Welcome to Management Science!

Management Science

Course Description

Management Science is an interdisciplinary field that applies scientific methods to organizational problem-solving and decision-making. By leveraging mathematical modeling, statistics, and numerical algorithms, management science helps businesses achieve their strategic goals effectively.

In this course, you'll build a comprehensive "consultant's toolkit" by solving real problems across diverse business domains. Each algorithm is a tool, each case is a client, and each presentation is a pitch. Throughout the semester, you'll work with realistic, business-relevant scenarios using Python. The course end in a consulting competition where teams tackle client briefs (food delivery routing, healthcare staff scheduling, or inventory optimization) and present solutions to a panel of "executives."

Learning Outcomes

By the end of this course, you will be able to:

Technical Skills:

- Implement Management Science solutions in Python
- Write clean, modular Python code (functions, control flow, data structures)
- Work effectively with NumPy and Pandas for analysis and modeling
- Apply Monte Carlo simulation to model uncertainty and risk
- Build and evaluate forecasting models for demand and time series
- Design and analyze scheduling solutions (SPT, EDD rules) with key performance metrics
- Solve routing problems using heuristics and local search improvements (nearest neighbor, 2-opt)
- Handle multi-objective trade-offs and combine decision criteria meaningfully
- Understand and apply metaheuristics for complex optimization problems

Professional Skills:

- Collaborate effectively in small teams (3-4 students)
- Communicate technical insights with clear visualizations and compelling narratives
- Present solutions in a consulting-style format to business stakeholders
- Approach complex problems with structured analytical thinking

Note: This course is specifically designed for business students. No prior programming experience required—our teaching format supports different skill levels so every student can progress effectively.

Course Structure

The course is organized into three distinct parts across 12 lectures:

Part I: Python Foundation (Lectures 1-3)

Building your analytical toolkit

Part II: Management Science Tools (Lectures 4-9)

Mini-competitions begin - apply algorithms to real business problems

Part III: Consulting Competition (Lectures 10-12)

Client challenges with professional presentations

Assignments & Grading

Assignment Structure

- Assignment 1: Risk & Forecasting (Due Lecture 8) - 30%
- Assignment 2: Full Optimization Toolkit (Due Lecture 10) - 30%
- Final Competition: Client Project (Lectures 10-12) - 40%

Bonus Opportunities

- Win mini-competitions during lectures (Lectures 4-9)
- Best client project in Part III chosen by peer teams

Time Expectations

- 4-6 hours per week outside class
- Assignments take 4-7 hours each
- Focus on insights over perfect code
- functional and clear solutions are the goal

Resources & Support

Required Tools

- Laptop capable of running Python and Jupyter notebooks
- Python (installed via uv package manager in class)
- GitHub Copilot (free with Student Developer Pack)
- VS Code or similar IDE

Getting Help

1. During class: Ask questions immediately, others likely have the same question
2. Team support: Leverage your group for collaborative problem-solving
3. Email: Response within 48 hours for urgent questions

Important Dates

Date	Milestone
Lecture 1	Course begins, teams formed
Lecture 4	Mini-competitions begin
Lecture 8	Assignment 1 due (Risk & Forecasting)
Lecture 10	Assignment 2 due (Optimization Toolkit)
Lecture 10	Client project teams formed
Lecture 12	Final presentations (Consulting Finals)

How to Navigate This Course

- Slides: Click “RevealJS” in the top right corner of each lecture page
- Notebooks: Interactive exercises accompany each lecture

You can find detailed information about course policies, grading rubrics, and expectations in the syllabus.

Questions & Contact

If you have any questions regarding the course, please contact me at vlcek@beyondsimulations.com.

Contributors

Thanks to Asvin Goel, who inspired part of this course.

Bibliography