

DISCUSSION AND REVIEW QUESTIONS

1. What is the chief role of the operations manager?
2. List the steps in the decision-making process.
3. Explain the term *bounded rationality*.
4. Explain the term *suboptimization*.
5. What are some of the reasons for poor decisions?
6. What information is contained in a payoff table?
7. What is sensitivity analysis, and how can it be useful to a decision maker?
8. Contrast maximax and maximin decision strategies. Under what circumstances is each appropriate?
9. Under what circumstances is expected monetary value appropriate as a decision criterion? When isn't it appropriate?
10. Explain or define each of the following terms.
 - a. Laplace criterion
 - b. Minimax regret
 - c. Expected value
 - d. Expected value of perfect information
11. What information does a decision maker need in order to perform an expected-value analysis of a problem? What options are available to the decision maker if the probabilities of the states of nature are unknown? Can you think of a way you might use sensitivity analysis in such a case?
12. Suppose a manager is using maximum EMV as a basis for making a capacity decision and, in the process, obtains a result in which there is a virtual tie between two of the seven alternatives. How is the manager to make a decision?
13. Identify three potential unethical actions or inactions related to decision analysis and the ethical principle each violates (see Chapter 1).

PROBLEMS

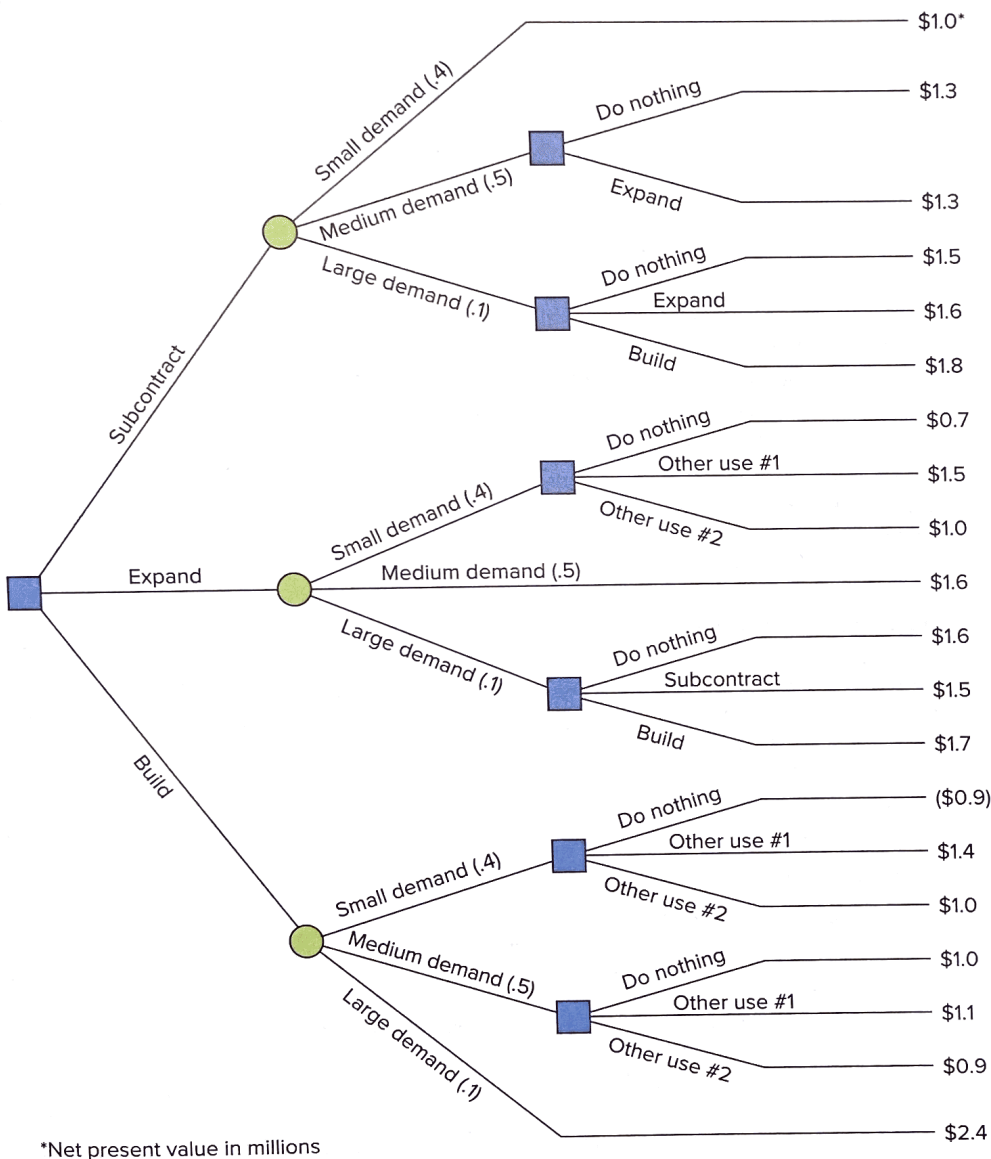
1. A small building contractor has recently experienced two successive years in which work opportunities exceeded the firm's capacity. The contractor must now make a decision on capacity for next year. Estimated profits under each of the two possible states of nature are as shown in the table below. Which alternative should be selected if the decision criterion is:
 - a. Maximax?
 - b. Maximin?
 - c. Laplace?
 - d. Minimax regret?

