

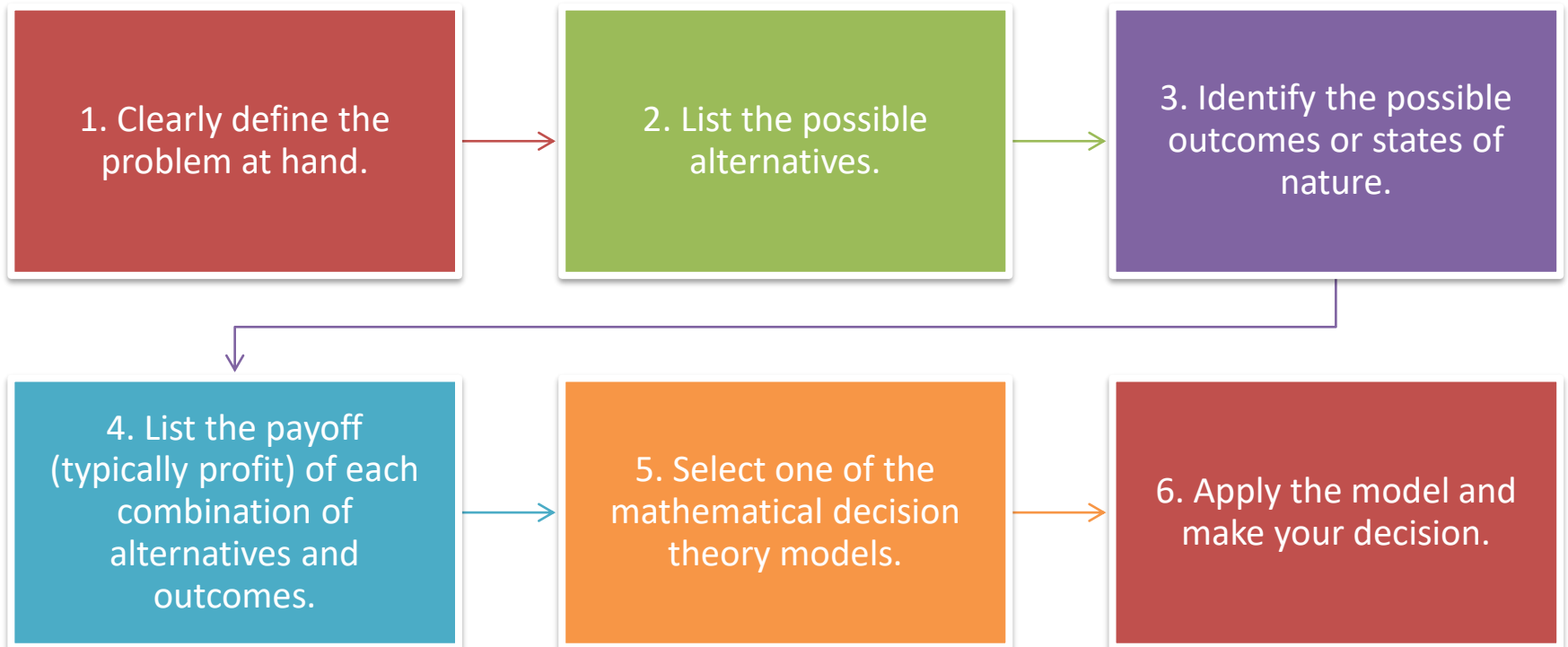
Teori Pengambilan Keputusan

Week 9

Decision Analysis

Decision Table

Six Steps in Decision Making



Thompson Lumber Company

- John Thompson merupakan *founder* dan pimpinan dari Thompson Lumber Company, sebuah perusahaan yang berlokasi di Portland, Oregon.

Step 1 - Define the Problem

- **Step 1.** Permasalahan yang dihadapi John Thompson adalah apakah ia perlu untuk menambah lini produksinya dengan memproduksi dan memasarkan produk baru, yaitu gudang penyimpanan kecil untuk di halaman belakang rumah.

Step 2 – Generate Alternatives

- An **alternative** is defined as a course of action or a strategy that the decision maker can choose.
- **Step 2.** John memutuskan bahwa alternative yang dimilikinya adalah membangun (1) pabrik baru yang besar untuk memproduksi gudang tersebut, (2) pabrik kecil, atau (3) tidak membuat pabrik baru sama sekali (misal, dia memiliki opsi untuk tidak mengembangkan produk baru tersebut).
- *One of the biggest mistakes that decision makers make is to leave out some important alternatives.*

Step 3 - Identify states of nature.

- The next step involves identifying the possible outcomes of the various alternatives
- In decision theory, those outcomes over which the decision maker has little or no control are called **states of nature**
- **Step 3.** Thompson menentukan bahwa hanya ada dua hasil yang mungkin didapatkannya: pasar untuk gudang tersebut menguntungkan, maksudnya terdapat permintaan tinggi untuk produk tersebut, atau bisa juga tidak menguntungkan, artinya permintaan untuk produk tersebut rendah.

