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: Solution presentations of previous competition
- Hour 2: Interactive lecture on core concepts
- Hour 3: Hands-on notebook practice + class discussion
- Hour 4: Mini-competition with real data
- 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

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

Bibliography