Alternative	NEXT YEAR'S DEMAND	
	Low	High
Do nothing	\$50*	\$60
Expand	20	80
Subcontract	40	70

*Profit in \$ thousands.

2. Refer to Problem 1. Suppose after a certain amount of discussion, the contractor is able to subjectively assess the probabilities of low and high demand: $P(\text{low}) = .3$ and $P(\text{high}) = .7$.
 - a. Determine the expected profit of each alternative. Which alternative is best? Why?
 - b. Analyze the problem using a decision tree. Show the expected profit of each alternative on the tree.
 - c. Compute the expected value of perfect information. How could the contractor use this knowledge?
3. Refer to Problems 1 and 2. Construct a graph that will enable you to perform sensitivity analysis on the problem. Over what range of $P(\text{high})$ would the alternative of doing nothing be best? Expand? Subcontract?

4. A firm that plans to expand its product line must decide whether to build a small or a large facility to produce the new products. If it builds a small facility and demand is low, the net present value after deducting for building costs will be \$400,000. If demand is high, the firm can either maintain the small facility or expand it. Expansion would have a net present value of \$450,000, and maintaining the small facility would have a net present value of \$50,000.
- If a large facility is built and demand is high, the estimated net present value is \$800,000. If demand turns out to be low, the net present value will be -\$10,000.
- The probability that demand will be high is estimated to be .60, and the probability of low demand is estimated to be .40.
- Analyze using a tree diagram.
 - Compute the EVPI. How could this information be used?
 - Determine the range over which each alternative would be best in terms of the value of P (demand low).
5. Determine the course of action that has the highest expected payoff for this decision tree.



6. The lease of Theme Park, Inc., is about to expire. Management must decide whether to renew the lease for another 10 years or to relocate near the site of a proposed motel. The town planning board is currently debating the merits of granting approval to the motel. A consultant has estimated the net present value of Theme Park's two alternatives under each state of nature as shown on the following page.

What course of action would you recommend using?

- Maximax
- Maximin
- Laplace
- Minimax regret

Options	Motel Approved	Motel Rejected
Renew	\$ 500,000	\$4,000,000
Relocate	5,000,000	100,000

- Refer to Problem 6. Suppose that the management of Theme Park, Inc., has decided that there is a .35 probability that the motel's application will be approved.
 - If management uses maximum expected monetary value as the decision criterion, which alternative should it choose?
 - Represent this problem in the form of a decision tree.
 - If management has been offered the option of a temporary lease while the town planning board considers the motel's application, would you advise management to sign the lease? The lease will cost \$24,000.
- Construct a graph that can be used for sensitivity analysis for the preceding problem.
 - How sensitive is the solution to the problem in terms of the probability estimate of .35?
 - Suppose that, after consulting with a member of the town planning board, management decides that an estimate of approval is approximately .45. How sensitive is the solution to this revised estimate? Explain.
 - Suppose the management is confident of all the estimated payoffs except for \$4 million. If the probability of approval is .35, for what range of payoff for renew/reject will the alternative selected using the maximum expected value remain the same?
- A firm must decide whether to construct a small, medium, or large stamping plant. A consultant's report indicates a .20 probability that demand will be low and an .80 probability that demand will be high.

If the firm builds a small facility and demand turns out to be low, the net present value will be \$42 million. If demand turns out to be high, the firm can either subcontract and realize the net present value of \$42 million or expand greatly for a net present value of \$48 million.

The firm could build a medium-size facility as a hedge: If demand turns out to be low, its net present value is estimated at \$22 million; if demand turns out to be high, the firm could do nothing and realize a net present value of \$46 million, or it could expand and realize a net present value of \$50 million.

