|  |
| --- |
| True / False |

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| 1. The process of decision making is more limited than that of problem solving.

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| --- | --- | --- |
|   | a.  | True |
|   | b.  | False |

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| *ANSWER:* | True |
| *POINTS:* | 1 |
| *DIFFICULTY:* | Easy |
| *LEARNING OBJECTIVES:* | IMS.ASWC.19.01.01 - 1.1 |
| *NATIONAL STANDARDS:* | United States - BUSPROG: Reflective Thinking |
| *TOPICS:* | 1.1 Problem Solving and Decision Making |
| *KEYWORDS:* | Bloom's: Understand |

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| 2. The breakeven point is the point at which the volume of output produced is the result of total revenue equaling total cost.

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| --- | --- | --- |
|   | a.  | True |
|   | b.  | False |

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| *ANSWER:* | True |
| *POINTS:* | 1 |
| *DIFFICULTY:* | Easy |
| *LEARNING OBJECTIVES:* | IMS.ASWC.19.01.04 - 1.4 |
| *NATIONAL STANDARDS:* | United States - BUSPROG: Reflective Thinking |
| *TOPICS:* | 1.4 Models of Cost, Revenue, and Profit |
| *KEYWORDS:* | Bloom's: Understand |

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| 3. Problem solving encompasses both the identification of a problem and the action to resolve it.

|  |  |  |
| --- | --- | --- |
|   | a.  | True |
|   | b.  | False |

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| --- | --- |
| *ANSWER:* | True |
| *POINTS:* | 1 |
| *DIFFICULTY:* | Easy |
| *LEARNING OBJECTIVES:* | IMS.ASWC.19.01.01 - 1.1 |
| *NATIONAL STANDARDS:* | United States - BUSPROG: Reflective Thinking |
| *TOPICS:* | 1.1 Problem Solving and Decision Making |
| *KEYWORDS:* | Bloom's: Remember |

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| 4. The decision-making process includes implementation and subsequent evaluation of the decision.

|  |  |  |
| --- | --- | --- |
|   | a.  | True |
|   | b.  | False |

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| --- | --- |
| *ANSWER:* | False |
| *POINTS:* | 1 |
| *DIFFICULTY:* | Easy |
| *LEARNING OBJECTIVES:* | IMS.ASWC.19.01.01 - 1.1 |
| *NATIONAL STANDARDS:* | United States - BUSPROG: Reflective Thinking |
| *TOPICS:* | 1.1 Problem Solving and Decision Making |
| *KEYWORDS:* | Bloom's: Understand |

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| 5. Most successful quantitative analysis models will advise separating the management analyst from the managerial team until after the problem has been fully structured.

|  |  |  |
| --- | --- | --- |
|   | a.  | True |
|   | b.  | False |

|  |  |
| --- | --- |
| *ANSWER:* | False |
| *POINTS:* | 1 |
| *DIFFICULTY:* | Moderate |
| *LEARNING OBJECTIVES:* | IMS.ASWC.19.01.03 - 1.3 |
| *NATIONAL STANDARDS:* | United States - BUSPROG: Reflective Thinking |
| *TOPICS:* | 1.3 Quantitative Analysis |
| *KEYWORDS:* | Bloom's: Understand |

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| 6. The value of making a decision based on models is dependent on how closely the model represents the real situation.

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| --- | --- | --- |
|   | a.  | True |
|   | b.  | False |

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| *ANSWER:* | True |
| *POINTS:* | 1 |
| *DIFFICULTY:* | Easy |
| *LEARNING OBJECTIVES:* | IMS.ASWC.19.01.03 - 1.3 |
| *NATIONAL STANDARDS:* | United States - BUSPROG: Reflective Thinking |
| *TOPICS:* | 1.3 Quantitative Analysis |
| *KEYWORDS:* | Bloom's: Understand |

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| 7. Uncontrollable inputs are the decision variables for a model.

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| --- | --- | --- |
|   | a.  | True |
|   | b.  | False |

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| --- | --- |
| *ANSWER:* | False |
| *POINTS:* | 1 |
| *DIFFICULTY:* | Easy |
| *LEARNING OBJECTIVES:* | IMS.ASWC.19.01.03 - 1.3 |
| *NATIONAL STANDARDS:* | United States - BUSPROG: Reflective Thinking |
| *TOPICS:* | 1.3 Quantitative Analysis |
| *KEYWORDS:* | Bloom's: Remember |

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| 8. The feasible solution is the best solution possible for a mathematical model.

|  |  |  |
| --- | --- | --- |
|   | a.  | True |
|   | b.  | False |

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| --- | --- |
| *ANSWER:* | False |
| *POINTS:* | 1 |
| *DIFFICULTY:* | Moderate |
| *LEARNING OBJECTIVES:* | IMS.ASWC.19.01.03 - 1.3 |
| *NATIONAL STANDARDS:* | United States - BUSPROG: Reflective Thinking |
| *TOPICS:* | 1.3 Quantitative Analysis |
| *KEYWORDS:* | Bloom's: Understand |

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| 9. Frederic W. Taylor is credited with providing the foundation for quantitative methodology in the early part of the 20th century.

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| --- | --- | --- |
|   | a.  | True |
|   | b.  | False |

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| *ANSWER:* | True |
| *POINTS:* | 1 |
| *DIFFICULTY:* | Easy |
| *LEARNING OBJECTIVES:* | IMS.ASWC.19.01.01 - 1.1 |
| *NATIONAL STANDARDS:* | United States - BUSPROG: Reflective Thinking |
| *TOPICS:* | 1.1 Problem Solving and Decision Making |
| *KEYWORDS:* | Bloom's: Remember |

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| 10. To identify the choice that provides the highest profit and also uses the fewest employees, we apply a single-criterion decision process.

|  |  |  |
| --- | --- | --- |
|   | a.  | True |
|   | b.  | False |

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| *ANSWER:* | False |
| *POINTS:* | 1 |
| *DIFFICULTY:* | Moderate |
| *LEARNING OBJECTIVES:* | IMS.ASWC.19.01.01 - 1.1 |
| *NATIONAL STANDARDS:* | United States - BUSPROG: Reflective Thinking |
| *TOPICS:* | 1.1 Problem Solving and Decision Making |
| *KEYWORDS:* | Bloom's: Understand |

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| 11. The most critical component in determining the success or failure of any quantitative approach to decision making is problem definition.