Step 4 - List the payoff

- The next step is to express the payoff resulting from each possible combination of alternatives and outcomes.
- In decision theory, we call such payoffs or profits **conditional values**.
- **Step 4.** Karena Thompson ingin memaksimalkan keuntungannya (profit), dia dapat menggunakan profit untuk mengevaluasi setiap pilihannya.

Next Steps

- Step 5 and 6 – Select and apply one of the mathematical decision theory

Decision Table

or

Decision Tree?



Types of Decision-Making Environments



Decision making under certainty



Decision making under uncertainty



Decision making under risk

DECISION MAKING UNDER UNCERTAINTY

Decision Making Under Uncertainty

1

- Optimistic (maximax)

2

- Pessimistic (maximin)

3

- Criterion of realism (Hurwicz)

4

- Equally likely (Laplace)

5

- Minimax regret

Optimistic (maximax)

ALTERNATIVE	STATE OF NATURE		MAXIMUM IN A ROW (\$)
	FAVORABLE MARKET (\$)	UNFAVORABLE MARKET (\$)	
Construct a large plant	200,000	-180,000	200,000
Construct a small plant	100,000	-20,000	100,000
Do nothing	0	0	0

The best (maximum) payoff for each alternative is considered and the alternative with the best (maximum) of these is selected

Pessimistic (maximin)

ALTERNATIVE	STATE OF NATURE		MINIMUM IN A ROW (\$)
	FAVORABLE MARKET (\$)	UNFAVORABLE MARKET (\$)	
Construct a large plant	200,000	-180,000	-180,000
Construct a small plant	100,000	-20,000	-20,000
Do nothing	0	0	0

The worst (minimum) payoff for each alternative is considered and the alternative with the best (maximum) of these is selected

Criterion of Realism (Hurwicz)

- Select a coefficient of realism, α :
 - **1** when the decision maker is 100% **OPTIMISTIC** about the future
 - **0** when the decision maker is 100% **PESSIMISTIC** about the future
- Compute the weighted average:

Weighted average

$$= \alpha(\text{best in row}) + (1-\alpha)(\text{worst in row})$$

Criterion of Realism (Hurwicz)

ALTERNATIVE	STATE OF NATURE		CRITERION OF REALISM OR WEIGHTED AVERAGE ($\alpha=0.8$) \$
	FAVORABLE MARKET (\$)	UNFAVORABLE MARKET (\$)	
Construct a large plant	200,000	-180,000	124,000
Construct a small plant	100,000	-20,000	76,000
Do nothing	0	0	0

the alternative with the highest weighted average is then chosen

Equally likely (Laplace)

ALTERNATIVE	STATE OF NATURE		ROW AVERAGE (\$)
	FAVORABLE MARKET (\$)	UNFAVORABLE MARKET (\$)	
Construct a large plant	200,000	-180,000	10,000
Construct a small plant	100,000	-20,000	40,000
Do nothing	0	0	0

Find the average payoff for each alternative, and selecting the alternative with the best or highest average.

Minimax Regret

Opportunity loss is the amount lost by not picking the best alternative in a given state of nature

ALTERNATIVE	STATE OF NATURE	
	FAVORABLE MARKET (\$)	UNFAVORABLE MARKET (\$)
Construct a large plant	200,000 – 200,000 = 0	0 – (-180,000) = 180,000
Construct a small plant	200,000 – 100,000 = 100,000	0 – (-20,000) = 20,000
Do nothing	200,000 – 0 = 200,000	0 – 0 = 0

Minimax regret

ALTERNATIVE	STATE OF NATURE		MAXIMUM IN A ROW (\$)
	FAVORABLE MARKET (\$)	UNFAVORABLE MARKET (\$)	
Construct a large plant	0	180,000	180,000
Construct a small plant	100,000	20,000	100,000
Do nothing	200,000	0	200,000

finds the alternative that *minimizes* the *maximum* opportunity loss within each alternative

DECISION MAKING UNDER RISK

Decision Making Under Risk

1

- Expected Monetary Value (EMV)
- Expected Value of Perfect Information (EVPI)

2

- Expected Opportunity Loss (EOL)

Expected Monetary Value (EMV)

$$\text{EMV (alternative)} = \sum X_i \cdot P(X_i)$$

X_i = payoff for the alternative in state of nature i

$P(X_i)$ = probability of achieving payoff X_i



Expected Monetary Value (EMV)

