

Course: Linear Programming

PEIMS Code: N1110026

Abbreviation: LINPROG

Number of credits that may be earned: 1/2

Brief description of the course (150 words or less):

Students are introduced to the six-steps used to solve Linear Programming problems and will practice each one. Students learn the process and techniques of using Linear Programming. Students research the historical development, purpose, and application of Linear Programming and apply the methods they have learned to real-world situations in a chosen career.

Essential Knowledge and Skills of the course:

Unit 1: Introduction to Linear Programming

- 1) Understand the concept of linear programming and why it's useful
- 2) Understand the history behind linear programming
- 3) Understand the concept of optimization problems
- 4) Understand the definitions of feasible region, optimal solution, constraints and restraints
- 5) Understand the concept of minimize or maximize solutions to problems given sets of constraints
- 6) Identify real world situations that can be described as linear programs

Unit 2: Graphical Introduction to Linear programming

- 1) Use graphs of systems to locate and identify the feasible regions
- 2) Isolate variables to find solutions for graphing
- 3) Test feasible solutions
- 4) Graph 3 dimension representations

Unit 3: Background and Matrix Operations

- 1) Use logical reasoning to identify situations that require linear programming
- 2) Recall and use symbol logic
- 3) Determine the validity of statements



- 4) Find the implications given conditions
- 5) Use basic matrix operations to solve problems
- 6) Use Row Echelon Form to solve systems of equations
- 7) Use Matrix Algebra to transpose and find determinants that are useful in solving problems
- 8) Know when and how to use Cramer's Rule to solve problems
- 9) Know matrix inversion

Unit 4: Tableaux and Pivoting

- 1) Write linear programs using matrix notation
- 2) Rewrite optimization problems as a linear program in standard form and as a canonical form
- 3) Manipulate problems by solving linear equations and eliminating variables
- 4) Rewrite linear programs in tableau form and solve using pivoting

Unit 5: The Simplex Method

- 1) Determine a feasible tableau
- 2) Determine the optimal solution by using elementary row operation in an algorithm called the simplex method
- 3) Write the augmented matrix of the system of equations
- 4) Use geometric interpretation

Unit 6: Transportation Problems

- 1) Apply linear programming to transportation problems
- 2) Find the feasible solution for transportation problems
- 3) Find the total transportation cost
- 4) Use linear programming to interpret cost per job per person and maximize the total cost.

Unit 7: Matrix Games

- 1) Use the simplex method to maximize one player's payoff
- 2) Relate matrix games with linear programming
- 3) Understand the concept of saddle point in relation to matrix games



- 4) Find the max min and min max given a matrix game
- 5) Solve a matrix game by linear programming

Description of the specific student needs this course is designed to meet:

Running a profitable business requires a careful balancing of resources (people, people's time, materials, and machine availability). A manager must choose the best use of these resources. Linear Programming, a relatively new branch of mathematics, provides mathematical methods for finding the best solution. Today, by using Linear Programming methods on computers, many otherwise impossible decision-making problems can be solved, such as routing millions of long distance calls over an immense network of telephone lines. This course teaches students to solve applied problems in their selected careers.

Major resources and materials to be used in the course:

An Illustrated Guide to Linear Programming by Saul I. Gass

Required activities and sample optional activities to be used:

This is a practical course for beginning operation researchers in which techniques are demonstrated by the teacher, by videos, by small or large groups, or by other professionals. Students then use guided practice to master the techniques. Students are required to select a career. They must choose an aspect of this career and apply Linear Programming. Primary and secondary research is demonstrated through the use of the library, internet, and classroom materials. Students interview a professional in their chosen career. Each student uses the techniques of Linear Programming to find maximum or minimum results. Finally, the student will develop a project using a model and linear programming to present to the class.

Methods for evaluating student outcomes:

Daily grades will be given on practice problems using skills and concepts.

Test grade given on evaluation of knowledge of concepts and the methods for applying them.

Project grade given on individual, small group and class (as in a business setting) work toward solving a particular linear programming problem using the concept studied.

Required qualifications of teachers:

Bachelor's degree in mathematics or several graduate math courses in addition to a bachelor's in education with math as a first teaching field.



Additional information (optional):

Original Course Creator: Dallas Independent School District