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| --- | --- | --- |
|   | a.  | True |
|   | b.  | False |

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| --- | --- |
| *ANSWER:* | True |
| *POINTS:* | 1 |
| *DIFFICULTY:* | Easy |
| *LEARNING OBJECTIVES:* | IMS.ASWC.19.01.03 - 1.3 |
| *NATIONAL STANDARDS:* | United States - BUSPROG: Reflective Thinking |
| *TOPICS:* | 1.3 Quantitative Analysis |
| *KEYWORDS:* | Bloom's: Remember |

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| 12. The first step in the decision-making process is to identify the problem.

|  |  |  |
| --- | --- | --- |
|   | a.  | True |
|   | b.  | False |

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| --- | --- |
| *ANSWER:* | True |
| *POINTS:* | 1 |
| *DIFFICULTY:* | Easy |
| *LEARNING OBJECTIVES:* | IMS.ASWC.19.01.01 - 1.1 |
| *NATIONAL STANDARDS:* | United States - BUSPROG: Reflective Thinking |
| *TOPICS:* | 1.1 Problem Solving and Decision Making |
| *KEYWORDS:* | Bloom's: Remember |

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| 13. All uncontrollable inputs or data must be specified before we can analyze the model and recommend a decision or solution for the problem.

|  |  |  |
| --- | --- | --- |
|   | a.  | True |
|   | b.  | False |

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| *ANSWER:* | True |
| *POINTS:* | 1 |
| *DIFFICULTY:* | Moderate |
| *LEARNING OBJECTIVES:* | IMS.ASWC.19.01.03 - 1.3 |
| *NATIONAL STANDARDS:* | United States - BUSPROG: Reflective Thinking |
| *TOPICS:* | 1.3 Quantitative Analysis |
| *KEYWORDS:* | Bloom's: Understand |

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| 14. If you are deciding to buy either machine A, B, or C with the objective of minimizing the sum of labor, material and utility costs, you are dealing with a single-criterion decision.

|  |  |  |
| --- | --- | --- |
|   | a.  | True |
|   | b.  | False |

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| --- | --- |
| *ANSWER:* | True |
| *POINTS:* | 1 |
| *DIFFICULTY:* | Moderate |
| *LEARNING OBJECTIVES:* | IMS.ASWC.19.01.01 - 1.1 |
| *NATIONAL STANDARDS:* | United States - BUSPROG: Reflective Thinking |
| *TOPICS:* | 1.1 Problem Solving and Decision Making |
| *KEYWORDS:* | Bloom's: Understand |

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| 15. Model development should be left to quantitative analysts; the model user's involvement should begin at the implementation stage.

|  |  |  |
| --- | --- | --- |
|   | a.  | True |
|   | b.  | False |

|  |  |
| --- | --- |
| *ANSWER:* | False |
| *POINTS:* | 1 |
| *DIFFICULTY:* | Moderate |
| *LEARNING OBJECTIVES:* | IMS.ASWC.19.01.01 - 1.1 |
| *NATIONAL STANDARDS:* | United States - BUSPROG: Reflective Thinking |
| *TOPICS:* | 1.1 Problem Solving and Decision Making |
| *KEYWORDS:* | Bloom's: Understand |

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| 16. A feasible solution is one that satisfies at least one of the constraints in the problem.

|  |  |  |
| --- | --- | --- |
|   | a.  | True |
|   | b.  | False |

|  |  |
| --- | --- |
| *ANSWER:* | False |
| *POINTS:* | 1 |
| *DIFFICULTY:* | Easy |
| *LEARNING OBJECTIVES:* | IMS.ASWC.19.01.03 - 1.3 |
| *NATIONAL STANDARDS:* | United States - BUSPROG: Reflective Thinking |
| *TOPICS:* | 1.3 Quantitative Analysis |
| *KEYWORDS:* | Bloom's: Understand |

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| 17. A toy train layout designed to represent an actual railyard is an example of an analog model.

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| --- | --- | --- |
|   | a.  | True |
|   | b.  | False |

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| --- | --- |
| *ANSWER:* | False |
| *POINTS:* | 1 |
| *DIFFICULTY:* | Easy |
| *LEARNING OBJECTIVES:* | IMS.ASWC.19.01.03 - 1.3 |
| *NATIONAL STANDARDS:* | United States - BUSPROG: Reflective Thinking |
| *TOPICS:* | 1.3 Quantitative Analysis |
| *KEYWORDS:* | Bloom's: Remember |

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| 18. The last step in any problem-solving process is to choose the correct alternative among those available.

|  |  |  |
| --- | --- | --- |
|   | a.  | True |
|   | b.  | False |

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| --- | --- |
| *ANSWER:* | False |
| *POINTS:* | 1 |
| *DIFFICULTY:* | Easy |
| *LEARNING OBJECTIVES:* | IMS.ASWC.19.01.01 - 1.1 |
| *NATIONAL STANDARDS:* | United States - BUSPROG: Reflective Thinking |
| *TOPICS:* | 1.1 Problem Solving and Decision Making |
| *KEYWORDS:* | Bloom's: Understand |

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| 19. Decision variables in a production process are those that cannot be controlled by the manager.

|  |  |  |
| --- | --- | --- |
|   | a.  | True |
|   | b.  | False |

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| --- | --- |
| *ANSWER:* | False |
| *POINTS:* | 1 |
| *DIFFICULTY:* | Easy |
| *LEARNING OBJECTIVES:* | IMS.ASWC.19.01.03 - 1.3 |
| *NATIONAL STANDARDS:* | United States - BUSPROG: Reflective Thinking |
| *TOPICS:* | 1.3 Quantitative Analysis |
| *KEYWORDS:* | Bloom's: Understand |

