graphs**

## **10.1    Graphs and Graph Models**

## **10.2    Graph Terminology and Special Types of Graphs**

# 11 Trees

## 11.1 Introduction to Trees