

## Decision Analysis

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- **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

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- **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**

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

## **Identifying Issues**

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- **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**

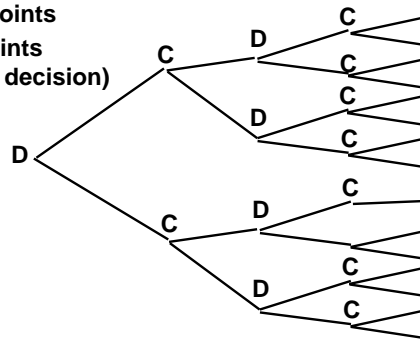
- The Decision Tree as an organized, disciplined means to present alternatives and possible states of nature

- **Two graphical elements**

1. Decision Points

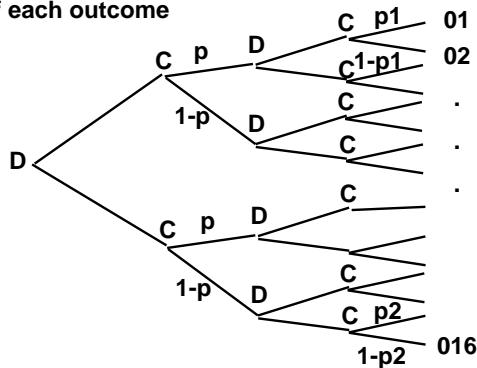
2. Chance Points

(after each decision)



## Constructing Decision Tree (2)

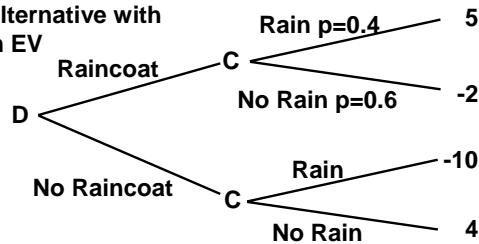
- Two data elements
  1. Probability
  2. Value of each outcome



- 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**

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- **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**

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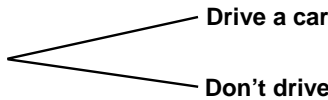
- **NOT as Simple Plan**
  - Do A in Period 1; Do B in Period 2; etc.
- **A DYNAMIC PLAN**
  - Do A in Period 1,
  - BUT in Period 2:
    - ◆ If Growth, do B
    - ◆ If Stagnation, do C
    - ◆ If Loss, do D

## 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 
  - Drive a car
  - Don't drive
- 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