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| 20. The optimal solution to a model is one in which known, specific values provide the best output.

|  |  |  |
| --- | --- | --- |
|   | a.  | True |
|   | b.  | False |

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| --- | --- |
| *ANSWER:* | True |
| *POINTS:* | 1 |
| *DIFFICULTY:* | Easy |
| *LEARNING OBJECTIVES:* | IMS.ASWC.19.01.03 - 1.3 |
| *NATIONAL STANDARDS:* | United States - BUSPROG: Reflective Thinking |
| *TOPICS:* | 1.3 Quantitative Analysis |
| *KEYWORDS:* | Bloom's: Understand |

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| 21. If all the uncontrollable inputs into the decision-making process are known to the decision maker, the model of decision making is known as "stochastic."

|  |  |  |
| --- | --- | --- |
|   | a.  | True |
|   | b.  | False |

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| *ANSWER:* | False |
| *POINTS:* | 1 |
| *DIFFICULTY:* | Moderate |
| *LEARNING OBJECTIVES:* | IMS.ASWC.19.01.03 - 1.3 |
| *NATIONAL STANDARDS:* | United States - BUSPROG: Reflective Thinking |
| *TOPICS:* | 1.3 Quantitative Analysis |
| *KEYWORDS:* | Bloom's: Remember |

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| Multiple Choice |

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| 22. The field of management science

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|   | a.  | concentrates on the use of quantitative methods to assist in decision making. |
|   | b.  | approaches decision making rationally, with techniques based on the scientific method. |
|   | c.  | is another name for decision science and for operations research. |
|   | d.  | All of these are correct. |

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| *ANSWER:* | d |
| *POINTS:* | 1 |
| *DIFFICULTY:* | Easy |
| *LEARNING OBJECTIVES:* | IMS.ASWC.19.01.01 - 1.1 |
| *NATIONAL STANDARDS:* | United States - BUSPROG: Reflective Thinking |
| *TOPICS:* | 1.1 Problem Solving and Decision Making |
| *KEYWORDS:* | Bloom's: Remember |

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| 23. By identifying and defining a problem, we have

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|   | a.  | taken the final step in the decision-making process. |
|   | b.  | proposed all viable alternatives. |
|   | c.  | considered multiple criteria.  |
|   | d.  | taken the first step of decision making. |

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| *ANSWER:* | d |
| *POINTS:* | 1 |
| *DIFFICULTY:* | Easy |
| *LEARNING OBJECTIVES:* | IMS.ASWC.19.01.01 - 1.1 |
| *NATIONAL STANDARDS:* | United States - BUSPROG: Reflective Thinking |
| *TOPICS:* | 1.1 Problem Solving and Decision Making |
| *KEYWORDS:* | Bloom's: Remember |

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| 24. The set of decision alternatives

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|   | a.  | should be identified before the decision criteria are established. |
|   | b.  | are limited to quantitative solutions. |
|   | c.  | are evaluated as a part of the problem definition stage. |
|   | d.  | are best generated by brainstorming. |

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| *ANSWER:* | a |
| *POINTS:* | 1 |
| *DIFFICULTY:* | Easy |
| *LEARNING OBJECTIVES:* | IMS.ASWC.19.01.01 - 1.1 |
| *NATIONAL STANDARDS:* | United States - BUSPROG: Reflective Thinking |
| *TOPICS:* | 1.1 Problem Solving and Decision Making |
| *KEYWORDS:* | Bloom's: Remember |

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| 25. Decision criteria

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|   | a.  | are the choices faced by the decision maker. |
|   | b.  | are the problems faced by the decision maker. |
|   | c.  | are the ways to evaluate the choices faced by the decision maker. |
|   | d.  | are unique for any problem. |

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| *ANSWER:* | c |
| *POINTS:* | 1 |
| *DIFFICULTY:* | Moderate |
| *LEARNING OBJECTIVES:* | IMS.ASWC.19.01.01 - 1.1 |
| *NATIONAL STANDARDS:* | United States - BUSPROG: Reflective Thinking |
| *TOPICS:* | 1.1 Problem Solving and Decision Making |
| *KEYWORDS:* | Bloom's: Understand |

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| 26. In a multicriteria decision problem

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|   | a.  | it is impossible to select a single decision alternative. |
|   | b.  | the decision maker must evaluate each alternative with respect to each criterion. |
|   | c.  | successive decisions must be made over time. |
|   | d.  | All of these are correct. |

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| *ANSWER:* | b |
| *POINTS:* | 1 |
| *DIFFICULTY:* | Moderate |
| *LEARNING OBJECTIVES:* | IMS.ASWC.19.01.01 - 1.1 |
| *NATIONAL STANDARDS:* | United States - BUSPROG: Reflective Thinking |
| *TOPICS:* | 1.1 Problem Solving and Decision Making |
| *KEYWORDS:* | Bloom's: Understand |

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| 27. The quantitative analysis approach requires

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|   | a.  | the manager's prior experience with a similar problem. |
|   | b.  | a relatively uncomplicated problem. |
|   | c.  | mathematical expressions for the relationships. |
|   | d.  | All of these are correct. |

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| *ANSWER:* | c |
| *POINTS:* | 1 |
| *DIFFICULTY:* | Easy |
| *LEARNING OBJECTIVES:* | IMS.ASWC.19.01.02 - 1.2 |
| *NATIONAL STANDARDS:* | United States - BUSPROG: Reflective Thinking |
| *TOPICS:* | 1.2 Quantitative Analysis and Decision Making |
| *KEYWORDS:* | Bloom's: Remember |

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| 28. A thermometer is an example of a model that does not have the same physical appearance as that which is being modeled; thus, it is a(n)

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|   | a.  | analog model. |
|   | b.  | iconic model. |
|   | c.  | mathematical model. |
|   | d.  | qualitative model. |

