FIT3158 Business Decision Modelling

Tutorial 9

Decision Analysis
Decision Trees – Risk and Uncertainty

Topics covered:

➢ **Decision Analysis**

➢ **Decision Trees**

➢ **Using TreePlan***

*Download the Excel spreadsheet, **FIT3158 Tutorial 9.xlsx** for Exercise 1 and 2 below.*

Exercise 1 **(Ragsdale – Prob. 14-7)**

A car dealer is offering the following three two-year leasing options:

Plan	Fixed Monthly Payment	Additional Cost Per Kilometer
I	$200	$0.095 per kilometer.
II	$300	$0.061 for the first 6000 kilometers; $0.050 thereafter.
III	$170	$0.000 for the first 6000 kilometers; $0.14 per kilometer thereafter.

Assume a customer expects to drive between 15000 to 35000 kilometers during the next two years according to the following probability distribution:

    P(driving 15000 kilometers) = 0.1
    P(driving 20000 kilometers) = 0.2
    P(driving 25000 kilometers) = 0.2
    P(driving 30000 kilometers) = 0.3
    P(driving 35000 kilometers) = 0.2

a) Construct a payoff matrix for this problem.

b) What decision should be made according to the maximax decision rule? (Keep in mind that the "payoffs" here are costs, where less is better).

c) What decision should be made according to the maximin decision rule?

d) What decision should be made according to the minimax regret decision rule?

e) What decision should be made according to the EMV decision rule?

f) What decision should be made according to the EOL decision rule?

Exercise 2 **(Ragsdale – Prob. 14-6)**

The Fish House (TFH) in Norfolk, Virginia sells fresh fish and seafood. TFH receives daily shipments of farm-raised trout from a nearby supplier. Each trout costs $2.45 and is sold for $3.95. To maintain its reputation for freshness, at the end of the day TFH sells any leftover trout to a local pet food manufacturer for $1.25 each. The owner of TFH wants to determine how many trout to order each day. Historically, the daily demand for trout is:

Demand	10	11	12	13	14	15	16	17	18	19	20
Probability	0.02	0.06	0.09	0.11	0.13	0.15	0.18	0.11	0.07	0.05	0.03

a) Construct a payoff matrix for this problem.

b) What decision should be made according to the maximax decision rule?

c)   What decision should be made according to the maximin decision rule?

d)   What decision should be made according to the minimax regret decision rule?

e)   What decision should be made according to the EMV decision rule?

f)   What decision should be made according to the EOL decision rule?

g)   Perform a sensitivity analysis on the EMV by varying the selling price and the purchase cost.

h)   Find the expected value with perfect information and the expected value of perfect information (EVPI). Explain how this value could be interpreted.

Exercise 3   **(Lapin & Whisler – Prob. 5-14)**

Answer the following question based on the payoff table below:

Event	Probability	Act		
		A_1	A_2	A_3
E_1	0.3	10	20	30
E_2	0.5	40	-10	20
E_3	0.2	20	50	20

a)   Determine the expected payoff for each act. According to the Bayes decision rule, which is the best act?

b)   What is the expected payoff under certainty (expected value with perfect information)?

c)   Using your answers to (a) and (b), calculate the expected value of perfect information.

d)   What is the minimum expected opportunity loss?

e)   What do you notice about your answers to (c) and (d)?

Exercise 4

Erica is going to fly to London on September 5, 2009 and return home on September 20, 2009. It is now August 1, 2006. On August 1, 2009, she may buy a one-way ticket (for $350) or a round-trip ticket (for $660). She may also wait until September 1, 2009 to buy a ticket. On September 1, 2009, a one-way ticket will cost $370, and a round-trip ticket will cost $730. It is possible that between August 1 and September 1, her sister (who works for the airline) will be able to obtain a free one-way ticket for Erica. The probability that her sister will obtain the free ticket is 30%. If Erica has bought a roundtrip ticket on August 1 and her sister has obtained a free ticket, she may return "half" of her round-trip to the airline. In this case, her total cost will be $330 plus a $50 penalty. Use a decision tree approach to determine how to minimize Erica's expected cost of obtaining round-trip transportation to London.

a)   Construct a decision tree structure using Excel's Treeplan that reflects Erica's decision problem above as accurately as possible.

b)   If Erica's goal is to minimize her expected cost of obtaining round-trip transportation to London, what should she do?

c)   What is her optimal expected cost?