

Decision Analysis

- **Objective**
 - To present a particular, effective technique for evaluating alternatives to risky situations
- **Three conclusions brought out by Decision Analysis. Think in terms of:**
 1. Strategies for altering choices as unknowns become known, rather than optimal choices
 2. Second best choices which offer insurance against extremes
 3. Education of client especially about range of alternatives

Motivation

- **People, when acting on intuition, deal poorly with complex, uncertain situations**
 - They process probabilistic information poorly
 - They simplify complexity in ways which alter reality
 - ◆ Focus on extremes
 - ◆ Focus on end states rather than process
 - ◆ Example: Mexico City Airports
- **Need for structured, efficient means to deal with situation**
- **Decision Analysis is the way**

General Features

- **Simple way of defining the wide range of choices**
- **Over several Periods**
- **Includes Risks**
- **Includes Levels of Consumer Satisfaction**
- **Standard Method**

Identifying Issues

- **What is the Important Risk for Situation?**
- **What Factors Define this Risk?**
- **What Management Decisions Relate to it?**
- **How do we represent the**
 - ◆ **Range of possible decisions,**
 - ◆ **Risks, and**
 - ◆ **Outcomes?**

Decision Tree

- **Representing the Analysis -- Decision Tree**

- Shows Wide Range of Choices
- Several Periods
- Permits Identification of Plans that
 - ◆ Exploit Opportunities
 - ◆ Avoid Losses

- **Components of Decision Tree**

- Structure
 - ◆ Choices; Possible Outcomes
- Data
 - ◆ Risks; Value of Each Possible Outcome

Constructing Decision Tree (1)

- **Structure**

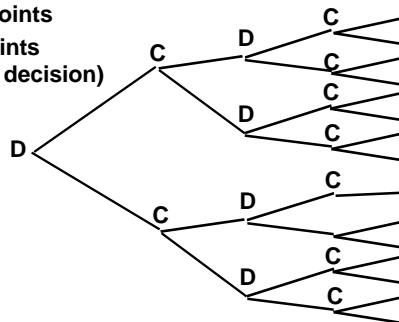
- The Decision Tree as an organized, disciplined means to present alternatives and possible states of nature

- **Two graphical elements**

1. Decision Points

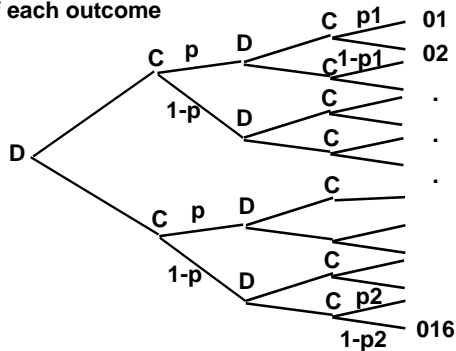
2. Chance Points

(after each decision)



Constructing Decision Tree (2)

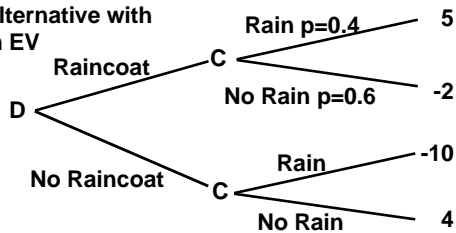
- Two data elements
 1. Probability
 2. Value of each outcome



- When does it become a “messy bush”?

Decision Analysis

- Calculation
 - Maximize Expected Value of Outcomes
- For each set of alternatives
 - Calculate Expect Value
 - Choose alternative with maximum EV



$\text{EV (raincoat)} = 2.0 - 1.2 = 0.8$ $\text{EV (no raincoat)} = -4.0 + 2.4 = -1.6$
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For Sequence of Alternatives

- Start at end of tree (rightmost edge)
- Calculate Expected Value for last (right hand side) alternatives
- Identify Best
 - This is the value of that decision point, and is the outcome at the end of the chance point for the next alternatives
- This is also the best choice, if you ever, by chance, reach that point
- Repeat, proceeding leftward until end of tree is reached
- Result: A sequence of optimal choices based upon and responsive to chance outcomes - "A Strategy"

Results Of Decision Analysis

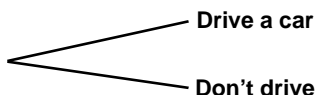
- NOT as Simple Plan
 - Do A in Period 1; Do B in Period 2; etc.
- A DYNAMIC PLAN
 - Do A in Period 1,
 - BUT in Period 2:
 - ◆ If Growth, do B
 - ◆ If Stagnation, do C
 - ◆ If Loss, do D

Decision Analysis Consequences

- Education of client, discipline of decision tree encourages perception of possibilities
 - A *strategy* as a preferred solution
 - NOT a single sequence or a Master Plan
- In general, Second Best strategies not optimal for any one outcome, but preferable because they offer flexibility to do well in a range of outcomes

In short: It is best to buy insurance!

Consequences Example

- You can choose 
- You may have an accident - or not
 - If accident

Drive	Worst
Don't Drive	Best
 - If no accident

Drive	Best
Don't Drive	Worst
- Optimal Solution: Drive with insurance
Never best - but never worst