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| *ANSWER:* | a |
| *POINTS:* | 1 |
| *DIFFICULTY:* | Moderate |
| *LEARNING OBJECTIVES:* | IMS.ASWC.19.01.03 - 1.3 |
| *NATIONAL STANDARDS:* | United States - BUSPROG: Reflective Thinking |
| *TOPICS:* | 1.3 Quantitative Analysis |
| *KEYWORDS:* | Bloom's: Understand |

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| 29. Inputs to a quantitative model

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|   | a.  | are a trivial part of the problem solving process. |
|   | b.  | are uncertain for a stochastic model. |
|   | c.  | are uncontrollable for the decision variables. |
|   | d.  | must all be deterministic if the problem is to have a solution. |

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| *ANSWER:* | b |
| *POINTS:* | 1 |
| *DIFFICULTY:* | Moderate |
| *LEARNING OBJECTIVES:* | IMS.ASWC.19.01.03 - 1.3 |
| *NATIONAL STANDARDS:* | United States - BUSPROG: Reflective Thinking |
| *TOPICS:* | 1.3 Quantitative Analysis |
| *KEYWORDS:* | Bloom's: Understand |

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| 30. When the value of the output cannot be determined even if the value of the controllable input is known, the model is

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|   | a.  | analog. |
|   | b.  | digital. |
|   | c.  | stochastic. |
|   | d.  | deterministic. |

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| *ANSWER:* | c |
| *POINTS:* | 1 |
| *DIFFICULTY:* | Moderate |
| *LEARNING OBJECTIVES:* | IMS.ASWC.19.01.03 - 1.3 |
| *NATIONAL STANDARDS:* | United States - BUSPROG: Reflective Thinking |
| *TOPICS:* | 1.3 Quantitative Analysis |
| *KEYWORDS:* | Bloom's: Understand |

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| 31. The volume that results in total revenue being equal to total cost is known as the

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|   | a.  | breakeven point. |
|   | b.  | marginal volume. |
|   | c.  | marginal cost. |
|   | d.  | profit mix. |

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| *ANSWER:* | a |
| *POINTS:* | 1 |
| *DIFFICULTY:* | Easy |
| *LEARNING OBJECTIVES:* | IMS.ASWC.19.01.04 - 1.4 |
| *NATIONAL STANDARDS:* | United States - BUSPROG: Reflective Thinking |
| *TOPICS:* | 1.4 Models of Cost, Revenue, and Profit |
| *KEYWORDS:* | Bloom's: Remember |

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| 32. Management science and operations research both involve

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|   | a.  | qualitative managerial skills. |
|   | b.  | quantitative approaches to decision making. |
|   | c.  | operational management skills. |
|   | d.  | scientific research as opposed to applications. |

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| *ANSWER:* | b |
| *POINTS:* | 1 |
| *DIFFICULTY:* | Easy |
| *LEARNING OBJECTIVES:* | IMS.ASWC.19.01.01 - 1.1 |
| *NATIONAL STANDARDS:* | United States - BUSPROG: Reflective Thinking |
| *TOPICS:* | 1.1 Problem Solving and Decision Making |
| *KEYWORDS:* | Bloom's: Remember |

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| 33. George Dantzig is important in the history of management science because he developed

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|   | a.  | the scientific management revolution. |
|   | b.  | World War II operations research teams. |
|   | c.  | the simplex method for linear programming. |
|   | d.  | powerful digital computers. |

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| *ANSWER:* | c |
| *POINTS:* | 1 |
| *DIFFICULTY:* | Easy |
| *LEARNING OBJECTIVES:* | IMS.ASWC.19.01.01 - 1.1 |
| *NATIONAL STANDARDS:* | United States - BUSPROG: Reflective Thinking |
| *TOPICS:* | 1.1 Problem Solving and Decision Making |
| *KEYWORDS:* | Bloom's: Remember |

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| 34. In order to undertake problem solving, the first step must be

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|   | a.  | the determination of the correct analytical solution procedure. |
|   | b.  | the definition of decision variables. |
|   | c.  | the identification of a difference between the actual and desired state of affairs. |
|   | d.  | None of these are correct. |

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| *ANSWER:* | c |
| *POINTS:* | 1 |
| *DIFFICULTY:* | Moderate |
| *LEARNING OBJECTIVES:* | IMS.ASWC.19.01.01 - 1.1 |
| *NATIONAL STANDARDS:* | United States - BUSPROG: Reflective Thinking |
| *TOPICS:* | 1.1 Problem Solving and Decision Making |
| *KEYWORDS:* | Bloom's: Understand |

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| 35. The process of problem definition must

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|   | a.  | include specific objectives and operating constraints. |
|   | b.  | occur prior to the quantitative analysis process. |
|   | c.  | involve both the analyst and the user of the results. |
|   | d.  | All of these are correct. |

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| *ANSWER:* | d |
| *POINTS:* | 1 |
| *DIFFICULTY:* | Moderate |
| *LEARNING OBJECTIVES:* | IMS.ASWC.19.01.03 - 1.3 |
| *NATIONAL STANDARDS:* | United States - BUSPROG: Reflective Thinking |
| *TOPICS:* | 1.3 Quantitative Analysis |
| *KEYWORDS:* | Bloom's: Understand |

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| 36. A model that uses a system of symbols or expressions to represent a problem is called a(n) \_\_\_\_\_\_ model.

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|   | a.  | mathematical |
|   | b.  | iconic |
|   | c.  | analog |
|   | d.  | constrained |

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| *ANSWER:* | a |
| *POINTS:* | 1 |
| *DIFFICULTY:* | Easy |
| *LEARNING OBJECTIVES:* | IMS.ASWC.19.01.03 - 1.3 |
| *NATIONAL STANDARDS:* | United States - BUSPROG: Reflective Thinking |
| *TOPICS:* | 1.3 Quantitative Analysis |
| *KEYWORDS:* | Bloom's: Understand |

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| 37. Which of the following is NOT one of the commonly used names for the body of knowledge involving quantitative approaches to decision making?

