

# Course Outline

## 1. Document Information

Degree Program	Computer Science
Course Number	MATH/CS 472
Course Title	Linear Programming
Semester Hours	3
Course Coordinator	Math Department
Revision Term	
Latest Revision	

## 2. Catalog Description

Introduction to finding extreme values of linear functionals subject to linear constraints. Topics include: recognition, formulation, and solution of real problems via the simplex algorithm; development of the simplex algorithm; artificial variables; the dual problem and duality theorem; complementary slackness; sensitivity analysis; and selected applications of linear programming.

## 3. Textbooks

- Linear Programming. Chvatal, Vasek. New York: W.H. Freeman & Co., 1983. ISBN: 9780716715870.
- An Introduction to Linear Programming and Game Theory, Paul R. Thie, John Wiley & Sons, New York, 1988.

## 4. References

## 5. Course Learning Outcomes

- To learn the theory and application of linear programming.

## 6. Assessment of the Contribution to Student Outcomes

Outcome	1	2	3	4	5	6	7	8	9	10
Assessed	X									X

## 7. Prerequisites by Topic

Mathematics 221 with C or better.

## 8. Major Topics Covered in the Course

- Definition and description of the model:  
 Objective function, constraints, feasibility restrictions, solution, feasible solution, optimal feasible solution.  
 Topology of the constraint set: convexity, inequalities, and intersections of inequalities, extreme points, and convex combination.  
 Simultaneous linear equations: statement of the problem, Gaussian reduction, Cramer's rule, rank, linear independence, spanning set, basic solutions, basic variables, degeneracy {6 classes}
- The Simplex Method:  
 Revised form of a linear programming problem, slack and surplus variables, matrix form, activity vectors, requirements vector, cost vector, rank.  
 precautions during phase 2 under certain phase 1 conditions. Examples.  
 Unrestricted variables: substitution, costs, activity vectors. Examples {10 classes}
- Duality Theory:  
 General Form of primal and dual, example, economic interpretation, and alternate forms.  
 Fundamental properties. Dual of the dual, relation of objective functions, equality of objective functions, existence of optimal solutions, unbounded solutions.  
 Complementary slackness: statement of conditions, proof, alternate forms. {8 classes}
- Revised Simplex and Sensitivity:  
 Post optimality problems, changing the price vector, changing the requirements vector, adding variables, adding constraints, parametric programming {9 classes}
- Transportation Problems:  
 Origins and destinations, shipping costs, objective function, form of the LP problem  
 The Stepping-Stone Algorithm: initial basic feasible solution, North West corner rule, tableau format, computation of  $z_{ij} - c_{ij}$ . Improving a basic feasible solution, vector to enter, vector to leave, transformation of tableau, optimality. Degeneracy {7 classes}