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

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

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
• 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