ALTERNATIVE	STATE OF NATURE		ROW AVERAGE (\$)
	FAVORABLE MARKET (\$)	UNFAVORABLE MARKET (\$)	
Construct a large plant	200,000	-180,000	10,000
Construct a small plant	100,000	-20,000	40,000
Do nothing	0	0	0
Probabilities	0.50	0.50	

The alternative with the maximum EMV is then chosen

Expected Value of Perfect Information (EVPI)

1. Choose the best alternative for each state of nature
2. Multiply its payoff times the probability of occurrence of that state of nature, or expected value with perfect information (EVwPI)

$$EVwPI = \sum(\text{best payoff in state of nature } i) \cdot (\text{probability of state of nature } i)$$

Expected Value of Perfect Information (EVPI)

3. The EVPI is the improvement in EMV that results from having perfect information

$$EVPI = EVwPI - \text{Best EMV}$$



Expected Value of Perfect Information (EVPI)

ALTERNATIVE	STATE OF NATURE		ROW AVERAGE (\$)
	FAVORABLE MARKET (\$)	UNFAVORABLE MARKET (\$)	
Construct a large plant	200,000	-180,000	10,000
Construct a small plant	100,000	-20,000	40,000
Do nothing	0	0	0
With perfect information	200,000	0	100,000
Probabilities	0.50	0.50	

Expected Opportunity Loss (EOL)

1. Construct an opportunity loss table
2. Compute the EOL for each alternative by multiplying the probability of each state of nature times the appropriate opportunity loss value and adding these together

Expected Opportunity Loss (EOL)

ALTERNATIVE	STATE OF NATURE		EOL
	FAVORABLE MARKET (\$)	UNFAVORABLE MARKET (\$)	
Construct a large plant	0	180,000	90,000
Construct a small plant	100,000	20,000	60,000
Do nothing	200,000	0	100,000
Probabilities	0.50	0.50	

