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PROFESSIONAL BODY FOR SUPPLY CHAIN MANAGEMENT

Decision Making Analysis for Supply Network Planning

Michael D. Ford

TQM Works Consulting

Agenda

I. Expected values

II. Alternate/Attribute Matrix

III. Decision-making:

- Under uncertainty
- Under risk
- Under certainty

Probabilities

"There are three kinds of lies: lies, damned lies and statistics"

Benjamin Disraeli

Any random probability

- [(The number of occurences of an event)/(total possibilities)]
- Randomly picking a number from 1 to 10
  = (1/10) or .1 or 10%
- Randomly picking an odd number from 1 to 10
  = (5/10) or .5 or 50%
- Randomly picking a 3, 4 or 5
  = (3/10) or .30 or 30%
- NOTE: the total probability will equal 1.00 or 100%

Flipping a two-sided fair coin

- Two possibilities, each with equal probability
- Probability of heads = ½ or .5 or 50%
- Probability of tails = ½ or .5 or 50%
- The total probability is ½ + ½ = 2/2 or 1.0 or 100%

Drawing a card from a fair deck, no jokers

- Probability of drawing a red card
  = (26 red cards)/(52 total cards) = ½ or .5 or 50%
- Probability of drawing a diamond
  = (13 diamonds)/(52 total cards) = 13/52 = ¼ or .25 or 25%
- Probability of drawing a jack
  = (4 jacks)/(52 total cards) = 1/13 or .0769 or 7.69%
- Probability of drawing a jack of diamonds
  = (1 jack of diamonds/52 total cards) = 1/52 or .019 or 1.9%

OR = (1/4) x (1/13) = 1/52 or .019 or 1.9%

- The total probability is (1/52) x 52 = 52/52 = 1.0 or 100%

Rolling a fair die

- There are six equally probably outcomes
- The probability of rolling any number, from 1 to 6:
  = 1/6 or .16667 or 16.7%
- The total probability is (1/6) x 6 = 6/6 = 1.0 or 100%
- The probability of rolling two die is the mutual probability
- Example: rolling a pair of sixes
  = (1/6) x (1/6) = 1/36 or .0278 or 2.78%

I. Expected Values

- The predicted outcomes
  - Statistical or judgmental
- A flip of a fair coin: heads
  - Would you bet 1R to possibly win 2R?
- A roll of a fair die: six
  - Would you bet 1R to possibly win 5R?

The expected value is commonly a statistical calculation.

I. Expected Values (cont.)

Playing a game of blackjack (aka 21)

- The dealer is showing a 7
- Your cards total 15
- Do you take a hit?

Two scenarios:

- Counting cards (statistical update)
- Not counting cards (heuristic)
  - Important: do not change strategy based on a hunch!

I. Expected Values (cont.)

- Probability Distributions for Random Events
  - Uniform – dice, coins, cards
  - Normal – temperature, birth weight, yields
  - Skewed – exam scores, wait times, life expectancy
- How to Assess the Distribution?
  - Statistical sampling
  - Past history
  - Visionaries

II. Alternate/Attribute Matrix

- Aka weighted ranking
- Supports qualitative analysis
- Lists alternative choices or options
- Identify important attributes/criteria
- Assign a weight to each criteria
- Score each alternative for each criteria
- Total the sum of each score x weight

II. Facility Location Matrix (example)

Location	Accessibility (50%)	Weather (30%)	Labor (20%)	Score
Kimberly	75	90	50	74.5
Cape Town	65	45	90	64.0
Jo-burg	85	80	75	81.5

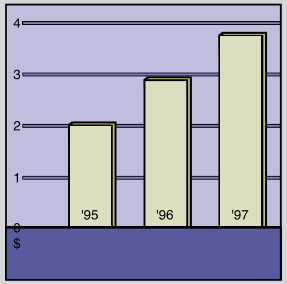
Q: Which location is preferred?

III. Decision-making Assumptions

- There are finite choices
  - The options or alternatives available
- There are finite outcomes
  - These are possible states of nature
- There is a gain (or loss) associated with each choice/outcome possibility
- Objective is to maximize the gain (or minimize the loss)

III. Decision-making Under Uncertainty

- Maximax
  - Maximize the maximum outcome
- Maximin
  - Maximize the minimum outcome
- Equally likely
  - Maximize the average outcome

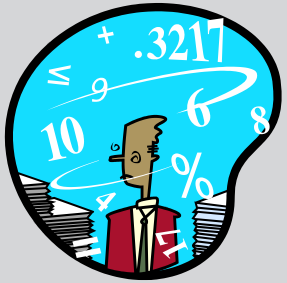


Sample Problem – Adding Capacity (uncertainty)

Capacity Choice (cost)	10 yr. demand (potential profit)	Net	Max.	Min.	Ave.
New Facility (100M)	Increases and satisfy (500M)	400M	400M	(100M)	150M
	Stays the same (0)	(100M)			
Expansion (10M)	Increases, partially satisfy (100M)	90M	90M	(10M)	40M
	Stays the same (0)	(10M)			
Do Nothing (0)	Increases, can't satisfy (0)	0	0	0	0
	Stays the same (0)	0			

III. Decision-making Under Risk

- Calculate or predict the *possibility* of each state of nature
- Calculate expected value of each choice
- Select option with highest gain
- This is often called the EMV
  - Expected monetary value



Same Problem – Adding Capacity (risk)

Capacity Choice (cost)	10 yr. demand (potential profit)	Net	Probability	Net x %	EV
New Facility (100M)	Increases and can satisfy (500M)	400M	0.6	240M	200M
	Stays the same (0)	(100M)	0.4	(40M)	
Expansion (10M)	Increases, partially satisfy (100M)	90M	0.6	54M	50M
	Stays the same (0)	(10M)	0.4	(4M)	
Do Nothing (0)	Increases, can't satisfy (0)	0	0.6	0	0
	Stays the same (0)	0	0.4	0	

III. Decision-making Under Certainty

- Scenario is defined as knowing which outcome (or state of nature) will result
- Risk is eliminated
- Often, there is a cost to attain the “perfect information”
- Calculate the EVPI
  - Expected value of perfect information

Same Problem – Adding Capacity (certainty)

Capacity Choice (cost)	10 yr. demand (potential profit)	Net
New Facility (100M)	Increases and satisfy (500M)	400M
	Stays the same (0)	(100M)
Expansion (10M)	Increases, partially satisfy (100M)	90M
	Stays the same (0)	(10M)
Do Nothing (0)	Increases, can't satisfy (0)	0
	Stays the same (0)	0

Summary

I. Expected values

II. Alternate/Attribute Matrix

III. Decision-making:

  – Under uncertainty

  – Under risk

  – Under certainty

- Any questions?