Introduction to Management Science 16th edition Camm Test Bank

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Name:_____ Class:_____ Date:_____

Chapter 01: Introduction

True / False

1. The process of decision making is more limited than that of problem solving.
   a. True
   b. False

ANSWER: True

2. The breakeven point is the point at which the volume of output produced is the result of total revenue equaling total cost.
   a. True
   b. False

ANSWER: True

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

ANSWER: True

4. The decision-making process includes implementation and subsequent evaluation of the decision.
   a. True
   b. False

ANSWER: False

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

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

ANSWER: True

7. Uncontrollable inputs are the decision variables for a model.
   a. True
   b. False

ANSWER: False

8. The feasible solution is the best solution possible for a mathematical model.
   a. True
   b. False

ANSWER: False

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

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century.

a. True

b. False

ANSWER: True

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

ANSWER: False

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

a. True

b. False

ANSWER: True

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

a. True

b. False

ANSWER: True

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

ANSWER: True

14. If you are deciding to buy 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

ANSWER: True

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

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

a. True

b. False

ANSWER: False

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Chapter 01: Introduction

17. A toy train layout designed to represent an actual railyard is an example of an analog model.
    a. True
    b. False
ANSWER: False

18. The last step in any problem-solving process is to choose the correct alternative among those available.
    a. True
    b. False
ANSWER: False

19. Decision variables in a production process are those that cannot be controlled by the manager.
    a. True
    b. False
ANSWER: False

20. The optimal solution to a model is one in which known, specific values provide the best output.
    a. True
    b. False
ANSWER: True

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
ANSWER: False

Multiple Choice

22. The field of management science
    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. applies to all of these choices.
ANSWER: d

23. By identifying and defining a problem, we have
    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.
ANSWER: d

24. The set of decision alternatives
    a. should be identified before the decision criteria are established.
    b. are limited to quantitative solutions.

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c. are evaluated as a part of the problem definition stage.
d. are best generated by brainstorming.

ANSWER: a

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

ANSWER: c

26. In a multicriteria decision problem
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 statements apply.

ANSWER: b

27. The quantitative analysis approach requires
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 elements.

ANSWER: c

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

ANSWER: a

29. Inputs to a quantitative model
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.

ANSWER: b

30. When the value of the output cannot be determined even if the value of the controllable input is known, the model is
a. analog.
b. digital.
c. stochastic.

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d. deterministic.

ANSWER: c

31. The volume that results in total revenue being equal to total cost is known as the
a. breakeven point.
b. marginal volume.
c. marginal cost.
d. profit mix.

ANSWER: a

32. Management science and operations research both involve
a. qualitative managerial skills.
b. quantitative approaches to decision making.
c. operational management skills.
d. scientific research as opposed to applications.

ANSWER: b

33. George Dantzig is important in the history of management science because he developed
a. the scientific management revolution.
b. World War II operations research teams.
c. the simplex method for linear programming.
d. powerful digital computers.

ANSWER: c

34. In order to undertake problem solving, the first step must be
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. the determination of the feasible region.

ANSWER: c

35. The process of problem definition must
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. do all of these.

ANSWER: d

36. A model that uses a system of symbols or expressions to represent a problem is called
a. a mathematical model.
b. an iconic model.
c. an analog model.
d. a constrained model.

ANSWER: a

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37. Which of the following is a commonly used name for the body of knowledge involving quantitative approaches to decision making?

a. Break-even analysis
b. Summary statistics
c. Operations research
d. Efficiency studies

ANSWER: c

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

a. repetitive, necessitating routine decision making.
b. unique and the manager has no prior experience solving this sort of problem.
c. particularly complex.
d. all of these aspects.

ANSWER: d

39. Write the following constraint as a linear inequality: A speedboat requires 8 hours of fabrication and a sailboat 9 hours. The fabrication department has at most 109 hours of labor available each week. Let x be the number of speedboats, and let y be the number of sailboats.

a. $8x - 9y \geq 109$
b. $9x - 8y \geq 109$
c. $8x + 9y \leq 109$
d. $9x + 8y \leq 109$

ANSWER: c

40. Write the following constraint as a linear inequality: An advertising company has a budget of $8200 to spend on social media and TV advertising. Each social media ad costs $120, and each TV ad costs $790. Let x be the number of social media ads, and let y be the number of TV ads.

a. $790x - 120y \geq 8200$
b. $120x - 790y \geq 8200$
c. $120x + 790y \leq 8200$
d. $790x + 120y \leq 8200$

ANSWER: c

41. A fragrance company will make a new type of perfume. The fixed cost for the production will be $24,000. The variable cost will be $37 per bottle of perfume. The bottles will sell for $108 each. How many bottles of perfume will have to be sold for the company to break even on this new line of fragrance?

a. 71 bottles
b. 223 bottles
c. 339 bottles
d. 649 bottles

ANSWER: c

42. A delivery service delivers packages that cost $3 per package to deliver. The fixed cost to run the delivery truck is $144 per day. If the company charges $7 per package, how many packages must be delivered daily to make a profit of

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$52?

a. 14 packages
b. 36 packages
c. 48 packages
d. 49 packages

ANSWER: d

43. 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. Write an expression for total profit.

a. P(x,y) = 350y − (30,000 + 14,000x)
b. P(x,y) = 3000y − (350 + 14,000x)
c. P(x,y) = 350y − (30,000x + 14,000)
d. P(x,y) = 14,000y − (30,000 + 350x)

ANSWER: a

Subjective Short Answer

44. A snack food manufacturer buys corn for tortilla chips from two suppliers, 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.

