

Ch. 19: Decision Analysis

Multiple Choice

1. An uncertain future event affecting the consequence, or payoff, associated with a decision is known as
- decision alternative.
 - payoff node.
 - chance event.
 - uncertain probability.

2. Rashmi's bakery is well known for its cookies. The following table gives the profits for three processes under two demand scenarios.

	Low Demand	High Demand
Process 1	10	18
Process 2	15	8
Process 3	9	13

Probabilities of the Low or High demands are unknown. Rashmi would like to know at what probability of Low demand will the Processes 2 and 3 give the same expected profit?

- 0.469
 - 0.513
 - 0.4545
 - 0.5454
3. Nodes indicating points where a decision is made are known as _____ nodes.
- decision
 - chance
 - unconditional
 - conditional

4. Rashmi's bakery is well known for its cookies. The following table gives the profits for three processes under two demand scenarios.

	Low Demand	High Demand
Process 1	10	18
Process 2	15	8
Process 3	9	13

Probabilities of the Low or High demands are unknown. Rashmi would like to know at what probability of Low demand will the Processes 1 and 2 give the same expected profit?

- 0.3333
- 0.6589
- 0.4123
- 0.6667

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5. New information obtained through research or experimentation that enables an updating or revision of the state-of-nature probabilities is _____ information.

- a. population
- b. prior
- c. sample
- d. conditional

6. The probability of one event given the known outcome of a (possibly) related event is known as _____ probability.

- a. posterior
- b. joint
- c. prior
- d. conditional

7. Rashmi's bakery is well known for its cookies. The following table gives the profits for three processes under two demand scenarios.

	Low Demand	High Demand
Process 1	10	18
Process 2	15	8
Process 3	9	13

Probabilities of the Low or High demands are unknown. Rashmi would like to know at what probability of Low demand will the Processes 1 and 3 give the same expected profit?

- a. 125%
- b. 83%
- c. Their expected values will never be equal.
- d. Always pick Process 3 regardless of the probabilities.

8. A tabular representation of the payoffs for a decision problem is a

- a. decision tree.
- b. payoff table.
- c. sequential node.
- d. problem table.

9. The outcomes of uncontrollable future events that can affect the outcome of a decision are known as

- a. alternatives.
- b. decision events.
- c. payoffs.
- d. states of nature.

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10. Avanti’s Electronics Ltd is deciding which of the three cities to start a new production facility in. The estimated profits in millions for each demand level is given below.

	Light Demand	Medium Demand	High Demand
Plano	16	24	19
Wichita	25	17	12
Pittsburgh	13	29	20
Probability	0.35	0.45	0.2

Given the current information, which city should be the preferred city?

- a. Pittsburgh
 - b. Wichita
 - c. Plano
 - d. Plano or Pittsburgh
11. A line or arc connecting the nodes of a decision tree is called a(n)
- a. junction.
 - b. intersection.
 - c. branch.
 - d. node.
12. A decision criterion which weights the payoff for each decision by its probability of occurrence is the
- a. payoff criterion.
 - b. expected value criterion.
 - c. decision strategy.
 - d. expected value of perfect information criterion.
13. For a decision alternative, the weighted average of the payoffs is known as
- a. the expected value of perfect information.
 - b. the expected value.
 - c. weighted probability.
 - d. perfect information.

14. Avanti’s Electronics Ltd is deciding which of the three cities to start a new production facility in. The estimated profits in millions for each demand level is given below.

	Light Demand	Medium Demand	High Demand
Plano	16	24	19
Wichita	25	17	12
Pittsburgh	13	29	20

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Probability 0.35 0.45 0.2

The management feels that Pittsburgh’s estimated profit for Medium demand is a bit on the higher side, and it should be lowered. At what profit level will the Expected profit from the Pittsburgh location be equal to that from the Plano location?

- a. 24.5633
- b. 25.9881
- c. 25.8889
- d. 26.4122

15. Which of the following is the increase in expected profit that would result if one knew with certainty which state of nature would occur?

- a. Expected monetary value
- b. Payoff
- c. Expected value of perfect information
- d. None of these alternatives is correct.

16. Avanti’s Electronics Ltd is deciding which of the three cities to start a new production facility in. The estimated profits in millions for each demand level is given below.