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|   | a.  | management science |
|   | b.  | business analytics |
|   | c.  | operations research |
|   | d.  | efficiency studies |

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| *ANSWER:* | d |
| *POINTS:* | 1 |
| *DIFFICULTY:* | Easy |
| *LEARNING OBJECTIVES:* | IMS.ASWC.19.01.01 - 1.1 |
| *NATIONAL STANDARDS:* | United States - BUSPROG: Reflective Thinking |
| *TOPICS:* | 1.1 Problem Solving and Decision Making |
| *KEYWORDS:* | Bloom's: Remember |

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| 38. A valid reason for using a quantitative approach to the decision-making process is when

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|   | a.  | the problem is repetitive, necessitating routine decision making. |
|   | b.  | the problem is unique and the manager has no prior experience solving this sort of problem. |
|   | c.  | the problem is particularly complex. |
|   | d.  | All of these are correct. |

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| *ANSWER:* | d |
| *POINTS:* | 1 |
| *DIFFICULTY:* | Moderate |
| *LEARNING OBJECTIVES:* | IMS.ASWC.19.01.02 - 1.2 |
| *NATIONAL STANDARDS:* | United States - BUSPROG: Reflective Thinking |
| *TOPICS:* | 1.2 Quantitative Analysis and Decision Making |
| *KEYWORDS:* | Bloom's: Understand |

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| Subjective Short Answer |

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| 39. A snack food manufacturer buys corn for tortilla chips from two cooperatives, one in Iowa and one in Illinois. The price per unit of the Iowa corn is $6.00 and the price per unit of the Illinois corn is $5.50.

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| a. | Define variables that would tell how many units to purchase from each source. |
| b. | Develop an objective function that would minimize the total cost. |
| c. | The manufacturer needs at least 12,000 units of corn. The Iowa cooperative can supply up to 8000 units, and the Illinois cooperative can supply at least 6000 units. Develop constraints for these conditions. |

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| *ANSWER:* | ​

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| a. | Let x1 = the number of units from Iowa |
|   | Let x2 = the number of units from Illinois |
| b. | Min 6x1 + 5.5x2 |
| c. | x1 + x 2 ≥ 12,000 |
|   | x1 ≥ 8000 |
|   | x1 ≥ 6000 |

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| *POINTS:* | 1 |
| *DIFFICULTY:* | Moderate |
| *LEARNING OBJECTIVES:* | IMS.ASWC.19.01.03 - 1.3 |
| *NATIONAL STANDARDS:* | United States - BUSPROG: Analytic |
| *TOPICS:* | 1.3 Quantitative Analysis |
| *KEYWORDS:* | Bloom's: Apply |

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| 40. The relationship d = 5000 − 25p describes what happens to demand (d) as price (p) varies. Here, price can vary between $10 and $50.

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| a. | How many units can be sold at the $10 price? How many can be sold at the $50 price? |
| b. | Model the expression for total revenue. |
| c. | Consider prices of $20, $30, and $40. Which of these three price alternatives will maximize total revenue? What are the values for demand and revenue at this price? |

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| *ANSWER:* |

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| a. | For p = 10, d = 4750 |
|   | For p = 50, d = 3750 |
| b. | TR = p(5000 − 25p) |
| c. | For p = 20, d = 4500, TR = $90,000 |
|   | For p = 30, d = 4250, TR = $127,500 |
|   | For p = 40, d = 4000, TR = $160,000 (maximum total revenue) |

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| *POINTS:* | 1 |
| *DIFFICULTY:* | Challenging |
| *LEARNING OBJECTIVES:* | IMS.ASWC.19.01.03 - 1.3 |
| *NATIONAL STANDARDS:* | United States - BUSPROG: Analytic |
| *TOPICS:* | 1.3 Quantitative Analysis |
| *KEYWORDS:* | Bloom's: Apply |

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| 41. There is a fixed cost of $50,000 to start a production process. Once the process has begun, the variable cost per unit is $25. The revenue per unit is projected to be $45.

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| a. | Write an expression for total cost. |
| b. | Write an expression for total revenue. |
| c. | Write an expression for total profit. |
| d. | Find the breakeven point. |

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| *ANSWER:* |

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| a. | C(x) = 50000 + 25x |
| b. | R(x) = 45x |
| c. | P(x) = 45x − (50000 + 25x) |
| d. | x = 2500 |

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| *POINTS:* | 1 |
| *DIFFICULTY:* | Challenging |
| *LEARNING OBJECTIVES:* | IMS.ASWC.19.01.04 - 1.4 |
| *NATIONAL STANDARDS:* | United States - BUSPROG: Analytic |
| *TOPICS:* | 1.4 Models of Cost, Revenue, and Profit |
| *KEYWORDS:* | Bloom's: Apply |

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| 42. An author has received an advance against royalties of $10,000. The royalty rate is $1.00 for every book sold in the United States, and $1.35 for every book sold outside the United States. Define variables for this problem and write an expression that could be used to calculate the number of books to be sold to cover the advance.

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| *ANSWER:* | Let x1 = the number of books sold in the U.S.Let x2 = the number of books sold outside the U.S.​10000 = 1x1 + 1.35x2 |
| *POINTS:* | 1 |
| *DIFFICULTY:* | Moderate |
| *LEARNING OBJECTIVES:* | IMS.ASWC.19.01.04 - 1.4 |
| *NATIONAL STANDARDS:* | United States - BUSPROG: Analytic |
| *TOPICS:* | 1.4 Models of Cost, Revenue, and Profit |
| *KEYWORDS:* | Bloom's: Apply |

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| 43. A university schedules summer school courses based on anticipated enrollment. The cost for faculty compensation, laboratories, student services, and allocated overhead for a computer class is $8500. If students pay $920 to enroll in the course, how large would enrollment have to be for the university to break even?

