Instructor: Javad Taheri; jtaheri@ncsu.edu

Course Scope and Objectives

- To build a general understanding of the field of Operations Research (OR) and become familiar with the OR methodologies as well as the application areas where OR has demonstrated its utility.
- To emphasize quantitative modeling of processes in service and manufacturing industries, government, health care, etc., with an introduction to algorithmic approaches of analysis and optimization including linear, integer, and non-linear optimization, Markov processes, and queuing.
- To set a foundation for future advanced graduate studies in Operations Research with applications in business systems.

General Class Information about ISE/OR 501

Prerequisites

Prerequisites: MA 421 or ST 421 or ST 371 and ST 372

Required Text


Academic Dishonesty Policy

Dishonesty is unfair to everyone, especially those who do their work honestly. Academic dishonesty will be fully prosecuted and given to the Judicial System. You will be required to sign an honor pledge on each test stating that you have neither given nor received help. All work turned in with your name is assumed to be only your own work. If what you turn in duplicates others, then it is cheating (regardless of who copied who).
Topics for ISE/OR501

The Chapters in the textbook may include:

- **Chapter 1: An Introduction to Building Model**
  - Seven steps in Building Model
  - Examples
- **Chapter 2: Introduction to Linear Algebra**
  - Matrices and Vectors
  - Matrices and Systems of Linear Equations
  - The Gauss-Jordan Method
  - Linear Independence and Linear Dependence
  - The inverse of a Matrix
- **Chapter 3: Introduction To Linear Programming**
  - What is LP Programming Problem
  - The graphical Solution of two-Variable LP problems
  - Special Cases
  - Classical LP problems
- **Chapter 4: The Simplex Algorithm**
  - How to Convert an LP to Standard Form
  - Preview of the Simplex Algorithm
  - Why Does an LP Have an Optimal Basic Feasible Solution
  - The Simplex Algorithm
  - Special Cases
  - The LINDO and Solver
  - The Big-M Method
- **Chapter 5: Sensitivity Analysis- An Applied Approach**
  - A Graphical Introduction to Sensitivity Analysis
  - The Computer and Sensitivity Analysis
  - Managerial use of Shadow Prices
- **Chapter 6: Sensitivity Analysis and Duality**
  - A Graphical Introduction to Sensitivity Analysis
  - Some Important Formula
  - Finding the Dual of an LP
  - Duality and Sensitivity Analysis
- **Chapter 7: Transportation, Assignment, and Transshipment Problems**
  - Formulating Transportation Problems
  - Finding Basic Feasible Solutions for Transportation Problems
  - Transportation Simplex Method
  - Sensitivity Analysis of Transshipment Problems
  - Assignment Problems
  - Transshipment Problems
- **Chapter 8: Network Models**
  - Shortest-Path Problems
  - Maximum-Flow Problems
  - CPM and PERT
- **Chapter 9: Integer Programming**
• Formulating IP Problems
• Solving IP problems with Solver and LINDO/LINGO
• Branch and Bound Method for Solving IP Problems

• Chapter 11: Nonlinear Programming
  o Introductory Concepts
  o Convex and Concave Functions
  o Solving NLPs with One Variable
  o Unconstrained NLPs with Several Variables
  o Other NLP Solution Methods

• Chapter 15: Deterministic EOQ Inventory Models
  o Introduction to Basic Inventory Models
  o Basic EOQ Model
  o Computing the Optimal EOQ When Quantity Discounts Are Allowed
  o Continuous Rate EOQ Model

• Chapter 16: Probabilistic Inventory Models
  o The News Vendor Problem
  o The EOQ With Uncertain Demand

• Chapter 17: Markov Chain
  o Definition of Stochastic Process and Markov Chain
  o Transition Probabilities
  o Classification of States
  o Steady-State Probabilities
  o Mean Flow Passage Times
  o Applications

• Chapter 18; Deterministic Dynamic Programming
  o Shortest-Path Problem
  o Computational Efficiency of DP
  o Characteristics of DP
  o Knapsack Problem
  o Dynamic Lot-Size Problem

• Chapter 20: Queuing Theory
  o Definitions
  o Modeling Arrival and Service Processes
  o Birth-Death Process
  o M/M/1 Queue
  o M/M/s Queue
  o Capacitated M/M/1 Queue

• Chapter 21: Simulation
  o Monte Carlo Simulation
  o Discrete Event Simulation
Grading System and Exam Dates for ISE/OR 501

- There will be two mid-semester tests, referred to as Test1 and Test2.
- The final exam is cumulative and it will include 20% on material covered by Test1, 20% on material covered by Test2, and 60% on material after Test2. There will be no questions on simulation (lecture #13) on the final exam.
- There are 11 homework sets, graded based on student’s effort.
- A number of in class exercises are graded as quizzes.
- The dates for Test1, Test2, and the final for the in-class students are on the calendar (a Wednesday from 6:00 P.M. to 9:00 P.M.) and for the DE students should be scheduled within the following Thursday and Friday.

The final grade for the course will be the better of two outcomes:

1. 25% (Test1), 25% (Test2), 45% (Final), 5% (HW)
2. Grade on the final exam.

Make-up exams may only be given for students with University-approved absences.