	Light Demand	Medium Demand	High Demand
Plano	16	24	19
Wichita	25	17	12
Pittsburgh	13	29	20
Probability	0.35	0.45	0.2

The management feels that Wichita’s estimated profit for High demand is a bit on the lower side, and it should be re-estimated. At what profit level will the Expected profit from the Pittsburgh location be equal to that from the Wichita location?

- a. 24.7
- b. 25.85
- c. 26.42
- d. 26.0

17. The probability of a state of nature that results after using Bayes' theorem to adjust the prior probability based on sample information is called _____ probability.

- a. joint
- b. conditional
- c. posterior
- d. decision

18. The outcomes of future events that cannot be controlled by the decision maker are called

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- a. decision outcomes.
- b. states of nature.
- c. prior events.
- d. posterior events.

19. A tabular presentation of the expected gain from the various options open to a decision maker is called
- a. a payoff table.
 - b. a decision tree.
 - c. the expected values table.
 - d. the branch probabilities table.

20. Given the following payoff table, compute probabilities P1 and P2 which will make the Expected Value of Setup 2 and Setup 3 equal? What is the value of P1?

	Low	Medium	High
Setup 1	16	21	15
Setup 2	25	17	18
Setup 3	20	25	15
Probability	0.2	P1	P2

- a. 0.6109
- b. 0.30909
- c. 0.2987
- d. 0.4123

21. The expected value of information that would tell the decision maker exactly which state of nature is going to occur is the _____ information.

- a. expected value of sample
- b. expected value of perfect
- c. revised state-of-nature
- d. updated research

22. Given the following payoff table, compute probabilities P1 and P2 which will make the Expected Value of Alt 1 and Alt 2 equal? What is the value of P1?

	s1	s2	s3
Alt 1	16	21	15
Alt 2	25	17	22
Alt 3	20	25	15
Probability	0.2	P1	P2

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- a. 0.6727
- b. 0.3273
- c. 0.4185
- d. 0.8122

23. The process of revising prior probabilities to create posterior probabilities based on sample information requires using
- a. decision strategies.
 - b. a subjective approach.
 - c. Bayes' theorem.
 - d. the posterior revision.

ANSWER: c

24. You are given the following table with income payoffs (in thousands of dollars).

Decision Alternative	States of Nature	
	s_1	s_2
d_1	100	200
d_2	50	300
d_3	500	0

Assume the following probability information is given. I_1 and I_2 are the outcomes of the sample information available.

$P(s_1) = 0.3;$

$P(s_2) = 0.7;$

$P(s_1 | I_1) = 0.6585; P(s_2 | I_1) = 0.3415$

$P(s_1 | I_2) = 0.0508, P(s_2 | I_2) = 0.9492$

What is the expected value of the sample information EVSI?

- a. \$225
- b. \$79.50
- c. \$84.12
- d. \$75.44

25. Below you are given a profit payoff table involving three decision alternatives and two states of nature.

Decision Alternative	States of Nature	
	s_1	s_2
A	6	8
B	10	12
C	20	6

The probability of occurrence of $s_1 = 0.2$. The expected value of alternative A is

- a. 7.6.
- b. 11.6.

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- c. 8.8.
- d. 13.6.

26. Below you are given a profit payoff table involving three decision alternatives and two states of nature.

Decision Alternative	States of Nature	
	s_1	s_2
A	6	8
B	10	12
C	20	6

The probability of occurrence of $s_1 = 0.2$. The recommended decision alternative based on the expected value is

- a. A.
- b. B.
- c. C.
- d. Both A and C are recommended.

27. Below you are given a profit payoff table involving three decision alternatives and two states of nature.

Decision Alternative	States of Nature	
	s_1	s_2
A	6	8
B	10	12
C	20	6

The probability of occurrence of $s_1 = 0.2$. The expected value of the best alternative is

- a. 8.8.
- b. 7.4.
- c. 9.6.
- d. 11.6.

28. Below you are given a profit payoff table involving three decision alternatives and two states of nature.

Decision Alternative	States of Nature	
	s_1	s_2
A	6	8
B	10	12
C	20	6

The probability of occurrence of $s_1 = 0.33$. The expected value of perfect information is

- a. 14.64
- b. 11.34
- c. 4.02
- d. 5.87

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29. Application of Bayes' theorem enables us to compute the
- prior probability of each state of nature.
 - posterior probability of each sample outcome.
 - conditional probability of the sample outcomes given each state of nature.
 - conditional probability of the states of nature given each sample outcome.
30. A posterior probability associated with sample information is of the form
- $P(\text{a sample outcome} \mid \text{a state of nature})$.
 - $P(\text{a state of nature} \mid \text{a sample outcome})$.
 - $P(\text{a decision alternative} \mid \text{a sample outcome})$.
 - $P(\text{a sample outcome} \mid \text{a decision alternative})$.

