15.063 Communicating with Data

Sloan Fellows/Management of Technology

Summer 2003

Introductions

- Prof.: John S. Carroll
- See master schedule for lectures and recitations
- Office hours for TI's will be posted
- Syllabus: this is our roadmap for the course. Please read it carefully. We try to follow it as closely as we can. Let's take a look…

Course Outline

- Course Philosophy and Approach
- Decision Trees
- Probability – Discrete and Continuous
- Simulation
- Regression
- Decision Making Examples and Exercises
- Communicating with Data

Course Grading

- Cases and Homeworks 40%
- Class Participation 10%
- Final Exam 50%
- Assignments indicate Read, Prepare, or Hand in

- Questions?

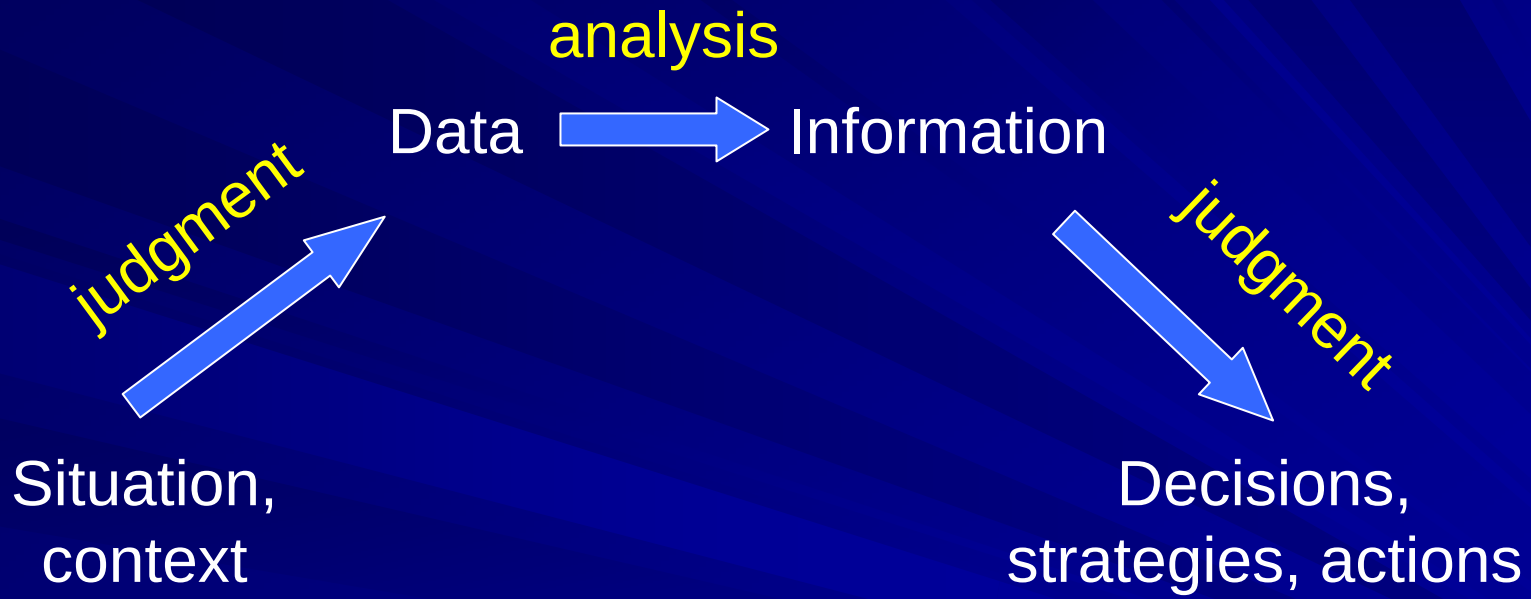
Course Philosophy

- Good managers are skilled decision makers
- Decision making requires information, analysis, judgment, and intuition
- Information is constructed from bits and pieces of ambiguous data
- Judgment involves understanding or framing situations and clarifying values

Communicating with Data

- We “communicate” with data by constructing information in order to make effective decisions and get results
- We also use data to communicate, to tell a persuasive story to stakeholders
- In the spirit of the Myers-Briggs Type Indicator, combine competency in analysis and intuition, “seeing” and judging, dealing with ideas, material resources, and people

Analysis and Judgment



- Analysis informs judgment, builds intuition
- Analysis is not a substitute for judgment

What Does the Data Mean?

- During WWII, 10,000 US bombers were lost, and many others returned to base with damage
- An analysis was done of the location of damage, proposing to reinforce some areas of the planes

Battle-damaged B-17s, Courtesy of US Air Force

Medical Decision Example

- 389 schoolboys screened by a panel of three doctors: 45% judged to need their tonsils removed
- 215 who were judged not to need their tonsils removed were examined by a new panel of doctors
- What % should be judged to need their tonsils removed?

Medical Decision, Continued

- Results: 46%
- 116 boys judged twice not to need their tonsils out were judged by a new panel of three doctors
- Results: 44%

How Did Doctors Decide?

- Experience
  - In the past, a bit less than half of patients presenting themselves had their tonsils out
  - Minimal systematic feedback: years of experience improve technical skills, but not decision making behavior
- Relative Judgments
  - Who had the bigger, redder tonsils?
  - Much easier than yes/no absolute judgments

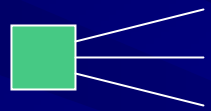
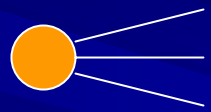
How Should They Decide?

