

Introduction to Management Science

Management 560: Management Science

Tuesday, March 10, 2009

Goals of this class meeting

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- Learn what is management science.
- Learn two basic techniques for modeling decision problems.
- Learn some basic quantitative techniques for solving such problems.

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- A.k.a. Operations Research, Quantitative Analysis, Decision Analysis, Decision Sciences, but strangely enough, not Operations Management.
- Application of quantitative methods to help managers make decisions that achieve one or more stated objectives.
- **Model:** abstract mathematical representation of a managers objective, possible decisions, and constraints.

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Model: Example

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Andy Mendoza makes handcrafted dolls, which he sells at craft fairs, and is considering mass-producing the dolls to sell in stores. He estimates that the initial investment for the plant and equipment will be \$10,000, the cost of labor will be \$5 per doll, the cost of material will be \$2 per doll, the cost of packaging and shipping will be \$3 per doll, and Andy will be able to sell the dolls for \$20 each.

Worksheet questions

Model Building

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- **Objective:** A very specific, one sentence description of the manager's goal.
- **Variables:** Things the manager can make a decision about. These are usually quantitative or binary decisions.
- **Parameters:** known constant values that usually help define an objective or constraint in a model.
- **Objective function:** a mathematical representation of the objective that includes the decision variables and parameters.

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Worksheet questions

Looking out for #1

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Andy is sick of helping ungrateful people, and from here on out Andy only wants to worry about Andy. Write down his objective function now. Does this problem seem realistic? Why not? It turns out dolls won't just sell for \$20 no matter what; he can increase or decrease the price of dolls, changing how many dolls people are willing to buy. Suppose for each \$1 increase in price, the quantity of dolls demanded drops by 40, and if Andy raises his price to \$50, then he will not be able to sell any.

Worksheet questions

Retread Tire Company: Breaking Even

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The Retread Tire Company recaps tires. The fixed annual cost of the recapping operation is \$60,000. The **variable cost** of recapping a tire is \$9 per tire. Suppose the company charges \$25 to recap a tire, and the company is interested in breaking even.

Worksheet questions

Retread Tire Company: Maximizing Profit

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Suppose instead of being able to charge \$25 per fixed tire, the demand for tire fixes decreases by 50 sales for each \$1 increase in price. Suppose also that if the price for tire fixes were as high as \$80, Retread Tire Company would not find a single customer.

Worksheet questions

Linear Programming

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- Linear programming: problems that involve *linear* objective functions and *linear* constraints.
- Possible objectives:
 - maximize profits, minimize costs, maximize revenues, minimize time to complete projects, minimize the total distances needed to transport goods from warehouses to stores, minimize total energy consumption.
- Objective function is subject to constraints such as:
 - Limited resources, restrictive guidelines, demand for goods at stores, supply of goods at warehouses, energy requirements for machines or buildings, time requirements for completing intermediate steps of a project.

Assembly Lines

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Suppose a company produces two products that are processed on two assembly lines. Assembly line 1 has 100 available hours, and assembly line 2 has 42 available hours. Each product requires 10 hours on assembly line 1, while Product A needs 7 hours on assembly line 2, and Product B needs 3 hours on assembly line 2. The company earn \$6 profit for every item of Product A produced and \$4 profit for every item of Product B produced.

Worksheet questions

Copperfield Mining Company

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Copperfield Mining Company owns two mines, each of which produces three grades of ore - high, medium, and low. The company has a contract to supply a smelting company with at least 12 tons of high-grade ore, 8 tons of medium-grade ore, and 24 tons of low-grade ore. Mine 1 produces 6 tons of high-grade ore, 2 tons of medium-grade ore, and 4 tons of low-grade ore for each hour it operates. Mine 2 produces 2 tons of high-grade ore, 2 tons of medium-grade ore, and 4 tons of low-grade ore for each hour it operates. The cost of operating mines is \$200 for mine 1 and \$160 for mine 2.

Worksheet questions

- Modeling basics and breaking even:
 - Pages 23-24, problems 2, 3, 15.
 - “Ocobee River Rafting Company” case problem, page 27.
 - “Constructing a Downtown Parking Lot in Draper” case problem, page 28.
- Linear programming:
 - Page 61, problem 5.