Subjective Short Answer

31. Assume you have a sum of money available that you would like to invest in one of the three available investment plans: stocks, bonds, or money market. The conditional annual return payoffs (in \$) of each plan under two possible economic conditions are shown below. The probability of the occurrence of economic condition I is 0.28.

	Economic Condition I	Economic Condition II
Stocks	1,500	3,500
Bonds	2,500	2,000
Money Market	1,800	4,000

- Compute the expected value of the three investment options. Which investment option would you select, based on the expected values?
- Compute the expected value with perfect information (i.e., expected value under certainty).
- Compute the expected value of perfect information (EVPI).

32. The following payoff table shows profits for two decision alternatives under three different states of nature. It is known that the probability of the occurrence of state of nature 1 is .1.

Profit	State of Nature 1	State of Nature 2	State of Nature 3
Decision Alternative 1	10	13	9
Decision Alternative 2	15	9	10

- What should the probabilities of states of nature 2 and 3 be so that the expected values of the two decision alternatives equal one another?
- Determine the expected values of the two decision alternatives.

33. Michael, Nancy, & Associates (MNA) produce color printers. The demand outcomes for their printers could be light, medium, or high with the following probabilities.

	Light Demand	Medium Demand	High Demand
Probability	0.5	0.3	0.2

The company has three production alternatives for the coming period. The annual profit payoffs (in millions of dollars) associated with the three alternatives are shown below.

Light Demand Medium Demand High Demand

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Alternative 1	18	28	20
Alternative 2	25	17	-5
Alternative 3	2	35	17

- Compute the expected value of the three alternatives. Which alternative would you select, based on the expected values?
- Compute the expected value with perfect information (i.e., expected value under certainty).
- Compute the expected value of perfect information (EVPI).

34. Suppose we are interested in investing in one of three investment opportunities: d_1 , d_2 , or d_3 . The following profit payoff table shows the profits (in thousands of dollars) under each of the three possible economic conditions— s_1 , s_2 , and s_3 . The probability of the occurrence of s_1 is 0.1, and the probability of the occurrence of s_2 is 0.3.

Decision Alternative	States of Nature		
	s_1	s_2	s_3
d_1	19	28	29
d_2	19	18	-5
d_3	4	40	16

- Determine the expected value of each alternative and indicate which decision alternative is the best.
- Determine the expected value with perfect information about the states of nature.
- Determine the expected value of perfect information.

35. You are given a decision analysis situation with three possible states of nature s_1 , s_2 , and s_3 . The prior probabilities are 0.20, 0.45, and 0.35. With sample information I , you are provided with the following information.

$$P(I | s_1) = 0.85; \quad P(I | s_2) = 0.70; \quad P(I | s_3) = 0.40$$

- Compute $P(I)$.
- Compute the revised probabilities of $P(s_1 | I)$, $P(s_2 | I)$, and $P(s_3 | I)$.

36. Assume you have a sum of money available that you would like to invest in one of the two available investment plans: stocks or bonds. The conditional annual return payoffs of each plan under two possible economic conditions are as follows.

	Economic Condition I	Economic Condition II
Stocks	\$40,000	\$8,000
Bonds	\$8,000	\$12,000

- If the probability of Economic Condition I occurring is 0.8, where should you invest your money? Use the expected value criterion and show the expected values for both the investment plans.
- Compute the expected value with perfect information about the economic conditions (expected value under certainty).
- Determine expected value of perfect information (EVPI).

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69. A poll released this week found that in a random sample of registered voters, 60% indicated that they think a female “**will run**” for the presidency, 30% said a female “**will not run**,” and 10% had “**no opinion**.” When asked their opinions on whether or not a female could be elected, 66% of those who said a female “**will run**” thought a female could be elected; 25% of those who thought a female “**will not run**” thought a female could be elected; whereas 20% of those who had no opinion said that a female could be elected.

- a. What percentage of registered voters (in this sample) thought that a female could be elected?
- b. Given that a person thought that a female could be elected, what is the probability that this person said a female “**will not run**” for the presidency?
- c. Compute all the posterior probabilities.