Miami-Dade Community College
MAD 3107: Discrete Structures

Course Description:

Topics include sets, logic, switching circuits, Boolean Algebra, combinatorics, probability, mathematical proofs, mathematical induction, functions, relations, and graph theory. Credit is not also given for MAD 2104. *Three credits*.
Prerequisite: MAC 2312.

Course Competencies:

Competency 1:   The student will demonstrate an understanding of set theory, logic, switching circuits, and Boolean algebra by

    a. recognizing that sets, logic, and switching circuits share the properties of Boolean algebra.
    b. performing basic operations on sets, including union, intersection, complementation, and Cartesian product.
    c. determining the power set of a given set.
    d. constructing truth tables of logical expressions or statements.
    e. determining whether or not a logical statement is a tautology.
    f. recognizing the various forms of valid arguments.
    g. determining a logical equivalence and/or a negation of a statement involving quantifiers.
    h. determining logical equivalences of a compound statement.
    i. simplifying a switching circuit.
    j. applying the properties of Boolean algebra to simplify a Boolean expression.
    k. applying the properties of Boolean Algebra to convert a Boolean expression to conjunctive and/or disjunctive normal form.
    l. proving properties of sets, logic, switching circuits, and/or Boolean algebra.

Competency 2:   The student will demonstrate an understanding of combinatorics and probability by

    a. counting objects in a finite set by applying sophisticated counting techniques such as the fundamental counting principle, combinations, and permutations.
    b. counting objects in the union of finite sets using the inclusion-exclusion principle.
    c. solving counting problems using the pigeonhole principle.
    d. computing probabilities by counting outcomes in a sample space and in an event using combinatorics.

    e. determining whether two or more events are mutually exclusive, independent, or dependent.
    f. computing conditional probabilities.
    g. computing the probability of an event within a stochastic process by using a tree diagram.

Competency 3:   The student will demonstrate an understanding of mathematical proof by

    a. writing a direct proof
    b. writing an indirect proof and/or proof by contradiction.
    c. writing a proof by mathematical induction.

Competency 4:   The student will demonstrate an understanding of functions and relations by

    a. determining the domain, codomain, and range of a given function or relation defined between two sets.
    b. determining whether or not a given function is an injection, surjection, or bijection.
    c. determining the composition of two given functions.
    d. determining the inverse of a given injection.

Competency 5:   The student will demonstrate an understanding of graph theory by

    a. identifying various types of graphs such as simple graphs, multigraphs, pseudographs, directed graphs, and directed multigraphs.
    b. determining the number of edges and vertices of a given graph.
    c. representing graphs by matrices.
    d. determining whether or not two given graphs are isomorphic.
    e. determining whether or not a given graph contains an Eulerian path and/or circuit.
    f. determining whether or not a given graph contains a Hamiltonian path and/or circuit.