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| *ANSWER:* | Enrollment would need to be 10 students. |
| *POINTS:* | 1 |
| *DIFFICULTY:* | Moderate |
| *LEARNING OBJECTIVES:* | IMS.ASWC.19.01.04 - 1.4 |
| *NATIONAL STANDARDS:* | United States - BUSPROG: Analytic |
| *TOPICS:* | 1.4 Models of Cost, Revenue, and Profit |
| *KEYWORDS:* | Bloom's: Evaluate |

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| 44. As part of their application for a loan to buy Lakeside Farm, a property they hope to develop as a bed-and-breakfast operation, the prospective owners have projected:

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| Monthly fixed cost (loan payment, taxes, insurance, maintenance) | $6000 |
| Variable cost per occupied room per night |       20 |
| Revenue per occupied room per night |       75 |

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| a. | Write the expression for total cost per month. Assume 30 days per month. |
| b. | Write the expression for total revenue per month. |
| c.​ | If there are 12 guest rooms available, can they break even? What percentage of rooms would need to be occupied, on average, to break even? |

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| *ANSWER:* | ​

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| a. | C(x) = 6000 + 20(30)x     (monthly) |
| b. | R(x) = 75(30)x     (monthly) |
| c. | Breakeven occupancy = 3.64 or 4 occupied rooms per night, so they have enough rooms to breakeven. This would be a 33% occupancy rate. |

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| *POINTS:* | 1 |
| *DIFFICULTY:* | Challenging |
| *LEARNING OBJECTIVES:* | IMS.ASWC.19.01.04 - 1.4 |
| *NATIONAL STANDARDS:* | United States - BUSPROG: Analytic |
| *TOPICS:* | 1.4 Models of Cost, Revenue, and Profit |
| *KEYWORDS:* | Blooms': Apply |

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| 45. Organizers of an Internet training session will charge participants $150 to attend. It costs $3000 to reserve the room, hire the instructor, bring in the equipment, and advertise. Assume it costs $25 per student for the organizers to provide the course materials.

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| a. | How many students would have to attend for the company to break even? |
| b. | If the trainers think, realistically, that 20 people will attend, then what price should be charged per person for the organization to break even? |

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| *ANSWER:* | ​

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| a. | C(x) = 3000 + 25x |
|   | R(x) = 150x |
|   | Breakeven students = 24 |
| b. | Cost = 3000 + 25(20) |
|   | Revenue = 20p |
|   | Breakeven price = $175 |

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| *POINTS:* | 1 |
| *DIFFICULTY:* | Challenging |
| *LEARNING OBJECTIVES:* | IMS.ASWC.19.01.04 - 1.4 |
| *NATIONAL STANDARDS:* | United States - BUSPROG: Analytic |
| *TOPICS:* | 1.4 Models of Cost, Revenue, and Profit |
| *KEYWORDS:* | Bloom's: Apply |

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| 46. In this portion of an Excel spreadsheet, the user has given values for selling price, the costs, and a sample volume. Give the cell formula for

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| a. | cell E12, breakeven volume. |
| b. | cell E16, total revenue. |
| c. | cell E17, total cost. |
| d. | cell E19, profit (loss). |

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|   | A | B | C | D | E |  |
| 1 |   |   |   |  |
| 2 |   |   |   |  |
| 3 |   |   |   |  |
| 4 |  Breakeven calculation |   |   |
| 5 |   |   |   |  |
| 6 |   | Selling price per unit | 10 |  |
| 7 |   |   |   |  |
| 8 |   | Costs |   |  |
| 9 |   |    Fix cost | 8400 |  |
| 10 |   |    Variable cost per unit | 4.5 |  |
| 11 |   |   |   |  |
| 12 |   | Breakeven volume |   |  |
| 13 |   |   |   |  |
| 14 |   | Sample calculation |   |  |
| 15 |   |    Volume | 2000 |  |
| 16 |   |    Total revenue |   |  |
| 17 |   |    Total cost |   |  |
| 18 |   |   |   |  |
| 19 |   |    Profit (loss) |   |  |

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| *ANSWER:* |

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| a. | =E9/(E6-E10) |
| b. | =E15\*E6 |
| c. | =E9+E10\*E15 |
| d. | =E16-E17 |

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| *POINTS:* | 1 |
| *DIFFICULTY:* | Challenging |
| *LEARNING OBJECTIVES:* | IMS.ASWC.19.01.05 - 1.5 |
| *NATIONAL STANDARDS:* | United States - BUSPROG: Analytic |
| *TOPICS:* | 1.5 Management Science Techniques |
| *KEYWORDS:* | Bloom's: Apply |

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| 47. A furniture store has set aside 800 square feet to display its sofas and chairs. Each sofa utilizes 50 sq. ft. and each chair utilizes 30 sq. ft. At least five sofas and at least five chairs are to be displayed.

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| a. | Write a mathematical model representing the store's constraints. |
| b. | Suppose the profit on sofas is $200 and on chairs is $100. On a given day, the probability that a displayed sofa will be sold is .03 and that a displayed chair will be sold is .05. Mathematically model each of the following objectives: |
|   | 1. | Maximize the total pieces of furniture displayed. |
|   | 2. | Maximize the total expected number of daily sales. |
|   | 3. | Maximize the total expected daily profit. |

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| *ANSWER:* |

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| a. | 50s + 30c ≤ 800 |
|   | s ≥ 5 |
|   | c ≥ 5 |
| b. | (1)  Max s + c |
|   | (2)  Max .03s + .05c |
|   | (3)  Max 6s + 5c |

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| *POINTS:* | 1 |
| *DIFFICULTY:* | Challenging |
| *LEARNING OBJECTIVES:* | IMS.ASWC.19.01.03 - 1.3 |
| *NATIONAL STANDARDS:* | United States - BUSPROG: Analytic |
| *TOPICS:* | 1.3 Quantitative Analysis |
| *KEYWORDS:* | Bloom's: Apply |

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| 48. A manufacturer makes two products, doors and windows. Each must be processed through two work areas. Work area #1 has 60 hours of available production time per week. Work area #2 has 48 hours of available production time per week. Manufacturing of a door requires 4 hours in work area #1 and 2 hours in work area #2. Manufacturing of a window requires 2 hours in work area #1 and 4 hours in work area #2. Profit is $8 per door and $6 per window.

