IEE 574: Applied Deterministic Operations Research Models (Fall 2022)

*** This is only the first page of the syllabus; the full copy will be distributed/posted on the first day of class ***

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Class numbers: 72437.

Course description: This is an advanced course on deterministic operations research techniques. The course will focus on translating real-life problems into suitable mathematical models, obtaining optimal solutions from the models, and carrying out further analyses from the solutions. To this end, we will review elements of the operations research approach and consider a variety of real-world applications including (but not limited to) production planning, blending, scheduling, assignment, and transportation. We will discuss different classes of mathematical programming models, but the primary emphasis will be on linear, integer, and mixed-integer programming. Related topics to be covered include archetypal operations research models, graphical solution approaches, convexity, the simplex and revised simplex algorithms, duality properties and theorems, sensitivity analysis, multiobjective optimization, goal programming, modeling of special logic restrictions via integer programming, branch & bound algorithms, dynamic programming, and other advanced operations research concepts and techniques. To enhance the practicality of the course, assigned activities will include implementing course concepts on modeling and mathematical programming software.

Prerequisite: Undergrad OR course (IEE 376 or equivalent), differential calculus, and basic linear algebra.

Course web page: https://asu.instructure.com/courses/120743 (Canvas). The Canvas site for this course will serve as a repository for course materials including announcements, downloadable software, and assignments. Please check this website frequently for up-to-date course information including suggested readings and a list of upcoming topics to be covered in class. Additionally, make sure to stay current with the class announcements delivered via e-mail.

Required textbook: W. L. Winston and M. Venkataramanan, *Introduction to Mathematical Programming: Applications and Algorithms*, 4th ed., Volume 1, Duxbury Press/Brooks/Cole Publishing Company, 2002. ISBN: 0-534-35964-7. (Note that the CD-ROM is not required for this course).

Reference books:

- F. S. Hillier & G. J. Lieberman, *Introduction to Operations Research*, 9th Ed., McGraw Hill Higher Education, 2010. ISBN: 978-0-07-337629-5.
- L. Wolsey, *Integer Programming*, John Wiley & Sons, 1998. ISBN:978-0-471-38366-9.

Course Learning Outcomes: After completing this course, students should be able to:

- Represent various types of real-world problems as mathematical models.
- Distinguish between distinct classes of mathematical models: linear, mixed-integer, pure integer, nonlinear, etc.
- Implement sets, indices, symbols, and other short-hand notation to model large-scale problems effectively.
- Determine suitable techniques for solving OR models and the tradeoffs between alternatives.
- Use modeling and mathematical programming software to solve problems.
- Interpret optimization solver output and perform sensitivity analysis, when applicable.
- Perform the basic roles required of a junior operations research analyst.