Virginia Community College Course Content Summary

Course Title: MTH 288: Discrete Mathematics

Course Description
Presents topics in sets, counting, graphs, logic, proofs, functions, relations, mathematical induction, Boolean Algebra, and recurrence relations. Lecture 3 hours per week. 3 credits.

General Course Purpose
The goal is to give the student a solid grasp of the methods and applications of discrete mathematics to prepare the student for higher level study in mathematics, engineering, computer science, and the sciences.

Course Prerequisites/Corequisites
Prerequisite: Completion of MTH 263 Calculus I with a grade of C or better or equivalent.

Course Objectives
Upon completing the course, the student will be able to:

Note: Methods of proofs and applications of proofs are emphasized throughout the course.

Logic - Propositional Calculus
● Use statements, variables, and logical connectives to translate between English and formal logic.
● Use a truth table to prove the logical equivalence of statements.
● Identify conditional statements and their variations.
● Identify common argument forms.
● Use truth tables to prove the validity of arguments.

Logic - Predicate Calculus
● Use predicates and quantifiers to translate between English and formal logic.
● Use Euler diagrams to prove the validity of arguments with quantifiers.

Logic - Proofs
● Construct proofs of mathematical statements - including number theoretic statements - using counterexamples, direct arguments, division into cases, and indirect arguments.
● Use mathematical induction to prove propositions over the positive integers.

Set Theory
● Exhibit proper use of set notation, abbreviations for common sets, Cartesian products, and ordered n-tuples.
● Combine sets using set operations.
● List the elements of a power set.
● Lists the elements of a cross product.
● Draw Venn diagrams that represent set operations and set relations.
● Apply concepts of sets or Venn Diagrams to prove the equality or inequality of infinite or finite sets.
● Create bijective mappings to prove that two sets do or do not have the same cardinality.

Functions and Relations
● Identify a function's rule, domain, codomain, and range.
● Draw and interpret arrow diagrams.
● Prove that a function is well-defined, one-to-one, or onto.
● Given a binary relation on a set, determine if two elements of the set are related.
● Prove that a relation is an equivalence relation and determine its equivalence classes.
● Determine if a relation is a partial ordering.

Counting Theory
● Use the multiplication rule, permutations, combinations, and the pigeonhole principle to count the number of elements in a set.
● Apply the Binomial Theorem to counting problems.
Graph Theory
● Identify the features of a graph using definitions and proper graph terminology.
● Prove statements using the Handshake Theorem.
● Prove that a graph has an Euler circuit.
● Identify a minimum spanning tree.

Boolean Algebra
● Define Boolean Algebra.
● Apply its concepts to other areas of discrete math.
● Apply partial orderings to Boolean algebra.

Recurrence Relations
● Give explicit and recursive descriptions of sequences.
● Solve recurrence relations.

Major Topics to be Included
Logic – Propositional Calculus
Logic - Predicate Calculus
Logic - Proofs
Set Theory
Functions and Relations
Counting Theory
Graph Theory
Boolean Algebra
Recurrence Relations