If the firm builds a large facility and demand is low, the net present value will be -\$20 million, whereas high demand will result in a net present value of \$72 million.

 - Analyze this problem using a decision tree.
 - What is the maximin alternative?
 - Compute the EVPI and interpret it.
 - Perform sensitivity analysis on $P(\text{high})$.
- A manager must decide how many machines of a certain type to buy. The machines will be used to manufacture a new gear for which there is increased demand. The manager has narrowed the decision to two alternatives: buy one machine or buy two. If only one machine is purchased and demand is more than it can handle, a second machine can be purchased at a later time. However, the cost per machine would be lower if the two machines were purchased at the same time.

The estimated probability of low demand is .30, and the estimated probability of high demand is .70.

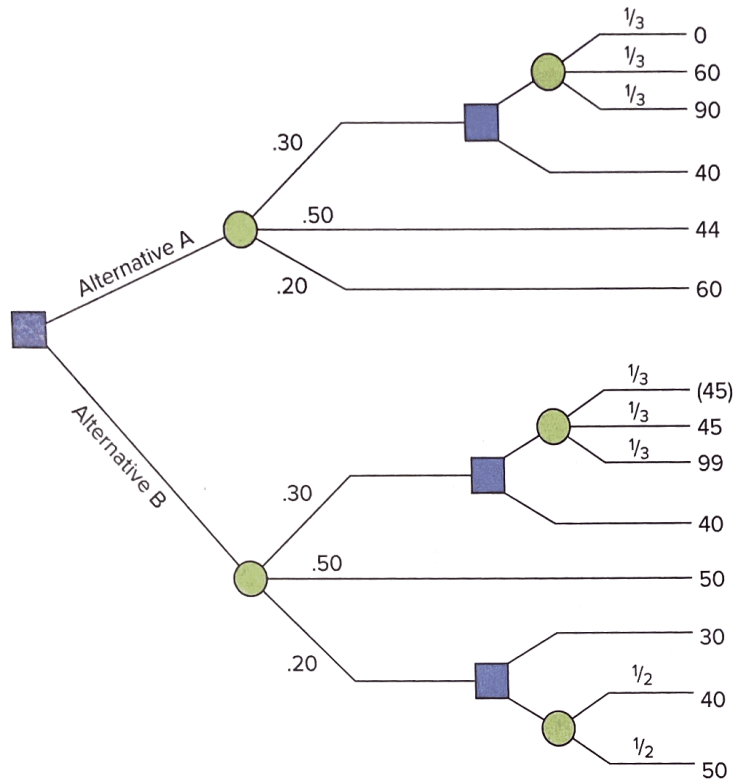
The net present value associated with the purchase of two machines initially is \$75,000 if demand is low and \$130,000 if demand is high.

The net present value for one machine and low demand is \$90,000. If demand is high, there are three options. One option is to do nothing, which would have a net present value of \$90,000.

A second option is to subcontract; that would have a net present value of \$110,000. The third option is to purchase a second machine. This option would have a net present value of \$100,000.

How many machines should the manager purchase initially? Use a decision tree to analyze this problem.

11. Determine the course of action that has the highest EMV for the accompanying tree diagram.



12. A logistics provider plans to have a new warehouse built to handle increasing demands for its services. Although the company is unsure of how much demand there will be, it must decide now on the size (large or small) of the warehouse. Preliminary estimates are that if a small warehouse is built and demand is low, the monthly income will be \$700,000. If demand is high, it will have to either expand the facility or lease additional space. Leasing will result in a monthly income of \$100,000, while expanding will result in a monthly income of \$500,000.
- If a large warehouse is built and demand is low, monthly income will only be \$40,000, while if demand is high, monthly income will be \$2 million.
- Construct a tree diagram for this decision.
 - Using your tree diagram, identify the choice that would be made using each of the four approaches for decision making under uncertainty.
13. The director of social services of a county has learned that the state has mandated additional information requirements. This will place an additional burden on the agency. The director has identified three acceptable alternatives to handle the increased workload. One alternative is to reassign present staff members, the second is to hire and train two new workers, and the third is to redesign current practice so that workers can readily collect the information with little additional effort. An unknown factor is the caseload for the coming year when the new data will be collected on a trial basis. The estimated costs for various options and caseloads are shown in the following table.

	CASELOAD		
	Moderate	High	Very High
Reassign staff	\$50*	60	85
New staff	60	60	60
Redesign collection	40	50	90

*Cost in \$ thousands.