Course Syllabus

Management Science

Course Structure & Schedule

Part I: Python Foundation (Lectures 1-3)

No mini-competitions yet - focus on solid foundations

Lecture 1: Welcome to Management Science

- Course introduction
- Python setup with uv package manager
- Variables, data types, basic operations
- Lists and indexing fundamentals
- Conditionals and basic loops

Lecture 2: Python Programming Advances

- Functions for code organization
- Dictionaries for structured data
- Tuples and multiple return values
- Sorting and optimization fundamentals
- GitHub Copilot integration and best practices

Lecture 3: Data Science Foundation

- NumPy for numerical computing and random simulation
- Pandas for data manipulation and analysis
- Data visualization with matplotlib
- CSV file handling and real dataset exploration
- Integration practice with business scenarios

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

Mini-competitions begin - apply algorithms to business problems

Format for Lectures 4-9:

- Hour 1: Interactive lecture on core concepts
- Hour 2: Hands-on notebook practice + class discussion
- Hours 3-4: Mini-competition with real data + solution presentations
- Bonus Points: Best solution teams earn points toward final grade

Lecture 4: Dealing with Uncertainty - Monte Carlo Simulation

- Probability distributions and random sampling
- Business risk modeling techniques

- Portfolio optimization under uncertainty
- Coffee shop simulation case study

Lecture 5: Forecasting the Future

- Time series analysis fundamentals
- Demand forecasting methods
- Forecast evaluation metrics
- Seasonal and trend analysis

Lecture 6: Smart Quick Decisions in Scheduling

- SPT (Shortest Processing Time) rule
- EDD (Earliest Due Date) rule
- Gantt chart visualization
- Performance metrics: makespan, tardiness, flow time

Lecture 7: Better Routing - Local Search & Improvements

- Nearest neighbor heuristic
- 2-opt local search improvements
- Route optimization metrics
- Real logistics applications

Lecture 8: Tough Trade-offs - Multi-Objective Optimization

- Weighted scoring methods
- Pareto efficiency concepts
- Decision criteria combination
- Business trade-off analysis

Lecture 9: The Metaheuristics Toolkit - Beyond Greedy

- When simple heuristics fail
- Genetic algorithms introduction
- Simulated annealing basics
- Algorithm selection strategies

Part III: Consulting Competition (Lectures 10-12)

Real client challenges with professional presentations

Lecture 10: Client Briefings

- Three client projects to choose from:
  - QuickBite: Food delivery routing optimization
  - NurseNext: Healthcare staff scheduling
  - TechMart: E-commerce inventory optimization
- Team formation and data exploration
- Project scope definition

Lecture 11: Development Sprint

- Presentation skills training

- Intensive solution development
- Peer consultation and feedback
- Prototype completion milestone

Lecture 12: The Consulting Finals
- Professional presentation competition
- "Executive panel evaluation"
- Solution demonstration and Q&A

Assessment & Grading

Grade Composition (100 points total)

Component	Points	Percentage	Description
Assignment 1: Risk & Forecasting	30	30%	Due Lecture 8
Assignment 2: Optimization Toolkit	30	30%	Due Lecture 10
Final Competition Project	40	40%	Lectures 10-12
• Solution Quality	20	20%	Technical implementation
• Presentation	20	20%	Communication effectiveness

Bonus Opportunities (Additional points possible)

- Mini-competition victories (Lectures 4-9): up to +10 points
- Peer-selected best client project: +5 points

Course Policies

Team Work Guidelines

- Teams of 3-4 students formed in Lecture 1
- All team members must contribute meaningfully
- Peer evaluation forms will be used to assess individual contributions
- Team conflicts should be reported to instructor immediately

Late Work Policy

- Assignment 1 & 2: –10% per day late (up to 3 days)
- Competition project: No late submissions accepted (real consulting deadline!)
- Extensions granted only for documented emergencies

Academic Integrity

- Collaboration encouraged within teams, between teams on concepts only

- GitHub Copilot and AI tools encouraged for learning, not for replacing thinking
- Copying solutions from internet or other students prohibited

Course Evolution

This course continuously evolves based on student feedback and industry trends. Your input throughout the semester helps improve the experience for future cohorts.

Bibliography