

Syllabus

Course coordinator: Asst. Prof. Robert M. Curry (rcurry@usna.edu)

Textbook: *Deterministic Operations Research*, by David Rader.

Course description: This course covers a range of advanced topics in mathematical programming. Topics include integer programming modeling, branch-and-bound methods, integer programming theory, and algorithms. Students will also learn to use a set-based modeling language for an advanced integer programming solver. Topics may vary with instructor.

Course objectives: By the end of this course, students will be able to

- (i) creatively and critically problem solve;
- (ii) successfully collaborate in groups;
- (iii) intuitively identify, creatively model, and solve (using software) a variety of real-world problems that can be formulated as integer linear programs;
- (iv) use Microsoft Excel and Python to develop a spreadsheet interface for a linked optimization model;
- (v) understand the theoretical and computational difficulty of integer linear optimization, along with associated theoretical and algorithmic considerations and algorithms.

Approximate weekly course schedule:

| Week | Topic |
|------|---|
| 1 | Mathematical Optimization Modeling and Software Review. |
| 2 | Network Models |
| 3 | Shortest Path Models |
| 4 | Maximum Flow Models |
| 5 | Fixed-charge Models, Set-covering, & Logical Constraints |
| 6 | Review & <i>Exam #1</i> |
| 7 | Python/Pyomo Resources |
| 8 | Minimum Spanning Tree Problem |
| 9 | Traveling Salesperson Problem (TSP) |
| 10 | Vehicle Routing Problems & Subtour-elimination Constraints. |
| 11 | Facility Location Models |

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| 11 | Review & <i>Exam #2</i> |
| 12 | Integrating Python, Pyomo, and Microsoft Excel & Improving Integer Feasible Region Formu |
| 13 | IP Formulations |
| 14 | Branch & Bound |
| 15 | Project Work |
| 16 | Project Presentations and Review |