

## **Outline Of Phase 2: Analysis**

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- **Strengths, Weaknesses, Opportunities, Threats**
- **The Issues**
  - What are risks? How are they defined?
  - How does management change risks?
  - How can we analyze the complexity?
- **Decision Analysis of Choices**
  - Decision Trees
- **Utility Analysis: Determining Satisfaction of Decision-Makers, of Users**
  - Decision-Makers' Feelings about Risk Levels
  - Customers' Feelings about Performance Levels

## **Strengths, Weaknesses, Opportunities, Threats**

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- **The Current State**
  - Positive: Strengths
  - Negative: Weaknesses
- **The Future**
  - Positive: Opportunities
  - Negative: Threats
- **An Effective Strategy**
  - Must be realistic about Situation
  - Deal proactively with Future

## **Identifying Issues**

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- **Identifying Issues**
- **In General**
  - 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?
- **See Case Studies for Examples**

## **The Solution -- Decision Analysis**

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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**

## **Decision Analysis**

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- **Objective**
- **Motivation**
- **Primitive Models**
- **Decision Analysis Methods**

## **Decision Analysis**

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- **Objective**
  - To present a particular, effective technique for evaluating alternatives to risky situations
- **Three Principal 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**

## **Decision Tree**

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- **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

## Decision Analysis

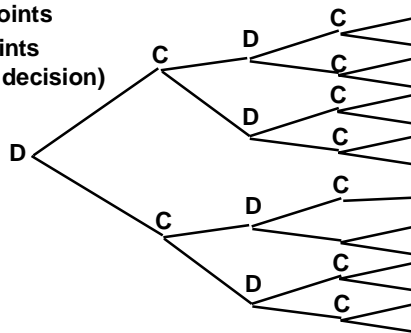
- Structure

- 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)



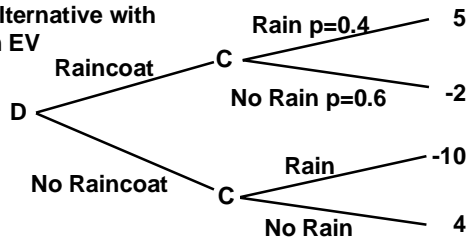
## Decision Analysis

- Calculation

- Maximize Expected Value of Outcomes

- For each set of alternatives

- Calculate Expect Value
- Choose alternative with maximum EV



$$\text{EV (raincoat)} = 2.0 - 1.2 = 0.8$$

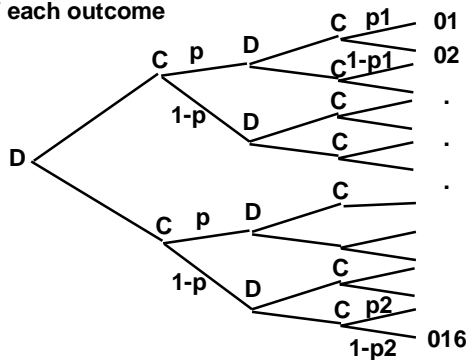
$$\text{EV (no raincoat)} = -4.0 + 2.4 = -1.6$$

## 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"

## Structure (continued)

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



- When does it become a "messy bush"?

## Results Of Decision Analysis

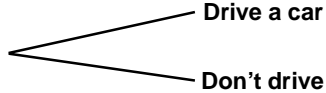
- **NOT as Simple Plan**
  - Do A in Period 1; Do B in Period 2; etc.
- **A DYNAMIC PLAN**
  - Do A in Period 1,
  - **BUT** in Period 2:
    - ◆ If Growth, do B
    - ◆ If Stagnation, do C
    - ◆ If Loss, do D

## 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**

**I.E., 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**

## Utility Analysis (1)

- **Key Issue: Feelings about Risk, Performance**
- **Two Questions**
  - (1) How much risk is appropriate for the decision-maker in this particular situation? This depends on
    - ◆ Particular situation of organization
      - Aggressive Developer,....., Pension Fund
    - ◆ Size of Risks
  - (2) What Level of Performance is Necessary?
    - ◆ To meet technical needs?
    - ◆ To meet competition?
- **Feelings must be measured**
  - This is the essence of Utility Analysis



## Utility Analysis (2)

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- **Feelings about Risk (See Lectures)**
- **Positive** -- Immediate losses may be worth big benefits
  - Lotteries
  - High-tech venture capital
- **Neutral** -- Insensitive to risk; do not care
- **Averse** -- Need to protect against big losses
  - bankruptcy
  - insurance against fire, loss of key assets

## Utility Analysis (3)

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- **Feelings about Performance (See Lectures)**
- **Diminishing Marginal Returns**
  - Extra Quality is not worth the cost
- **Increasing Returns**
  - To Scale (Process Facilities, Telephone, Power)
  - To Scope (Extent of Market Penetration)
- **Threshold Effect** -- because of
  - Standards Set by Competition
  - Deadlines, Windows of Opportunity

## **Utility Analysis (4)**

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- **Methods of Measuring Utility (See Lectures)**
- **Interview Process**
  - Preferences are Personal
  - Measurement must refer to Person, Group
- **Standard Techniques**
  - See References
- **Assess: MIT Expert System on Computer**
  - More Reliable Results
  - Much Faster
  - Much more economical, cost-effective