

The Mathematics Program

Discrete Math

Discrete Mathematics introduces students to the mathematics of networks, social choice, and decision making. The course extends students' application of matrix arithmetic and probability. Applications and modeling are central to this course of study. Appropriate technology, from manipulatives to calculators and application software, should be used regularly for instruction and assessment.

Prerequisites

- Describe phenomena as functions graphically, algebraically and verbally; identify independent and dependent quantities, domain, and range, input/output, mapping.
- Translate among graphic, algebraic, numeric, tabular, and verbal representations of relations.
- Define and use linear and exponential functions to model and solve problems.
- Operate with matrices to model and solve problems.
- Define complex numbers and perform basic operations with them.

Competency Goal 1:

The learner will use matrices and graphs to model relationships and solve problems.

Objectives

Student will be able to...

1.01 Use matrices to model and solve problems.

- a. Add and Subtract Matrices
- b. Multiply matrices
- c. Look at long term trends by repetitive multiplication of a transition matrix
- d. Solve matrix equations using an inverse matrix
- e. Create and solve matrices for the Leslie method, Lontief Input-Output model, Markov Chains and Game Theory.

1.02 Use graph theory to model relationships and solve problems

- a. Modeling projects
- b. Find critical paths
- c. Find Euler Circuits and paths
- d. Find Hamiltonian Circuits and Paths

- e. Use graph coloring
- f. Distinguish between planar and non-planar graphs
- g. Create trees
- h. Find the shortest path and minimum spanning trees

Competency Goal 2:

The learner will apply probability concepts to solve problems.

Objectives

Student will be able to...

2.01 Apply properties, definitions, and theorems of angles and lines to solve problems and write proofs.

- a. Use addition and multiplication principles.
- b. Calculate and apply permutations and combinations.
- c. Create and use simulations for probability models.
- d. Find expected values and determine fairness.
- e. Identify and use discrete random variables to solve problems.
- f. Apply the Binomial Theorem.

2.02 Model and solve problems involving fair outcomes:

- a. Perform Apportionment. Apportion representatives for various populations
- b. Perform Election Theory techniques, which includes Plurality, Borda Method, Run off and Sequential Run Off, and Condorcet winners.
- c. Calculate Voting Power.
- d. Perform Fair Division techniques of dividing estates and cakes.

Competency Goal 3:

The learner will describe and use recursively-defined relationships to solve problems.

Objectives

Student will be able to...

3.01 Use recursion to model and solve problems.

- a. Identify and use numbers patterns to solve problems

- b. Find the sum of a finite sequence.
- c. Find the sum of an infinite sequence.
- d. Determine whether a given series converges or diverges.
- e. Write explicit definitions using iterative processes, including finite differences and arithmetic and geometric formulas.
- f. Determine colors of pixels in the Mandelbrot set based on its recursive pattern.
- g. Create a fractal.
- h. Create savings, mortgage and annuity spreadsheets

Discrete Mathematics Through Applications

Authors: Crisler, Fisher, and Froelich

Publisher: W. H. Freeman Publishers

Copyright: 2006