Using minimum EOL as the decision criterion

SENSITIVITY ANALYSIS

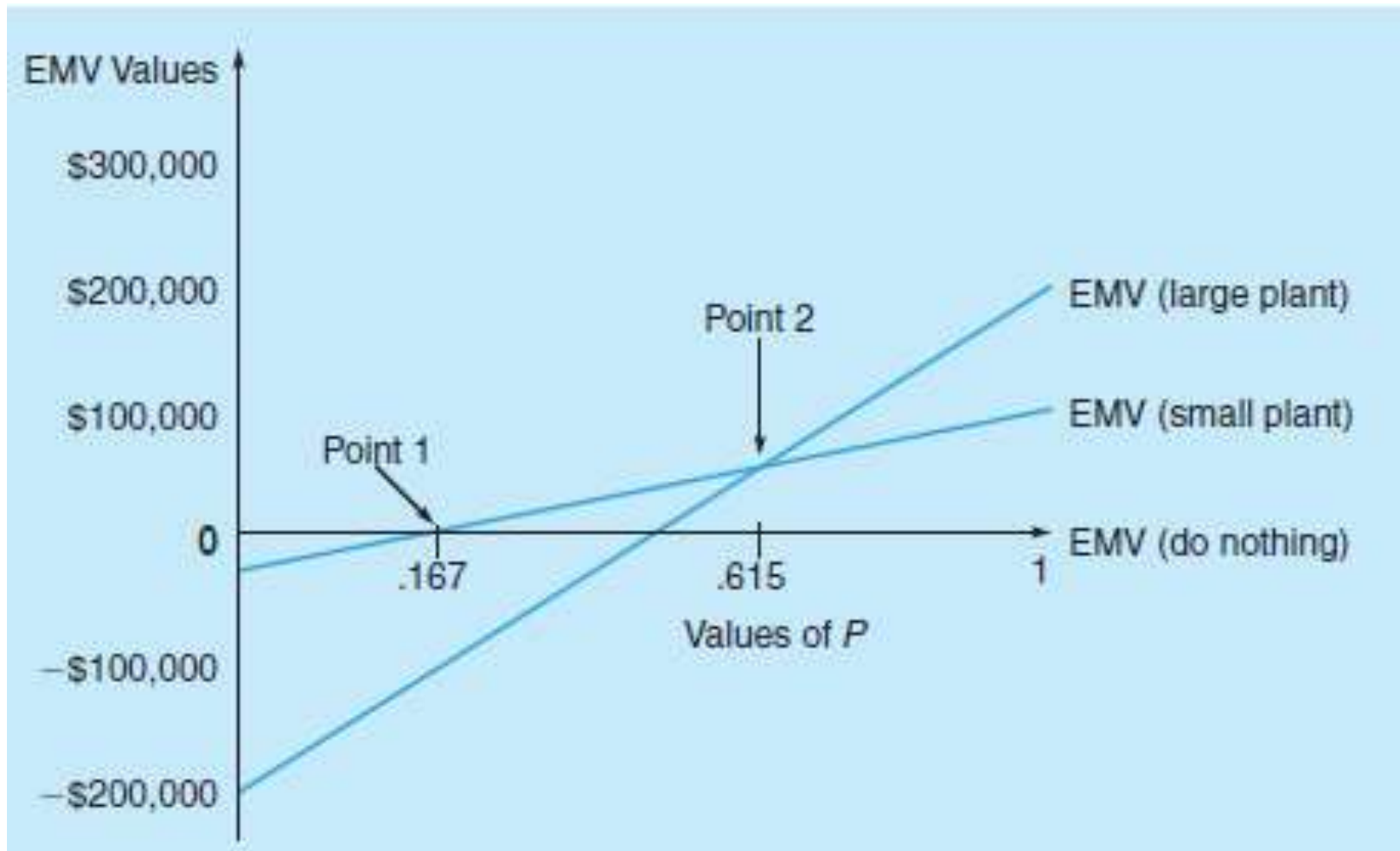
Sensitivity analysis

- *Sensitivity analysis* investigates how our decision might change given a change in the problem data.
- Example:
To know the effect of probabilities (P) on decision

Sensitivity analysis

- EMV(large plant)
 - = $\$200,000P - \$180,000(1 - P)$
 - = $\$200,000P - \$180,000 + 180,000P$
 - = $\$380,000P - \$180,000$
- EMV(small plant)
 - = $\$100,000P - \$20,000(1 - P)$
 - = $\$100,000P - \$20,000 + 20,000P$
 - = $\$120,000P - \$20,000$
- EMV(do nothing) = $\$0P + \$0(1 - P) = \$0$

Sensitivity analysis



EXERCISE

3-20 (1)

Mickey Lawson sedang mempertimbangkan untuk menginvestasikan uang warisan yang diterimanya. Berikut adalah tabel payoff (keuntungan) yang bisa diperoleh tahun depan dari tiga jenis investasi yang sedang dipertimbangkan Mickey :

ALTERNATIF KEPUTUSAN	<i>STATE OF NATURE</i>	
	EKONOMI BAIK	EKONOMI BURUK
Pasar saham	80.000	-20.000
Obligasi	30.000	20.000
Deposito	23.000	23.000
Probabilitas	0,5	0,5

3-20 (2)

- a. Apakah keputusan yang dapat memaksimalkan keuntungan yang diharapkan (expected profits)?
- b. Berapakah jumlah maksimum yang harus dibayar untuk mendapatkan peramalan sempurna tentang kondisi ekonomi?
- c. Buatlah tabel *opportunity loss* untuk investasi-investasi tersebut.
- d. Apakah keputusan yang akan meminimasi *expected opportunity loss (EOL)*?
- e. Berapakah EOL minimal?

3-24 (1)

Today's Electronics memiliki spesialisasi dalam memproduksi komponen elektronik modern. Perusahaan ini juga akan memproduksi mesin untuk memproduksi komponen tersebut. Phyllis Weinberger, orang yang bertanggung jawab sebagai konsultan bagi pimpinan Today's Electronics tentang mesin manufaktur elektronik tersebut, telah membuat tabel berikut mengenai fasilitas yang akan dibangun:

	<i>STATE OF NATURE</i>		
	PASAR BAIK	PASAR SEDANG	PASAR BURUK
Fasilitas besar	550.000	110.000	-310.000
Fasilitas medium	300.000	129.000	-100.000
Fasilitas kecil	200.000	100.000	-32.000
Tidak ada fasilitas	0	0	0

3-24 (1)

- a. Apakah keputusan jika menggunakan metode maximax?
- b. Apakah keputusan jika menggunakan metode maximin?
- c. Apakah keputusan jika menggunakan metode Hurwicz? (gunakan *coefficient of realism* 0,3)
- d. Apakah keputusan jika menggunakan metode laplace?
- e. Buatlah tabel *opportunity loss*.
- f. Apakah keputusan jika menggunakan metode minimax regret?
- g. Diskusikan perbedaan pada hasil-hasil tersebut.

3-26

Perusahaan Megley Cheese adalah perusahaan kecil yang memproduksi beberapa jenis produk keju. Salah satu produknya adalah selai keju yang dijual di toko-toko ritel. Jason Megley harus memutuskan berapa banyak selai keju yang harus diproduksi tiap bulan. Probabilitas adanya permintaan enam kardus adalah 0,1, untuk 7 kardus adalah 0,3, untuk 8 kardus adalah 0,5, dan untuk 9 kardus adalah 0,1. Biaya tiap kardus adalah \$45, dan harga jual tiap kardus adalah \$95. Tiap kardus yang tidak terjual hingga akhir bulan tidak akan memiliki nilai, karena sudah basi. Berapa kardus selai keju yang harus diproduksi Jason tiap bulan?

THANK YOU