Prefix, Number and Name of Course: ACM 620  Optimization of Discrete Models

Credit Hours: 1
In Class Instructional Hours: 1  Labs: 0  Field Work: 0

Catalog Description:
Prerequisite: MAT 202 or equivalent
Real-world problems which optimize linear objective functions subject to systems of linear inequalities are formulated mathematically and solved by the two-phase revised simplex method. Applications are given in diverse areas such as business management, industry, economics, finance, and game theory.

Reasons for Addition or Revision:
To create a one-semester-hour core module for the graduate Professional Applied and Computational Mathematics program where students will formulate and solve mathematical models for optimization problems encountered in a variety of business and industrial settings.

<table>
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<th>Student Learning Outcomes:</th>
<th>Course Content References:</th>
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<tbody>
<tr>
<td>Students will:</td>
<td>I</td>
<td>1. Group work in class, individual homework assignments, exams.</td>
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<td></td>
<td>II</td>
<td>2. Group work in class, individual homework assignments, exams, and computer projects.</td>
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<td>III</td>
<td>3. Individual homework assignments, exams and computer projects.</td>
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<td>IV</td>
<td>4. Group work in class, individual homework assignments, computer projects, exams.</td>
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Student Learning Outcomes:
1. formulate optimization problems mathematically as linear programming (LP) problems.
2. solve LP problems by hand and (for larger problems) by use of technology.
3. analyze and interpret the solutions to the primal and dual LP problems.
4. construct solutions to applied problems from diverse settings using methods from operations research.

Course Content:

I. Mathematical modeling
   A. Formulating real-world problems as linear programs
   B. Graphical solutions of two-variable problems
   C. Pathological cases

II. Operations research
   A. Simplex method: algebraic derivation
   B. Avoiding pitfalls: Bland’s theorem
   C. Revised simplex method: matricial formulation
   D. Implicit prices
E. Programming the simplex method

III. Duality
   A. Formulating the dual LP problem
   B. Relationship between the primal and dual problems
   C. Checking optimal solutions
   D. Complementary slackness
   E. Sensitivity analysis

IV. Selected applications
   A. Allocation of resources
   B. Scheduling production and inventory
   C. The cutting-stock problem
   D. Approximating data by linear functions
   E. Matrix games: minimax theorem

Resources:

Scholarships in the Field:


**Periodicals:**

*Advanced Modeling and Optimization*
*Computational Optimization and Applications*
*Journal of Computational Mathematics and Optimization*
*Journal of Optimization Theory and Applications*
*Optimization Methods and Software*
*Optimization – A Journal of Mathematical Programming and Operations Research*
*SIAM Journal of Optimization*

**Electronic and/or Audiovisual Resources:**


Journal of the Operations Research Society of America, JSTOR.


Undergraduate Applications in Mathematics Modules, COMAP.