- How can we structure the decision?
- What are the Goals/values associated with the outcomes?
- What are the Options/action alternatives?
- What are the Outcomes?
- What are the Probabilities/uncertainties?
- How can we use the analysis to inform our decision making?

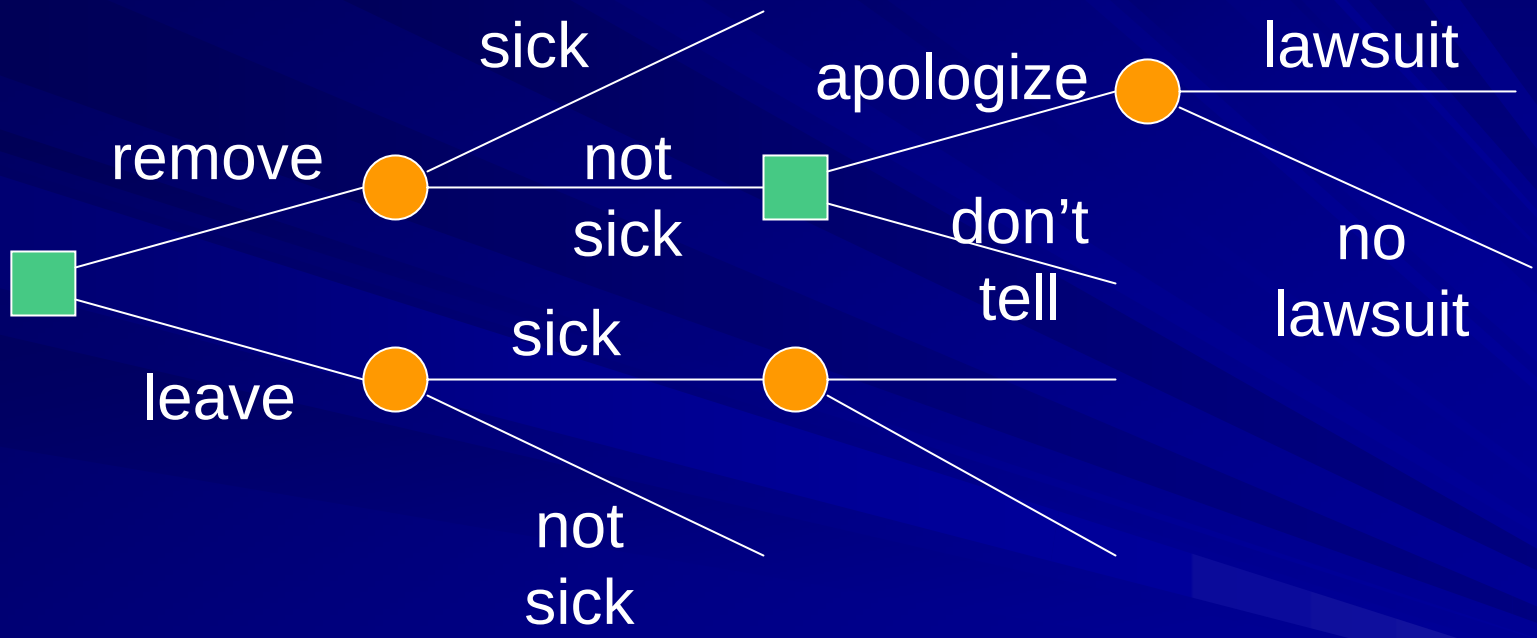
Decision Analysis

- Decision trees provide an elegant framework for combining options, contingencies, consequence probabilities, and outcome values to help you select the best option.
- Decision trees map all options and potential consequences in a manner that makes it easier to understand and communicate the situation.

Decision Trees

- List options (include all possible action alternatives!)
- List uncertain events (mutually exclusive and collectively exhaustive)
- Construct a decision tree along a time line:
  - decision nodes  (list choices)
  - event nodes  (list events)
- Evaluate endpoints (outcomes for each end branch)
- Assess event probabilities
- “Expect-out and Fold Back” = Backwards Induction
- Sensitivity Analysis
- What does it mean for decision making?

Remove Tonsils?



Analysis Paralysis?

- The tonsillectomy decision tree could get very “bushy” (complex), ambiguous, time consuming
- Many possible contingencies and uncertainties
- Therefore, doctors don’t analyze this way
- Instead, medical practice and research creates simpler decision rules (heuristics)
- Imagine a research-based guide with pictures of tonsils: best medical practice would match the picture and follow the guide unless there is a reason to override (new decision analysis!)

Well-Structured Decisions

- Known list of action alternatives
- Measurable outcomes, often monetary
- Uncertainties can be stated as probability or probability range

Decision Analysis Skills

- The skills of decision analysis are not in the computations
- The skills are in applying these concepts to a wider range of real decisions
- The decision tree calculations/sensitivity analysis can be implemented in Excel as shown in the text, and the actual decision tree can be drawn using TreePlan. Different versions are available at:

http://www.treeplan.com/treeplan.htm

Closing Comments

- "Commercial Strength" alternatives:

  DecisionPro ($795 14-day free demo available)

  http://www.vanguardsw.com/default.htm

  PrecisionTree Pro ($795 Excel Compatible)

  http://www.palisade.com/html/ptree.html

- Be ready for lecture 2: study chapter 1, read 2.1, 2.2., 2.3 and prepare the *Kendall Crab and Lobster Inc.* Case.