

Optimization with Constraints on Resources

Examples:

1. How should Mayor Bloomberg spend \$100,000,000 on political advertising to maximize his chances of being reelected?
2. How should I invest \$1000 to maximize my expected return in 3 years?
3. How should I invest \$1000 to maximize the chances that I will have \$5000 in 3 years?
4. How often should I replace my car?
5. How should I choose food at a salad bar to meet my nutritional needs for the minimum amount of money?
6. Where should the government store emergency supplies to help out in a natural disaster?
7. How does an oil company decide where to drill wells?
8. How should an auto factory be set up to maximize the number of cars made per day?
9. Where should a cell phone company locate its towers to maximize coverage area?
10. How does a UPS driver visit 87 customers in one day and still get home in time to watch the Mets game on TV?

11. Should I buy skis?

12. How do I get to Carnegie Hall?

Topics

See syllabus

Q. Why study this stuff?

A. It's a success.

Some examples

1. *Police Patrol Officer Scheduling in San Francisco.* Using linear programming, goal programming and integer programming, the department saves \$11 million per year, improved response times by 20% and increased revenue from traffic citations by \$3 million per year.
2. *Reduction of Fuel Costs in Electric Power Industry* Using dynamic programming, 79 electric utilities saved \$125 million per year.
3. *Gasoline Blending at Texaco.* Using blending models, Texaco saves \$30 million annually
4. *Scheduling Trucks at North American Van Lines.* Using network models and dynamic programming to assign loads to North American Van Line drivers reduced costs by \$2.5 million per year and improved service.
5. *Linear programming to determine bond portfolios.*
6. *Linear programming to plan Creamery Production*

Why is mathematical programming a success

- Real Life Models
- Mathematical Insight
- Efficient Algorithms
- Fast Computers

All four exist in a synergistic fashion.

Goals of the course

- Learn how to model real-life problems mathematically
- Understand the mathematics behind optimization
- Understand different types of problems/solutions/methods/algorithms
- Learn how to interpret the solutions to the models