# 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