

FIT3158 Note - W9 Decision Analysis & Decision Trees – Risk and Uncertainty

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Non-probabilistic

[Decision Analysis 1: Maximax, Maximin, Minimax Regret - YouTube](#)

Optimistic Approach (Maximax) 大中取大

- Best of Best

we choose the alternative with the best of the best payoffs.

它找出每種行動的最好結果，再從最好結果中找一個更好的做為選擇

Conservative Approach (Maximin) 小中取大

- Best of Worst scenario

we choose the alternative that has best of the worst payoffs. We first choose the worst payoff in each alternative, and then choose the best of them.

它找出每種行動的最壞結果，再從最壞結果中找一個最好的做為它的選擇

Payoff Matrix &			
Land Purchased at Location(s)	Airport is Built at Location		
	A	B	MAX
A	\$13	(\$12)	\$13
B	(\$8)	\$11	\$11
A&B	\$5	(\$1)	\$5
None	\$0	\$0	\$0

大中取大
-->maximum

Land Purchased at Location(s)	A	B	MIN
A	\$13	(\$12)	(\$12)
B	(\$8)	\$11	(\$8)
A&B	\$5	(\$1)	(\$1)
None	\$0	\$0	\$0

小中取大
-->maximum

Opportunity Loss (Minimax Regret) 最小機會損失準則

- Minimize the maximum regret.
- $Regret = Best\ Payoff - Payoff\ Received$

小最大後悔準則，它利用機會成本的概念來進行決策。

- 決策首先要電腦會損失 (後悔值) 矩陣；機會損失的概念是，當一個事件發生時，由於你沒有選擇最優決策而帶來的收入損失。
- 決策者不知道各種自然狀態中任一種發生的機率，決策目標是確保避免較大的機會損失。
- 運用最小最大後悔值法時，首先要將決策矩陣從利潤矩陣轉變為機會損失矩陣；然後確定每一可選方案的最大機會損失；再次，在這些方案的最大機會損失中，選出一個最小值，與該最小值對應的可選方案便是決策選擇的方案。
- we choose the alternative with the minimum of all the maximum regrets across all alternatives. Regret is the difference between the best payoff and the actual payoff received in a particular state of nature.

		Best payoff			Regret = Best Payoff - Payoff Received
Alternatives		Growing	Stable	Declining	
Bonds		70 - 40 = 30 40	45 - 45 = 0 45	5 - 5 = 0 5	
Stocks		70 - 70 = 0 70	45 - 30 = 15 30	5 - (-13) = 18 -13	
Mutual Funds		70 - 53 = 17 53	45 - 45 = 0 45	5 - (-5) = 10 -5	

Alternatives	Growing	Stable	Declining	Maximum
Bonds	30	0	0	30
Stocks	0	15	18	18
Mutual Funds	17	0	10	17

Minimise regret 要做幾步
1. 暫max regret
2. 暫max regret 裏面ge min regret

step 2: Minimise regrets

Step1 : 暫Regret

Probabilistic

[Decision Analysis 2: EMV & EVPI - Expected Value & Perfect Information - YouTube](#)

Expected Monetary Value (EMV)

A weighted average of the payoffs for a decision alternative.

Alternatives	Growing	Stable	Declining	EMV
Bonds	40	45	5	32.0
Stocks	70	30	-13	25.1
Mutual Funds	53	45	-5	31.6
Probability	0.2	0.50	0.3	

由於32 為最大值，所以invest in Bond

Expected Value of Perfect Information (EVPI)

Expected Value of Perfect Information EVPI

maximum payment for additional information

$$EVPI = EVwPI - EVwoPI$$

Expected Value With
Perfect Information

Expected Value Without
Perfect Information

we choose the best payoff for each state of nature and multiply them by the probability of their state of nature, and add the results.

		Best payoff		
		$EVPI = EVwPI - EVwoPI$		
		Growing	Stable	Declining
<i>Bonds</i>		40	45	5
<i>Stocks</i>		70	30	-13
<i>Mutual Funds</i>		53	45	-5
<i>Probability</i>		0.2	0.50	0.3
$EVwPI = 70(0.2) + 45(0.5) + 5(0.3) = 38$				

$$\begin{aligned} & EVPI = EVwPI - EVwoPI \\ & EVwPI = 38 \\ & EVwoPI = 32 \\ & EVPI = 38 - 32 = 6 \end{aligned}$$

Expected Regret or Opportunity Loss (EOL)