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| a.​ | Define decision variables that will tell how many units to build (doors and windows) per week. |
| b. | Develop an objective function that will maximize total profit per week. |
| c. | Develop production constraints for work area #1 and #2. |

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| *ANSWER:* |

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| a. | Let D = the number of doors to build per week |
|   | Let N = the number of windows to build per week |
| b. | Weekly Profit = 8D + 6W |
| c. | 4D + 2W ≤ 60 |
|   | 2D + 4W ≤ 48 |

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| *POINTS:* | 1 |
| *DIFFICULTY:* | Challenging |
| *LEARNING OBJECTIVES:* | IMS.ASWC.19.01.03 - 1.3 |
| *NATIONAL STANDARDS:* | United States - BUSPROG: Analytic |
| *TOPICS:* | 1.3 Quantitative Analysis |
| *KEYWORDS:* | Bloom's: Apply |

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| 49. A firm builds and sells small, ergonomic conference tables.  The investment in plant and equipment is $165,000. The variable cost per table is $1,500. The selling price of each table is $3,000. How many tables would have to be sold for the firm to break even?

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| *ANSWER:* | 110 tables |
| *POINTS:* | 1 |
| *DIFFICULTY:* | Moderate |
| *LEARNING OBJECTIVES:* | IMS.ASWC.19.01.04 - 1.4 |
| *NATIONAL STANDARDS:* | United States - BUSPROG: Analytic |
| *TOPICS:* | 1.4 Models of Cost, Revenue, and Profit |
| *KEYWORDS:* | Bloom's: Evaluate |

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| 50. A computer rework center has the capacity to rework 300 computers per day. The expected number of computers needing to be reworked per day is 225. The center is paid $26 for each computer reworked. The fixed cost of renting the reworking equipment is $250 per day. Work space rents for $150 per day. The cost of material is $18 per computer and labor costs $3 per computer. What is the breakeven number of computers reworked per day?

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| *ANSWER:* | 80 computers |
| *POINTS:* | 1 |
| *DIFFICULTY:* | Challenging |
| *LEARNING OBJECTIVES:* | IMS.ASWC.19.01.04 - 1.4 |
| *NATIONAL STANDARDS:* | United States - BUSPROG: Analytic |
| *TOPICS:* | 1.4 Models of Cost, Revenue, and Profit |
| *KEYWORDS:* | Bloom's: Evaluate |

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| 51. To establish a driver education school, organizers must decide how many cars, instructors, and students to have. Costs are estimated as follows. Annual fixed costs to operate the school are $30,000. The annual cost per car is $3000. The annual cost per instructor is $11,000 and one instructor is needed for each car. Tuition for each student is $350. Let x be the number of cars and y be the number of students.

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| a. | Write an expression for total cost. |
| b. | Write an expression for total revenue. |
| c. | Write an expression for total profit. |
| d.​​ | The school offers the course eight times each year. Each time the course is offered, there are two sessions. If they decide to operate five cars, and if four students can be assigned to each car, will they break even? |

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| *ANSWER:* | ​

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| a. | C(x) = 30000 + 14000x |
| b. | R(y) = 350y |
| c. | P(x,y) = 350y − (30000 + 14000x) |
| d.​​​ | Each car/instructor can serve up to (4 students/session)(2 sessions/course)(8 courses/year) = 64 students annually. Five cars can serve 320 students. If the classes are filled, then profit for five cars is 350(320) − (30000 + 14000(5)) = 12000. So, the school can reach the breakeven point. |

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| *POINTS:* | 1 |
| *DIFFICULTY:* | Challenging |
| *LEARNING OBJECTIVES:* | IMS.ASWC.19.01.04 - 1.4 |
| *NATIONAL STANDARDS:* | United States - BUSPROG: Analytic |
| *TOPICS:* | 1.4 Models of Cost, Revenue, and Profit |
| *KEYWORDS:* | Bloom's: Apply |

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| 52. Zipco Printing operates a shop that has five printing machines. The machines differ in their capacities to perform various printing operations due to differences in the machines' designs and operator skill levels. At the start of the workday there are five printing jobs to schedule. The manager must decide what the job-machine assignments should be.

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| a. | How could a quantitative approach to decision making be used to solve this problem? |
| b. | What would be the uncontrollable inputs for which data must be collected? |
| c. | Define the decision variables, objective function, and constraints to appear in the mathematical model. |
| d. | Is the model deterministic or stochastic? |
| e. | Suggest some simplifying assumptions for this problem. |

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| *ANSWER:* | ​

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| a. | A quantitative approach to decision making can provide a systematic way for deciding the job-machine pairings so that total job processing time is minimized. |
| b. | How long it takes to process each job on each machine, and any job-machine pairings that are unacceptable. |
| c. | Decision variables: one for each job-machine pairing, taking on a value of 1 if the pairing is used and 0 otherwise. |
|   | Objective function: minimize total job processing time. |
|   | Constraints: each job is assigned to exactly one machine, and each machine be assigned no more than one job. |
| d. | Stochastic: job processing times vary due to varying machine set-up times, variable operator performance, and more. |
| e. | Assume that processing times are deterministic (known/fixed). |

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| *POINTS:* | 1 |
| *DIFFICULTY:* | Challenging |
| *LEARNING OBJECTIVES:* | IMS.ASWC.19.01.03 - 1.3 |
| *NATIONAL STANDARDS:* | United States - BUSPROG: Analytic |
| *TOPICS:* | 1.3 Quantitative Analysis |
| *KEYWORDS:* | Bloom's: Evaluate |

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| 53. Consider a department store that must make weekly shipments of a certain product from two different warehouses to four different stores.

