

Finite Math and Statistics

I. Description of the Course

A. Purpose

This course provides an elective college preparatory math course as an alternative to Trigonometry/Math Analysis or Calculus.

1. Encourage all students to take four years of mathematics.
2. Allow math students to see the practical uses of math.

B. Grade Placement

11th and 12th Grades

C. Prerequisites

Successful completion of Algebra 3/4 with a C or Better

D. Credit

5.0 or 10.0 credits of mathematics, 1st or 2nd semester

E. Text

For All Practical Purposes: Introduction to Contemporary Mathematics, fourth edition, W.H. Freeman and Company, 1997

II. Topics of the Course

- A. Reviewing and Extending Algebra 3/4 and Geometry Skills
- B. Coding Information
- C. Statistics
- D. Management Science
- E. Social Choices and Decision Making (Optional)

III. Student Objectives

- A. Reviewing and Extending Algebra 3/4 and Geometry Skills

The student will:

1. Become more proficient at **Algebra 3/4 Skills** by:
 - a) Using graphic calculators
 - b) Solving complicated equations
 - c) Working with exponents and roots
 - d) Graphic functions
 - e) Solving literal equations
 - f) Factoring and simplifying algebraic expressions

2. Become more proficient at **Geometry Skills** by
 - a) using scaling factor
 - b) finding area and perimeter
 - c) finding volume and surface areas
 - d) working with parallel postulate
 - e) using Fibonacci sequence
 - f) using four transformations
 - g) working with regular polygons
 - h) working with tiling

B. Coding Information

The student will:

1. Become familiar with the basic elements of **identification numbers** by:
 - a) understanding the purpose of a check digit and be able to determine one for various schemes
 - b) being given an identification number and the scheme used to determine it, and being
 - c) able to decide if the number is a valid number for that scheme.
 - d) converting a given ZIP code to its corresponding bar code, and vice versa
 - e) converting a given UPC number to its corresponding bar code.
2. Become familiar with the basic elements of **transmitting information** by:
 - a) knowing what a binary code is
 - b) computing check digits for code words given the parity check sums for the code

C. Statistics

The student will:

1. Become familiar with the basic elements of **producing data** by:
 - a) learning the difference between good and bad sampling methods
 - b) learning what is the simple random sample and using a table of random digits to produce a simple random sample
 - c) learning about statistical estimation and the margin of error
 - d) learning about experiments versus observations and randomized comparative experiments
 - e) discussing ethics in experiments

2. Become familiar with describing data by:
 - a) making dot plots and histograms
 - b) learning to discuss shape, center and spread of distributions of data, and more specifically, calculating the median and mean, finding quartiles, making a box plot, and calculating the standard deviation
 - c) learning how to make and describe scatter plots, how to use a graphing calculator to enter data and calculate equations for regression lines, and how to use regression lines to estimate additional values
 - d) discussing sophisticated computerized ways of graphing data in more than two dimensions

D. Social Choices and Decision Making (Optional)

The student will:

1. Become familiar with the basic elements of **elections with two or more alternatives** by:
 - a) understanding how only two alternatives are fair
 - b) explaining, applying, knowing how to use, and knowing what the difference is between the majority rule and the plurality method
 - c) discussing why voting with three or more candidates is never fair.
 - d) explaining the process of approval voting and discussing its consideration in political races
2. Become familiar with **weighted voting systems** by:
 - a) identifying winning and losing coalitions by analyzing a given weighted voting system
 - b) calculating the number of coalitions for a given weighted voting system
 - c) listing the eight coalitions for a three-voter weighted voting system
 - d) calculating the theoretically possible ways that the participants can vote; that is, all the different combinations of yes and no votes.
 - e) listing the possible permutations for a three- or four-voter weighted voting system
3. Become familiar with **fair division problem** by:
 - a) describing the goal of a fair-division problem
 - b) listing three different categories of fair-division problem
 - c) explaining what is meant by a continuous and discrete case fair-division problem
4. Become familiar with **apportionment** by:
 - a) explaining the difference between quota and apportionment
 - b) recognizing the difference in computing quotas between the Hamilton method and divisor methods
 - c) explaining why Webster's method is the "best" apportionment method
 - d) calculating the critical divisor for each state

IV. Skill Objectives

A. Basic Study Skills

The student will learn and apply:

1. Skills of acquiring new information: listening, observing, interviewing, and reading.
2. Note taking skills for various types of classroom activities.
3. Skills analyzing written and visual data presented in textbooks, the media, and through technology.
4. Effective communication skills.
5. The vocabulary, terminology and key concepts central to contemporary math.

B. Critical Thinking Skills

The student will learn and apply skills by:

1. Identifying and clarifying questions for discussion and further research.
2. Critically analyzing facts and opinions.
3. Recognizing and interpreting causes and effects.
4. Predicting consequences of a series of events.

C. Participation and Citizenship Skills

The student will:

1. Learn and apply skills to better participate in society by understanding how math permeates all aspects of life.
2. Review **probability** and understand its **relevance to statistics** by:
 - a. reviewing simple probabilities and counting methods
 - b. learning about sampling distributions and then: connection to the normal distribution
 - c. learning about probability as an area
 - d. learning about the normal curve, and specifically, how the mean and standard deviation of a normal distribution relate to the shape of the normal curve
 - e. learning about and using the 68-95-99.7 rule regarding the percent of the observations within one, two or three standard deviations
 - f. learning about and applying the central limit theorem
3. Become familiar with **statistical inference** by:
 - a. learning the difference between parameters and statistics
 - b. finding standard deviations of sampling distributions
 - c. learning about confidence intervals
 - d. learning to estimate population means and state them with confidence intervals
 - e. learning about statistical process control
 - f. discussing the dangers inherent in data analysis

D. Management Science (Sections 1 and 2 optional)

The student will:

1. Become familiar with the basic elements of **street networks** by:
 - a. identifying vertices, edges, determine the valence of a graph
 - b. constructing a graph by street network and know if it is connected graph
 - c. identifying, defining and determining the existence of an Euler Circuit, which is a circuit that covers every edge only once.
 - d. determining how to change a circuit into an Euler Circuit
2. Become familiar with **Hamiltonian circuits**, **heuristic algorithm**, and a **tree** by
 - a. defining and determining the Existence of a Hamiltonian Circuit, which is a circuit that starts and ends at the same place and only visits each vertex once.
 - b. differentiating between an Euler circuit and a Hamiltonian circuit
 - c. defining algorithm and the advantages or disadvantages of heuristic algorithm.
 - d. defining the steps in the nearest-neighbor and the sorted-edges algorithms
 - e. defining tree
 - f. explaining the difference between a graph and a directed graph
3. Become familiar with **planning** and **scheduling** by:
 - a. stating the assumptions for the scheduling model
 - b. describing and applying the list-processing algorithm
 - c. explaining how a bin-packing problem differs from a scheduling problem
 - d. solving problems using next-fit, first-fit, and worst-fit bin-packing algorithm
4. Become familiar with **Linear Programming** by:
 - a. creating a chart to represent a linear programming problem with two or more variables
 - b. listing two methods for solving linear programming with many variables
 - c. graphing linear equalities and inequalities in a coordinate-axis system
 - d. using feasible region to evaluate profit function and maximum profit