

**3450:208 Introduction to  
Discrete Mathematics  
Review of Course Topics**

1. Logic

- Propositions
- Connectives (not, and, or, implies, iff), and precedence
- Truth Tables
- Converse, inverse and contrapositive of conditional statements
- The algebra of propositions : de Morgan's laws, etc.
- Valid and invalid arguments

2. Logic Gates and Circuits

- Logic Gates
- Input/Output Table
- Canonical Sum-of-products
- Karnaugh maps
- Logic Circuits

3. Binary and Hexadecimal Number Systems

- Conversion : Decimal to and from Binary
- Conversion : Decimal to and from Hexadecimal
- Conversion : Binary to and from Hexadecimal
- Conversion : n-bit two's complement
- Binary and Hexadecimal addition

4. Quantifiers

- Universal quantifier
- Existential quantifier
- Domain
- Truth set
- Negations of quantified statements

- Contrapositive of a quantified implication

5. Proofs

- Proofs of quantified statements
- Counterexamples for quantified statements
- Syllogisms and diagrams of validity

6. Integers

- The division algorithm
- DIV and MOD
- The Chinese Remainder Theorem
- The Euclidean GCD algorithm
- The floor and ceiling functions

7. Set Theory

- Definition of set operations
- Venn diagrams
- The algebra of sets
- Power sets

8. Boolean algebras

- Definition
- Dual statements
- Proofs in Boolean algebras
- Deducing statements in symbolic logic and set theory

9. The Halting Problem

10. Combinatorics (Counting)

- Counting integers in lists
- Simple probabilities
- The Sum rule of counting
- The Multiplication rule of counting
- Permutations
- Combinations

11. Functions

- Definition : functions defined on sets, domain, codomain, range
- Piecewise-defined functions
- Logarithmic functions
- Hashing functions
- One-to-one functions
- Onto functions
- Inverse functions
- The Pigeonhole Principle
- Composition of functions
- Statement of the PMI
- Statement of the PCI
- Using the PMI or PCI to prove sum and product formulae
- Using the PMI or PCI to prove divisibility, inequalities
- Using the PMI or PCI to solve recurrence relations

## 12. Relations

- Definition of relations, domain, range, inverse
- The directed graph of a relation
- Reflexive, symmetric, transitive, antisymmetric relations
- Equivalence relations, equivalence classes
- Partial orders, total orders

## 13. Recursion

- Definition of recurrence relation; initial conditions
- Solving problems by recursion
- Solving recurrence relations by iteration

## 14. Sequences

- Sum and product notation
- Writing sums and products in closed form
- Writing sums and products as recurrence relations
- Finding terms of sequences
- Finding general formulae for sequences
- Evaluating sums and products

## 15. Mathematical Induction