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| a. | How could a quantitative approach to decision making be used to solve this problem? |
| b. | What would be the uncontrollable inputs for which data must be gathered? |
| c. | What would be the decision variables of the mathematical model? the objective function? the constraints? |
| d. | Is the model deterministic or stochastic? |
| e. | Suggest assumptions that could be made to simplify the model. |

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| *ANSWER:* |

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| a. | A quantitative approach to decision making can provide a systematic way to determine a minimum shipping cost from the warehouses to the stores. |
| b. | Fixed costs and variable shipping costs; the demand each week at each store; the supplies each week at each warehouse. |
| c. | Decision variables--how much to ship from each warehouse to each store; objective function--minimize total shipping costs; constraints--meet the demand at the stores without exceeding the supplies at the warehouses. |
| d. | Stochastic--weekly demands fluctuate as do weekly supplies; transportation costs could vary depending upon the amount shipped, other goods sent with a shipment, etc. |
| e. | Make the model deterministic by assuming fixed shipping costs per item, demand is constant at each store each week, and weekly supplies in the warehouses are constant. |

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| *POINTS:* | 1 |
| *DIFFICULTY:* | Challenging |
| *LEARNING OBJECTIVES:* | IMS.ASWC.19.01.03 - 1.3 |
| *NATIONAL STANDARDS:* | United States - BUSPROG: Analytic |
| *TOPICS:* | 1.3 Quantitative Analysis |
| *KEYWORDS:* | Bloom's: Evaluate |

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| 54. Three production processes—A, B, and C—have the following cost structure:​

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| Process | Fixed Costper Year | Variable Costper Unit |
| A | $120,000 | $3.00 |
| B | 90,000 | 4.00 |
| C | 80,000 | 4.50 |

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| a. | What is the most economical process for a volume of 8,000 units? |
| b. | How many units per year must be sold with each process to have annual profits of $50,000 if the selling price is $6.95 per unit? |
| c. | What is the breakeven volume for each process? |

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| *ANSWER:* | ​a.   C(x) = FC + VC(x)Process A:   C(x) = $120,000 + $3.00(8,000) = $144,000 per yearProcess B:   C(x) = $  90,000 + $4.00(8,000) = $122,000 per yearProcess C:   C(x) = $  80,000 + $4.50(8,000) = $116,000 per yearProcess C has the lowest annual cost for a production volume of 8,000 units.​b.   Q = (profit + FC)/(price - VC)Process A:   Q = ($50,000 + $120,000)/($6.95 - $3.00) = 43,038 unitsProcess B:   Q = ($50,000 + $  90,000)/($6.95 - $4.00) = 47,458 unitsProcess C:   Q = ($50,000 + $  80,000)/($6.95 - $4.50) = 53,062 unitsProcess A requires the lowest production volume for an annual profit of $50,000.​c.   At breakeven, profit (the pretax profits per period) is equal to zero.Q = FC/(price - VC)Process A:   Q = $120,000/ ($6.95 - $3.00) = 30,380 unitsProcess B:   Q = $  90,000/ ($6.95 - $4.00) = 30,509 unitsProcess C:   Q = $  80,000/ ($6.95 - $4.50) = 32,654 unitsProcess A has the lowest breakeven quantity, while Process B’s is almost as low.​ |
| *POINTS:* | 1 |
| *DIFFICULTY:* | Challenging |
| *LEARNING OBJECTIVES:* | IMS.ASWC.19.01.04 - 1.4 |
| *NATIONAL STANDARDS:* | United States - BUSPROG: Analytic |
| *TOPICS:* | 1.4 Models of Cost, Revenue, and Profit |
| *KEYWORDS:* | Bloom's: Apply |

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| 55. Jane Persico, facility engineer at the El Paso plant of Computer Products Corporation (CPC), is studying a process selection decision at the plant. A new printer is to be manufactured and she must decide whether the printer will be auto-assembled or manually assembled. The decision is complicated by the fact that annual production volume is expected to increase by almost 50% over three years.  Jane has developed these estimates for two alternatives for the printer assembly process:​

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| ​ | ​ | Auto-AssemblyProcess | ManualAssemblyProcess |
| Annual fixed cost | ​ | $690,000 | $269,000 |
| Variable cost per product | ​ | $29.56 | $31.69 |
| Estimated annual production | ​ | ​ | ​ |
| (in number of products): | Year 1 | 152,000 | 152,000 |
| ​ | Year 2 | 190,000 | 190,000 |
| ​ | Year 3 | 225,000 | 225,000 |

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| a. | Which production process would be the least-cost alternative in Years 1, 2, and 3? |
| b.​ | How much would the variable cost per unit have to be in Year 2 for the auto-assembly process to justify the additional annual fixed cost for the auto-assembly process over the manual assembly process? |

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| *ANSWER:* | ​a.   C(x) = fixed cost + variable cost(x)Year 1:CA  =  690,000  +  29.56(152,000)  =  $5,183,120CM  =  269,000  +  31.69(152,000)  =  $5,085,880   (least-cost alternative)Year 2:CA  =  690,000  +  29.56(190,000)  =  $6,306,400CM  =  269,000  +  31.69(190,000)  =  $6,290,100   (least-cost alternative)Year 3:CA  =  690,000  +  29.56(225,000)  =  $7,341,000   (least-cost alternative)CM  =  269,000  +  31.69(225,000)  =  $7,399,250​b.   CA = CMFCA + vA(190,000) = FCM + vM(190,000)690,000 + v(190,000) = 269,000 + 31.69(190,000)vA = (269,000 + 6,021,100 - 690,000)/190,000vA = $29.47   (roughly a 0.3% reduction)​ |
| *POINTS:* | 1 |
| *DIFFICULTY:* | Challenging |
| *LEARNING OBJECTIVES:* | IMS.ASWC.19.01.04 - 1.4 |
| *NATIONAL STANDARDS:* | United States - BUSPROG: Analytic |
| *TOPICS:* | 1.4 Models of Cost, Revenue, and Profit |
| *KEYWORDS:* | Bloom's: Analyze |

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