MATH 487
Deterministic Operations Research
3 Credits

Instructor: Prof. T. Quint
Office: DMS 325
Email: quint@unr.edu
Office Hours: MW 4:00-5:00PM

Course Description: Linear programming and duality theory, integer programming, dynamic programming, PERT scheduling, EOQ inventory model, and nonlinear programming. Emphasis is on both theory and applications.

Prerequisites: MATH 182; completion of CO 1 – 8; junior or senior standing.
Recommended Preparation: MATH 330

Course materials:
• Computer and Software: You will need to have access to a PC, so that you can run LINDO and LINGO. These programs come free-of-charge with the required textbook, and are also installed on the computers in the Math Center.

Course Objectives:
• Core Objective 13 (Integration & Synthesis): Students will be able to integrate and synthesize Core knowledge, enabling them to analyze open-ended problems or complex issues.
Specifically, students will learn to:
• Set up and model real world problems as linear/nonlinear/integer programs, scheduling problems, shortest path problems, max-flow problems and/or spanning tree problems.
• Use the simplex method to solve linear programs
• Use sensitivity analysis to investigate the robustness and range of validity of a linear programming model.
• Demonstrate understanding of the economic interpretations of the primal linear program and its dual, and/or the basic theorems of duality theory.
• Use current optimization software tools, such as LINDO and LINGO.

Student Learning Outcomes: Students will be able to
• Use methods of deterministic operations research to model real-world situations, and interpret the results to reach sound conclusions (CO 2).
• Communicate, in written form, the results of a model in the context of current thought on the situation being modeled (CO 1).
• Distinguish between sound and unsound interpretations of model results applied to issues affecting society (CO 9).
• Analyze a problem’s societal context and the impact of context on sound interpretation of mathematical models applied to real-world situations (CO 13).
**Special Note:** This course emphasizes both the theory and the applications of deterministic operations research, perhaps with a little more emphasis on the applications. For a purely theoretical course, take MATH 751. I strongly encourage students to eventually take MATH 751 in addition to this course; the two courses complement each other nicely.

**Grading policy:** A letter grade for the course is based on homework (20%), midterm exam (30%), and the final exam (50%). Grading is done on a curve; however anyone that attains the percentages below is guaranteed at least the corresponding grade on the following scale:

<table>
<thead>
<tr>
<th>Letter</th>
<th>A</th>
<th>A-</th>
<th>B+</th>
<th>B</th>
<th>B-</th>
<th>C+</th>
<th>C</th>
<th>D+</th>
<th>D</th>
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<tbody>
<tr>
<td>Score</td>
<td>93%</td>
<td>90%</td>
<td>87%</td>
<td>83%</td>
<td>80%</td>
<td>77%</td>
<td>70%</td>
<td>67%</td>
<td>60%</td>
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Plus/minus grading WILL be used. You will not need blue books for any exam.

**Homework:** There will be weekly assignments. For longer problems, you might not get full credit unless you show your work. Note that homework counts 20%, so not doing it can kill your grade.

In many HW problems involving real-world applications, you will be asked to model them and/or analyze them using the techniques of deterministic operations research. This will require demonstration of an understanding of problem context and how results are interpreted in terms of that context. In particular, in their written work students will be expected to communicate their assumptions and conclusions in a way that a non-specialist would understand.

Some of the applications covered in homework include how to most efficiently achieve school integration via school busing, manage financial portfolios, develop inventory policy for businesses, and achieve wastewater disposal. Many of these problems will be presented in the form of “business school style” cases.

**Calendar and Topics:** Lectures and Readings from Winston. It is a good idea to try and do each lecture’s reading before the appropriate lecture. Note that this is only a tentative schedule – I’ll let you know of any changes!

<table>
<thead>
<tr>
<th>WEEK</th>
<th>SUBJECT</th>
<th>READING</th>
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<tbody>
<tr>
<td>1-3</td>
<td>Linear Programming</td>
<td>Chapter 3</td>
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<tr>
<td>4-5</td>
<td>Sensitivity Analysis</td>
<td>Chapter 5</td>
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<td>5</td>
<td>Duality</td>
<td>Sections 6.5-6.7</td>
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<tr>
<td>6-7</td>
<td>Integer Programming</td>
<td>Chapter 9</td>
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<tr>
<td>8</td>
<td>Midterm</td>
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<td>8-9</td>
<td>Networks</td>
<td>Chapter 8</td>
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<tr>
<td>10-11</td>
<td>Inventory Theory-EOQ Model</td>
<td>Chapter 15</td>
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<td>12-13</td>
<td>Dynamic Programming</td>
<td>Chapter 18</td>
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<td>14-15</td>
<td>Nonlinear Programming</td>
<td>Chapter 11</td>
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**Academic Dishonesty:** “Cheating, plagiarism or otherwise obtaining grades under false pretenses” constitute academic dishonesty according to the code of this university. Academic dishonesty will not be tolerated and penalties can include canceling a student's enrollment without a grade, giving an F for the course or for the assignment. For more details, see the University of Nevada, Reno General Catalog.

**Disability Services:** Any student with a disability needing academic adjustments or accommodations is requested to speak with me or the Disability Resource Center (Thompson Building, Suite 101) as soon as possible to arrange for appropriate accommodations.

**Academic Success Services:** Your student fees cover usage of these three centers:

- Math Center (784-4433 or [www.unr.edu/mathcenter/](http://www.unr.edu/mathcenter/)),
- Tutoring Center (784-6801 or [www.unr.edu/tutoring-center](http://www.unr.edu/tutoring-center))
- University Writing Center (784-6030 or [http://www.unr.edu/writing-center](http://www.unr.edu/writing-center)).

These centers support your classroom learning; it is your responsibility to take advantage of their services. Keep in mind that seeking help outside of class is the sign of a responsible and successful student.

**Audio and Video Recording:** Surreptitious and covert videotaping of class or unauthorized audio recording of class is prohibited by law and by Board of Regents policy. This class may be videotaped or audio recorded only with the written permission of the instructor. In order to accommodate students with disabilities, some students may have been given permission to record class lectures and discussions. Therefore, students should understand that their comments during class may be recorded.