# MATH-2010: INTRODUCTION TO DISCRETE MATHEMATICS

## Cuyahoga Community College

### Viewing: MATH-2010 : Introduction to Discrete Mathematics

**Board of Trustees:**
2007-05-24

**Academic Term:**
Fall 2020

**Subject Code**
MATH - Mathematics

**Course Number:**
2010

**Title:**
Introduction to Discrete Mathematics

**Catalog Description:**
Foundation course in discrete mathematics with applications. Topics include logic, methods of proof, elementary number theory, set theory, functions, efficiency of algorithms, and mathematical induction.

**Credit Hour(s):**
4

**Lecture Hour(s):**
4

### Requisites

**Prerequisite and Corequisite**
MATH-1530 College Algebra or MATH-153H College Algebra or MATH-1580 Precalculus; or sufficient score on assessment test; or departmental approval: equivalent coursework.

### Outcomes

**Course Outcome(s):**
Apply logical analysis to compound statements.

**Objective(s):**
1. Construct truth tables for compound, conditional, and biconditional statements.
2. Apply DeMorgan's Laws.
3. Determine the negation, contrapositive, converse, and inverse of a conditional statement.
4. Prove or disprove the validity of an argument.
5. Recognize and apply the argument forms of modus ponens and modus tollens.

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**Course Outcome(s):**
Apply logical analysis to quantified statements.

**Objective(s):**
1. Prove or disprove the validity of an argument with quantified statements.
2. Find the truth set of a predicate.
3. Prove the truth or falsity of universal statements and existential statements.
4. Determine the negation of universal statements and existential statements.
5. Interpret and negate multiply-quantified statements.

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**Course Outcome(s):**
Apply basic methods of proof to elementary number theory.

**Objective(s):**

1. Prove existential statements with constructive proof of existence.
2. Disprove universal statements with a counterexample.
3. Prove theorems and statements using the methods of direct proof, proof by contradiction, and proof by contraposition.

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**Course Outcome(s):**

Apply basic methods of proof to set theory.

**Objective(s):**

1. Define and apply the basic properties of and operations on sets.
2. Recognize and form partitions of sets, power sets, and Cartesian products.
3. Prove or disprove subset relations and set identities.
4. Define and apply the properties of a Boolean algebra.

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**Course Outcome(s):**

Apply properties of functions to evaluate the efficiency of an algorithm.

**Objective(s):**

1. Graph basic functions in the Cartesian plane, including power functions, functions defined on sets of integers, multiples of functions, increasing and decreasing functions, exponential functions, and logarithmic functions.
2. Determine the order of a function using O-, Omega-, and Theta-notations.
3. Evaluate the efficiency of an algorithm.

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**Course Outcome(s):**

Apply mathematical induction to prove conjectures about the outcomes of processes.

**Objective(s):**

1. Define and apply the basic properties of sequences.
2. Compute and apply properties of summations and products.
3. Prove conjectures by mathematical induction and strong mathematical induction.

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**Course Outcome(s):**

Apply methods and ideas learned throughout this course to computer science.

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**Methods of Evaluation:**

1. A minimum of 3 periodic exams
2. Quizzes
3. Homework
4. In-class collaborative work
5. Computer application problems
6. Comprehensive final exam

**Course Content Outline:**

1. Logic
    a. Truth tables
        i. Compound statements
        ii. Conditional and biconditional statements
            1. negation
            2. contrapositive
            3. converse
            4. inverse
    b. DeMorgan"s Laws
    c. Validity of an argument
        i. Modus ponens
        ii. Modus tollens
        iii. Contradiction rule

2. Quantified statements
    a. Truth set
    b. Universal statements
        i. Truth or falsity
        ii. Negation
    c. Existential statements
        i. Truth or falsity
        ii. Negation
    d. Multiply-quantified statements
        i. Truth or falsity
        ii. Negation
    e. Arguments with quantified statements
3. Number theory and proofs
    a. Proof of existence
    b. Counterexample
    c. Direct proof
    d. Proof by contradiction
    e. Proof by contraposition
4. Set theory and proofs
    a. Properties of and operations on sets
        i. Subset
        ii. Proper subset
        iii. Union
        iv. Intersection
        v. Difference
        vi. Complement
        vii. Partition
        viii. Power set
        ix. Cartesian product
    b. Proofs
        i. Subset relations
        ii. Set identities
    c. Boolean algebras
        i. Definition
        ii. Proofs
5. Functions and proofs
    a. Basic functions
    b. Boolean functions
    c. One-to-one functions
    d. Onto functions
    e. One-to-one correspondences
    f. Inverse functions
    g. Composition of functions
6. Efficiency of an algorithm
    a. Graph basic functions
        i. Power functions
        ii. Functions defined on sets of integers
        iii. Multiples of functions
        iv. Increasing and decreasing functions
        v. Exponential functions
        vi. Logarithmic functions
    b. Order of a function
        i. O-notation
        ii. Omega-notation
        iii. Theta-notation
7. Mathematical induction
    a. Sequences
    b. Sums and products

c. Proofs by mathematical induction
d. Proofs by strong mathematical induction

## Resources

Epp, Susanna S. *Discrete Mathematics with Applications.* 3rd ed. Belmont, CA: Brooks/Cole-Thomson Learning, 2004.

Rosen, Kenneth H. *Discrete Mathematics and Its Applications.* 6th ed. New York, NY: McGraw-Hill, 2007.

Lipschutz, Seymour, and Marc Lars Lipson. *2000 Solved Problems in Discrete Mathematics.* New York, NY: McGraw-Hill, 1992.

Lipschutz, Seymour, and Marc Lars Lipson. *Schaum's Outline of Discrete Mathematics.* 2nd ed. New York, NY: McGraw-Hill, 1997.

Haggard, Gary, John Schlipf, and Sue Whitesides. *Discrete Mathematics for Computer Science.* Belmont, CA: Brooks/Cole-Thomson Learning, 2006.

**Resources Other**

1. Instructor companion website. http://www.thomsonedu.com (http://www.thomsonedu.com/)

## Instructional Services

**OAN Number:**
Ohio Transfer Module TMMSL

Top of page
Key: 2869