[Decision Analysis 2b: Expected Opportunity Loss \(EOL\) - YouTube](#)

Alternatives	Growing	Stable	Declining
<i>Bonds</i>	40 30	45 0	5 0
<i>Stocks</i>	70 0	30 15	-13 18
<i>Mutual Funds</i>	53 17	45 0	5 - (-5)=10

Step1 : 握Regret like ([Here](#))

Alternatives	Growing	Stable	Declining	EOL
<i>Bonds</i>	30	0	0	$EOL(Bonds) = 0.2(30) + 0.5(0) + 0.3(0)$ 6.0 Minimum
<i>Stocks</i>	0	15	18	$EOL(Stocks) = 0.2(0) + 0.4(15) + 0.3(18)$ 12.9
<i>Mutual Funds</i>	17	0	10	$EOL(Mutual Funds) = 0.2(17) + 0.5(0) + 0.3(10)$ 6.4
<i>Probability</i>	0.2	0.50	0.3	

step 2: 握EOL。

由於6 為最小值， 所以invest in Bond

▼ Posterior probability

Calculating Posterior Probabilities

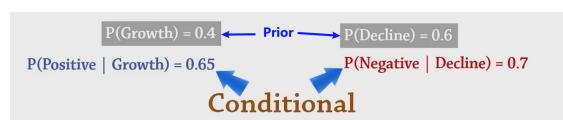
Suppose, in recent years, economic growth occurs 40% of the time, and economic decline occurs 60% of the time.

$P(Growth) = 0.4$

$P(Decline) = 0.6$

Report 意即Result = consultant ge 業績

In the past, when there was economic growth, the consultant's report was positive 65% of the time. And when there was economic decline, the consultant's report was negative 70% of the time.



題目

$P(\text{Growth}) = 0.4$ $P(\text{Positive} \mid \text{Growth}) = 0.65$ $P(\text{Negative} \mid \text{Growth}) = 1 - 0.65 = 0.35$	$P(\text{Decline}) = 0.6$ $P(\text{Positive} \mid \text{Decline}) = 0.7$																														
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Decision Analysis 5: Posterior (Revised) Probability Calculations

$P(\text{Growth}) = 0.4$ $P(\text{Positive} \mid \text{Growth}) = 0.65$	$P(\text{Decline}) = 0.6$ $P(\text{Positive} \mid \text{Decline}) = 0.7$																														
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	Prior	Conditional	Joint	Posterior												
Growth	0.4	0.65	0.26													
Decline	0.6	0.3	0.18													
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	Prior	Conditional	Joint	Posterior												
Growth	0.4	0.35	0.14													
Decline	0.6	0.7	0.42													

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	Prior	Conditional	Joint	Posterior												
Growth	0.4	0.65	0.26	0.59												
Decline	0.6	0.3	0.18	0.41												
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	Prior	Conditional	Joint	Posterior												
Growth	0.4	0.35	0.14	0.25												
Decline	0.6	0.7	0.42	0.42 / 0.56												

▼ Expected Value of Sample Information

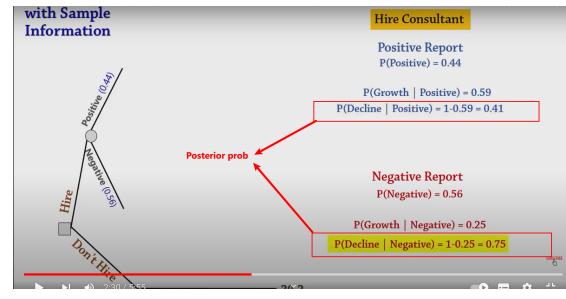
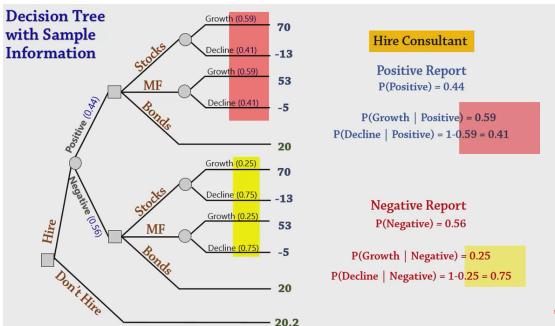


1. 握Expected value

Scenario: Now suppose there is an economic consultant that can provide additional information about the states of nature (or outcomes). And this consultant has some success history. We now have an additional decision situation. Should we hire this consultant or not?



Suppose the conditional probs of these are:"



Suppose the posterior probs of these are:

