Consulting Projects

Lecture 10 - Management Science

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Introduction

Your Final Challenge

Three major clients need your expertise:

- QuickBite: Food delivery routing crisis
- NurseNext: Healthcare scheduling nightmare
- TechMart: Inventory allocation disaster
- Each group picks ONE client to work with
- This is 40% of your final grade

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> ℹ Note
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> You're not just students anymore - you're consultants.

Today's Learning Objectives

By the end of this session, you will:

1. Understand three realistic optimization problems
2. Select a client project aligned with your team's strengths
3. Begin data exploration and initial solution development
4. Plan your approach using techniques from the course
5. Prepare for professional consulting presentations

The Expectation

What makes a successful consulting project?

- Clear recommendations backed by data
- Business impact quantified in €€€
- Confidence in your approach and results
- Actionable insights clients can implement

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> 💡 Tip
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> "Reasonable and well-explained beats perfect and incomprehensible"

Meet Your Clients

Client Briefing: QuickBite

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CEO's Morning Crisis:

"We're bleeding money on delivery costs while customers complain about cold food! Our 4 drivers just 'wing it' every day. Result? 75% late deliveries, angry customers, and investors getting nervous."

QuickBite: The Delivery Chaos

QuickBite's daily logistics nightmare:

- 120 meal deliveries across Hamburg every day
- 4 drivers starting from one central depot
- Current approach: Drivers choose routes by "intuition"
- The damage: Monthly waste in fuel + penalties
- Customer complaints: Up 40% this quarter

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> ❗ Important
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> The Stakes: Cut costs AND improve on-time delivery before investors pull funding!

QuickBite: Your Mission

What you need to solve:

- Vehicle Routing Problem with time windows
- 120 delivery locations across Hamburg
- 4 drivers with capacity constraints
- Time windows for each delivery (violations = penalty)
- Trade-offs: Distance vs. punctuality vs. driver workload balance

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> ❗ Important
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> Any questions?

Client Briefing: NurseNext Hospital

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COO's Scheduling Crisis:

"I spend 8 hours every week manually scheduling nurses, and they're still terrible! Massive monthly overtime, 25% sick leave from burnout, nurses quitting citing 'unfair scheduling.'"

NurseNext: The Burnout Problem

NurseNext's staffing crisis:

- 20 nurses across 3 departments (ED, Med-Surg, ICU)
- Current system: Manual scheduling by exhausted COO
- The damage: Overtime, 25% sick leave rate
- Fairness issues: Unequal weekend distribution
- Turnover: Losing 3-4 experienced nurses annually

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> ! Important
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> The Stakes: Reduce overtime massively AND improve nurse satisfaction or face staffing collapse!

NurseNext: Your Mission

What you need to solve:

- Employee Scheduling with complex constraints
- Multiple skill levels (Junior, Senior, Specialist) and departments
- Shift patterns: Morning (7-15), Evening (15-23), Night (23-7)
- Labor law: Max consecutive shifts, rest periods, weekly hours
- Fairness: Weekend equity, workload balance, distribution
- Robustness: What happens when nurses call in sick?

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> ! Important
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> Any questions?

Client Briefing: TechMart Electronics

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COO's Inventory Paradox:

"We have €10M stuck in inventory, yet we're constantly out of stock on bestsellers! 20% stockout rate on popular items while slow-movers occupy our fast warehouse. Black Friday is in 3 weeks!"

TechMart: The Allocation Disaster

TechMart's warehouse crisis:

- 30 electronics SKUs: Smartphones, laptops, …
- Two warehouses: Fast (Hamburg) and large (Poland)
- Current problem: Wrong products in wrong warehouses
- Last Black Friday: Ran out of top items in Hamburg on Day 1

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> **!Important**
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> The Stakes: Optimize inventory allocation before Black Friday or repeat last year's disaster!

TechMart: Your Mission

What you need to solve:

- Demand Forecasting from 3 years of sales history
- Identify: Patterns seasonality , trends, and Black Friday spike
- Inventory Optimization: Which SKUs go in the fast warehouse?
- Monte Carlo Simulation: Test allocation under uncertainty
- Trade-offs: Shipping speed vs. warehouse capacity

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> **!Important**
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> Any questions?

Project Details

Timeline

Your three-session consulting engagement:

Session	Focus	What Happens
Lecture 10	Kickoff	Choose client, explore data, start coding

Session	Focus	What Happens
Lecture 11	Development	Presentation training + intensive work
Lecture 12	Final	Presentations + Q&A

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> 💡 Tip
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> You will likely need 6-10 hours to complete this project. If you start today in class and also use Monday in two weeks, everything should be manageable.

Grading (40% of Final Grade)

How your consulting project will be evaluated:

Solution (20%)
- Correctness (8%)
- Technical Implementation (7%)
- Analysis & Insights (5%)

Presentation (20%)
- Clarity (8%)
- Visualization (7%)
- Business Communication (5%)

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> ❗ Important
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> Any questions here?

Deliverables

All groups must submit by lecture 12:

1. Jupyter notebook with complete solution
   - Results and visualizations embedded
2. Presentation slides (8 minutes maximum)
   - Problem understanding & Solution approach
   - Results, Visualization and validation
   - Business impact

Bonus Points Opportunity

Student Voting (After Presentations)

After all presentations, you'll vote for:

- Best Solution for each client (3 winners)
- Winners receive 5 bonus points per group member

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> 💡 Tip
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> Last chance on bonus points!

Tips for Success

Strategic Advice

How to approach your project:

1. Choose your client wisely
   - Pick based on your team's strengths
2. Start with data exploration
   - Understand the data BEFORE coding
3. Build incrementally
   - Simple solution first (greedy)
   - Then improve (local search, metaheuristics)

Common Pitfalls to Avoid

Watch out for these:

- Scope creep: Trying to solve everything perfectly
- Poor time management: Coding until the last minute
- Ignoring business context: Technical solution without impact
- Bad visualizations: Unreadable charts or no visuals

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> ! Important
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> Don't build a solution that you can't explain to the client!

Let's Get Started!

Next Steps

Your roadmap for today's session:

1. Hour 1-2: Choose your client
2. Hour 3-4:
   - Open the project notebook
   - Explore the data
   - Start coding initial solution

- Ask clarifying questions

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> 💡 Tip
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> We only see each other again in 2 weeks, use the time!

Final Thoughts

You have all the tools you need:

- Monte Carlo simulation
- Forecasting techniques
- Greedy heuristics
- Local search optimization
- Multi-objective trade-offs
- Metaheuristics concepts

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> ❗ Important
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> You have ALL the tools you need to succeed.

Break!

Take 20 minutes, then we start choosing

Next up: You'll choose a project and group and start working on it.

Bibliography