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.

ANSWER:

a. Let x_1 = the number of units from Iowa
   Let x_2 = the number of units from Illinois
b. Min $6x_1 + 5.5x_2$
c. $x_1 + x_2 \geq 12{,}000$
   $x_1 \leq 8000$
   $x_1 \leq 6000$

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

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?

ANSWER:

a. For p = 10, d = 4750
   For p = 50, d = 3750

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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)

46. 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.
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.

ANSWER:
a. C(x) = 50,000 + 25x
b. R(x) = 45x
c. P(x) = 45x − (50,000 + 25x)
d. x = 2500

47. 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.

ANSWER: Let x_1 = the number of books sold in the U.S.

Let x_2 = the number of books sold outside the U.S.

$10{,}000 = 1x_1 + 1.35x_2$

48. 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?

ANSWER: Enrollment would need to be 10 students.

49. As part of its application for a loan to buy Lakeside Farm, a property it hopes to develop as a bed-and-breakfast operation, the prospective owners have projected:

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

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?

ANSWER:
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 break even. This would be a 33% occupancy rate.

50. 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?

ANSWER:

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

51. 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

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

	A	B	C	D	E
1					
2					
3					
4	Breakeven calculation				
5					
6		Selling price per unit			10
7					
8		Costs			
9		Fixed 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)			

ANSWER:

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

52. 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.

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 0.03 and that a displayed chair will be sold is 0.05. Mathematically model each of the following objectives:

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1. Maximize the total pieces of furniture displayed.
2. Maximize the total expected number of daily sales.
3. Maximize the total expected daily profit.

ANSWER:

a. $50s + 30c \leq 800$
   $s \geq 5$
   $c \geq 5$
b. (1) Max $s + c$
   (2) Max $0.03s + 0.05c$
   (3) Max $6s + 5c$

53. 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.

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 areas #1 and #2.

ANSWER:

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. $4D + 2W \leq 60$
   $2D + 4W \leq 48$

54. A firm builds and sells small, ergonomic conference tables. The investment in plant and equipment is $165,000. The variable cost per table is $1500. The selling price of each table is $3000. How many tables would have to be sold for the firm to break even?

ANSWER: 110 tables

55. 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?

ANSWER: 80 computers

56. 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.

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?

ANSWER:

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a. C(x) = 30,000 + 14,000x
b. R(y) = 350y
c. P(x,y) = 350y − (30,000 + 14,000x)
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) − (30,000 + 14,000*5) = 12,000. So, the school can reach the breakeven point.

57. 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.
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.

ANSWER:

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 is 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).

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

ANSWER:

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

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e. depending upon the amount shipped, other goods sent with a shipment, etc.
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.

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

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

a. What is the most economical process for a volume of 8000 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?

ANSWER:

a. C(x) = FC + VC(x)
Process A: C(x) = $120,000 + $3.00(8,000) = $144,000 per year
Process B: C(x) = $ 90,000 + $4.00(8,000) = $122,000 per year
Process C: C(x) = $ 80,000 + $4.50(8,000) = $116,000 per year
Process 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 units
Process B: Q = ($50,000 + $ 90,000)/($6.95 – $4.00) = 47,458 units
Process C: Q = ($50,000 + $ 80,000)/($6.95 – $4.50) = 53,062 units
Process 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 units
Process B: Q = $ 90,000/ ($6.95 – $4.00) = 30,509 units
Process C: Q = $ 80,000/ ($6.95 – $4.50) = 32,654 units
Process A has the lowest breakeven quantity, while Process B's is almost as low.

60. Sam 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 Sam 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. Sam has developed these estimates for two alternatives for the printer assembly process:

	Auto-Assembly Process	Manual Assembly Process
Annual fixed cost	$690,000	$269,000

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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

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?

ANSWER:

a. C(x) = fixed cost + variable cost(x)

Year 1:

$C_A = 690{,}000 + 29.56(152{,}000) = \$5{,}183{,}120$

$C_M = 269{,}000 + 31.69(152{,}000) = \$5{,}085{,}880$ (least-cost alternative)

Year 2:

$C_A = 690{,}000 + 29.56(190{,}000) = \$6{,}306{,}400$

$C_M = 269{,}000 + 31.69(190{,}000) = \$6{,}290{,}100$ (least-cost alternative)

Year 3:

$C_A = 690{,}000 + 29.56(225{,}000) = \$7{,}341{,}000$ (least-cost alternative)

$C_M = 269{,}000 + 31.69(225{,}000) = \$7{,}399{,}250$

b. $C_A = C_M$

$FC_A + v_A(190{,}000) = FC_M + v_M(190{,}000)$

$690{,}000 + v(190{,}000) = 269{,}000 + 31.69(190{,}000)$

$v_A = (269{,}000 + 6{,}021{,}100 - 690{,}000)/190{,}000$

$v_A = \$29.47$ (roughly a 0.3% reduction)

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