

Problems in Air Traffic Flow Management

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Assignment #1

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Airlines and the FAA collectively manage the flow of aircraft around the US

- Objective:
 - Strategic and tactical routing of aircraft
 - Minimize the “cost”: fuel, labor, risk, lost goodwill of customers
 - Analyze the entire system as a whole
- Tools:
 - Mathematics
 - Optimal Algorithms
 - X “is the provably best way to” do something
- Examples:
 - Creating an airline schedule
 - Rerouting aircraft during periods of inclement weather

Some types of problems are difficult to solve

- Problems are too large and, therefore, cannot be solved by optimal algorithms
- Some aspects of the problem cannot be modeled mathematically
 - For example, how do you define equity?
 - Experience counts when it comes to modeling qualitative factors in a quantitative manner
- There is a tradeoff between how much of a problem is considered mathematically and how easy the math is to solve

Evaluating a model

- Analytical models always make some type of assumption
 - Data requirements
 - Practicality
 - Risk/Uncertainty
 - Static/Dynamics
 - Decision Makers
- A good model
 - Minimizes major assumptions
 - Is conceptually sound/similar to the system
 - Can be used to predict future behavior
 - Can be solved in hours/days

More “traditional” approaches often conflict with optimization

- In practice, the industry (FAA, airlines) approach the problem differently
 - Decisions are made based upon “feel”, intuition, or policy
 - Problems are often highly stochastic *and* qualitative
 - Decisions are made on the fly by separate actors
 - “Optimization” work occurs only in isolated departments
- In making decisions
 - Experiential learning is key
 - Difficult problems are those for which there is no prior experience

The traditional approach values solutions differently, as well

- A good solution
 - Follows procedure, allowing separate actors to make cohesive decisions
 - Avoids crisis points and disasters
 - Is economically efficient
- The disparity between the academic and practical approaches poses an additional challenge to research!