MISSOURI WESTERN STATE UNIVERSITY

COLLEGE OF LIBERAL ARTS AND SCIENCES

DEPARTMENT OF COMPUTER SCIENCE, MATHEMATICS, AND PHYSICS

COURSE NUMBER: MAT 110E

COURSE NAME: Contemporary Problem Solving

COURSE DESCRIPTION:

Mathematics for solving selected real-world problems using elementary graph theory, data analysis, probability, and the mathematics of finance. (4 credit hours: 3 hours lecture, 2 hours lab)

PREREQUISITE:

ACT math subscore of at least 18 or a sufficient score on the math placement exam or successful completion of MAT 083 or departmental approval.

TEXT:

This course does not require any textbooks.

TECHNOLOGY:

Use of scientific calculators will be required throughout the course and each student must have access to a suitable scientific calculator. The scientific calculator must have logarithmic and exponential capabilities, and depending on the instructor, the ability to do combinations and permutations.

COURSE OBJECTIVES:

Mathematics is important in the life of every citizen and, in particular, in the life of every college graduate. Colleges and universities should strive to ensure that every graduate has achieved quantitative literacy in the sense of being able confidently to analyze, discuss, and use quantitative information; to develop a reasonable level of facility in mathematical problem solving; to understand connections between mathematics and other disciplines; and to use these skills as an adequate base for life-long learning.

(FOCUS, Volume 13, Number 3, June 1993)

This course is intended to satisfy the general studies mathematics requirement for a baccalaureate degree. It is also designed to produce mathematically literate citizens by illustrating practical applications of mathematics. In order to meet this goal, students will learn how to:

1. Recognize real-world problems as network problems; translate these problems into graph theoretical language; choose an appropriate technique for solving the problem.

2. Use counting techniques to determine the number of ways of performing various tasks; relate this to probability.

3. Use basic rules of probability to find probabilities; draw a probability tree and compute basic conditional probabilities with a tree.

4. Construct various visual displays of data; calculate the measures of central tendency and dispersion; understand the properties of the normal distribution and calculate its probabilities.

5. Use the mathematics of finance to compute interest, future value, finance charges, monthly payments, and present value.

6. Communicate mathematical ideas correctly both symbolically and verbally.

   The instructor may determine additional objectives based on additional material that may be covered in the course.

STUDENT COMPETENCIES:

Successful students in Contemporary Problem Solving will be able to do or perform the following:

1. Build a graph theoretical model of a real-world situation.

2. Determine whether a graph has an Euler circuit, and if it does, find the Euler circuit.

3. Eulerize a graph that is not Eulerian.

4. Find a Hamilton path and Hamilton circuit of a graph.

5. Determine whether a graph is complete.

6. Solve a Traveling Salesman Problem using the Brute-Force Algorithm, the Nearest Neighbor Algorithm, and the Best-Edge (Cheapest Link) Algorithm.

7. Use the Fundamental Counting Principle.

8. Identify whether a combination or permutation would be appropriate to count the elements of a given set.

9. Compute probabilities using counting techniques.

10. Compute probabilities using a probability tree.

11. Construct visual displays of data including a frequency table and a histogram.

12. Compute the mean, median, and find the mode of a given data set.

13. Find the values in the Five-Number Summary.

14. Determine the range and the standard deviation of a data set.

15. Understand the properties of the normal distribution; compute z-scores and determine probabilities using the standard normal table.

16. Find and interpret a confidence interval.

17. Compute simple interest, compound interest, and determine the future value of an account for each type of interest.

18. Calculate the time necessary for a current account to reach a desired amount.

19. Calculate the monthly payment of an installment loan and compute the finance charge on a credit card loan.

20. Find the future value of an ordinary annuity, as well as determine the payments of a sinking fund.

21. Compute the payments of an amortized loan and the present value of an annuity.

    The instructor may identify additional competencies based on other material that may be covered in the course.

COURSE OUTLINE:

I. Graph Theory

   A. Euler Circuits and Applications

   B. The Traveling Salesman Problem
      1. Hamiltonian Circuits
      2. Nearest Neighbor Algorithm
      3. Best Edge (Cheapest Link) Algorithm

   C. Trees and Kruskal's Algorithm

II. Data Analysis and Probabilities

A. Counting
   1. Trees and Lists
   2. The Fundamental Counting Principle
   3. Combinations and Permutations

B. Probability
   1. Sample Spaces and Events
   2. Basic Properties of Probability
   3. Probability Trees and Conditional Probability

B. Descriptive Statistics
   1. Visual Displays of Data
   2. Measures of Central Tendency
   3. Measures of Dispersion
   4. The Normal Distribution
      a. Properties
      b. Areas under the Standard Normal Curve
   5. Confidence Intervals

III. The Mathematics of Finance

A. Interest
   1. Simple Interest
   2. Compound Interest
   3. Future Value of an Account

B. Loans
   1. Monthly Payment
   2. Finance Charge

C. Annuities
   1. Future Value of an Ordinary Annuity
   2. Payment for a Sinking Fund

D. Amortization
   1. Payment on an Amortized Loan
   2. Present Value of an Annuity

V. Other Mathematics Applications

The instructor shall determine other material to be covered in this course. These topics should include applications of mathematics related to problem solving. Topics may be but are not limited to the following: Set Theory, Logic, Counting, Voting Theory, Apportionment, Geometry,

Algebraic Models, Matrices, Number Theory, Mathematical Applications of Music.