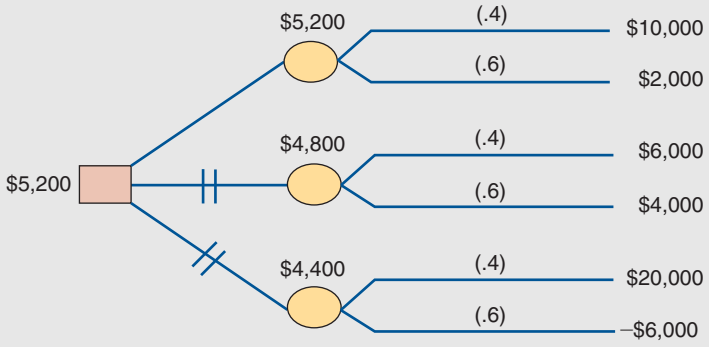
Module A *Rapid* Review

Main Heading	Review Material	MyOMLab
THE DECISION PROCESS IN OPERATIONS (pp. 678–679)	To achieve the goals of their organizations, managers must understand how decisions are made and know which decision-making tools to use. Overcoming uncertainty is a manager's mission. Decision tables and decision trees are used in a wide number of OM situations. ■ **Big data**—The huge amount of economic, production, and consumer data now being collected in digital form.	Concept Questions: 1.1–1.4
FUNDAMENTALS OF DECISION MAKING (pp. 679–680)	*Alternative*—A course of action or strategy that may be chosen by a decision maker. *State of nature*—An occurrence or a situation over which a decision maker has little or no control. Symbols used in a decision tree: **1.** □—A decision node from which one of several alternatives may be selected. **2.** ○—A state-of-nature node out of which one state of nature will occur. When constructing a decision tree, we must be sure that all alternatives and states of nature are in their correct and logical places and that we include *all* possible alternatives and states of nature, usually including the "do nothing" option.	Concept Questions: 2.1–2.4
DECISION TABLES (p. 680)	■ **Decision table**—A tabular means of analyzing decision alternatives and states of nature. A decision table is sometimes called a payoff table. For any alternative and a particular state of nature, there is a *consequence*, or an *outcome*, which is usually expressed as a monetary value; this is called the *conditional value*.	Concept Questions: 3.1–3.4
TYPES OF DECISION-MAKING ENVIRONMENTS (pp. 681–684)	There are three decision-making environments: (1) decision making under uncertainty, (2) decision making under risk, and (3) decision making under certainty. When there is complete *uncertainty* about which state of nature in a decision environment may occur (i.e., when we cannot even assess probabilities for each possible outcome), we rely on three decision methods: (1) maximax, (2) maximin, and (3) equally likely. ■ **Maximax**—A criterion that finds an alternative that maximizes the maximum outcome. ■ **Maximin**—A criterion that finds an alternative that maximizes the minimum outcome. ■ **Equally likely**—A criterion that assigns equal probability to each state of nature. Maximax is also called an "optimistic" decision criterion, while maximin is also called a "pessimistic" decision criterion. Maximax and maximin present best case/worst case planning scenarios. Decision making under risk relies on probabilities. The states of nature must be mutually exclusive and collectively exhaustive, and their probabilities must sum to 1. ■ **Expected monetary value (EMV)**—The expected payout or value of a variable that has different possible states of nature, each with an associated probability. The EMV represents the expected value or *mean* return for each alternative *if we could repeat this decision (or similar types of decisions) a large number of times*. The EMV for an alternative is the sum of all possible payoffs from the alternative, each weighted by the probability of that payoff occurring: EMV (Alternative i) = (Payoff of 1st state of nature) × (Probability of 1st of state of nature) + (Payoff of 2nd state of nature) × (Probability of 2nd state of nature) + . . . + (Payoff of last state of nature) × (Probability of last state of nature) ■ **Expected value of perfect information (EVPI)**—The difference between the payoff under perfect information and the payoff under risk. ■ **Expected value *with* perfect information (EVwPI)**—The expected (average) return if perfect information is available. EVPI represents an upper bound on what you would be willing to spend on state-of-nature information: EVPI = EVwPI − Maximum EMV EVwPI = (Best outcome for 1st state of nature) × (Probability of 1st state of nature) + (Best outcome for 2nd state of nature) × (Probability of 2nd state of nature) + . . . + (Best outcome for last state of nature) × (Probability of last state of nature)	Concept Questions: 4.1–4.4 Problems: A.1–A.20 Virtual Office Hours for Solved Problems: A.1, A.2

Module A *Rapid* Review *continued*

Main Heading	Review Material	MyOMLab
DECISION TREES (pp. 684–688)	When there are two or more sequential decisions, and later decisions are based on the outcome of prior ones, the decision tree (as opposed to decision table) approach becomes appropriate. ■ **Decision tree**—A graphical means of analyzing decision alternatives and states of nature. Analyzing problems with *decision trees* involves five steps: 1. Define the problem. 2. Structure or draw the decision tree. 3. Assign probabilities to the states of nature. 4. Estimate payoffs for each possible combination of decision alternatives and states of nature. 5. Solve the problem by computing the expected monetary values (EMV) for each state-of-nature node. This is done by working *backward*—that is, by starting at the right of the tree and working back to decision nodes on the left:  Decision trees force managers to examine all possible outcomes, including unfavorable ones. A manager is also forced to make decisions in a logical, sequential manner. Short parallel lines on a decision tree mean "prune" that branch, as it is less favorable than another available option and may be dropped.	Concept Questions: 5.1–5.4 Problems: A.21–A.32 Virtual Office Hours for Solved Problem: A.3

Self Test

■ **Before taking the self-test,** refer to the learning objectives listed at the beginning of the module and the key terms listed at the end of the module.

LO A.1 On a decision tree, at each state-of-nature node:
a) the alternative with the greatest EMV is selected.
b) an EMV is calculated.
c) all probabilities are added together.
d) the branch with the highest probability is selected.

LO A.2 In decision table terminology, a course of action or a strategy that may be chosen by a decision maker is called a(n):
a) payoff.
b) alternative.
c) state of nature.
d) all of the above.

LO A.3 If probabilities are available to the decision maker, then the decision-making environment is called:
a) certainty. **b)** uncertainty.
c) risk. **d)** none of the above.

LO A.4 What is the EMV for Alternative 1 in the following decision table?

	STATE OF NATURE	
Alternative	***S1***	***S2***
A1	$15,000	$20,000
A2	$10,000	$30,000
Probability	0.30	0.70

a) $15,000 **b)** $17,000
c) $17,500 **d)** $18,500
e) $20,000

LO A.5 The most that a person should pay for perfect information is:
a) the EVPI.
b) the maximum EMV minus the minimum EMV.
c) the minimum EMV.
d) the maximum EMV.

LO A.6 On a decision tree, once the tree has been drawn and the payoffs and probabilities have been placed on the tree, the analysis (computing EMVs and selecting the best alternative):
a) is done by working backward (starting on the right and moving to the left).
b) is done by working forward (starting on the left and moving to the right).
c) is done by starting at the top of the tree and moving down.
d) is done by starting at the bottom of the tree and moving up.

LO A.7 A decision tree is preferable to a decision table when:
a) a number of sequential decisions are to be made.
b) probabilities are available.
c) the maximax criterion is used.
d) the objective is to maximize regret.

Answers: LO A.1. b; LO A.2. b; LO A.3. c; LO A.4. d; LO A.5. a; LO A.6. a; LO A.7. a.