Intermediate Deterministic Models (3334)

Spring 2021 Course Description

**Instructor:** Dr. Frommer ([Ian.Frommer@uscga.edu](mailto:Ian.Frommer@uscga.edu), 860-444-8398, Satterlee 144)

**Course Objectives:**

1. to deepen and extend knowledge in **deterministic modeling and optimization**
2. to develop proficiency in **computer implementation** and solution of deterministic modeling problems
3. to increase **attention to detail** in technical work produced (including written, computational, and oral)

**Course knowledge areas.** This course covers problem solving at an intermediate level in the following areas of Operations Research: linear programming, mixed-integer programming, combinatorial optimization, multiple-objective optimization, network optimization, constraint programming, nonlinear optimization, and others.

**Computer implementation.** The size and complexity of many of the problems we will consider makes solution by hand or even by spreadsheet (e.g. Excel) untenable. Instead, we will implement these problems in computer programs (primarily in Python) that take advantage of existing solver code libraries. For example, we will solve complex linear programs in Python using the PuLP library. It is important that you refresh and maintain your knowledge of such Python constructs as functions, lists, dictionaries, objects, file I/O, libraries, and more. While it will not typically be required, you are welcome to use Jupyter notebooks (as opposed to Spyder) in this course.

**Attention to detail.** Often in your prior ORCA courses, you have received partial credit on problems when you incorrectly formatted results or made a small mistake that caused your solution to be incorrect, your program to crash or produce incorrect results, etc. For the practicing Operations Research Analyst, there is no such thing as partial credit. Small mistakes, formatting errors, and the like can have major consequences from losing large contract awards to incorrect system outputs to catastrophic real-time system failures. With this in mind, there will be more emphasis placed on correct solutions and correct formatting in this course as compared with previous ORCA courses. Meeting this objective will help prepare you for your Capstone work and future OR/Analytics work you may do.

**Prerequisites**:

3231 (Linear Optimization), 3235 (Computer Modeling Languages), and 3333 (NaNO) or instructor permission

**Textbooks:**

**Required:**

1. W.L. Winston, *Operations Research: Applications and Algorithms*, 4th edition, Brooks/Cole, 2004.
2. C.T. Ragsdale, *Spreadsheet Modeling & Decision Analysis*, 8th edition, Cengage Learning, 2018.

**Recommended:**

1. R. Bronson & G. Naadimuth, *Schaum’s Outlines – Operations Research*, 2nd edition, McGraw Hill, 1997.
2. S. Epp, *Discrete Mathematics with Applications*, 4rd edition, Brooks/Cole, 2011.
3. C. Hortsmann & R. Necaise, *Python for Everyone,* 2nd edition, Wiley, 2016.
4. B. Miller & D. Ranum, *Problem Solving with Algorithms and Data Structures using Python*, 2nd Edition,

Franklin, Beedle and Associaties, 2011.

1. G. Woolsey, *The Woolsey Papers*, Lionheart Press, 2003.

**Course Requirements:**

**Homework.** There will be regular reading and homework assignments, to be announced in class and/or electronically on D2L. In support of the course **attention to detail** objective, homework will require a specific format with a cover sheet that will be supplied to you either on D2L or hard copy. Homework will be graded based on effort, correctness, or a combination of the two, along with attention to detail in formatting. Late homework will generally incur a penalty of 50%.

**Quizzes.** Quizzes **may** be given periodically. If so, quiz problems will be based on material from prior classes, homework, and exams. Quizzes may be announced or unannounced and may require the use of a computer. Doing the work required of you in class and on assignments and frequently reviewing and practicing what you have learned will serve as the best preparation for quizzes.

**Exams.** There will be a **midterm** **exam** and a **final exam.** These will cover material and techniques used in class and possibly extensions thereof.

**Course Grading:**

**Course Item Points**

Midterm Exam 100

Final Exam 150

Quizzes 0-100

Homework 50

**Total 300 - 400**

**Distraction Policy.** Use of smart phones / computers / tablets for non-class activities (e.g., checking email), working on assignments for other classes, reading novels, and other similar distractions during class time detract from your attention, distract those around you and distract your instructor. This will negatively impact your performance and may reduce your course grade. Please refrain from these activities in this class.

**Extra Help**. Please contact me if you are in need of extra help in this course using my contact information at the top of this Course Description, via Teams or in person.

**Extra Credit.** Extra credit may be available during the semester.