

Pick the one best answer. Two points each (50 points total). Record your answers for grading on the separate answer form.

You may use your text. However, work alone without consulting someone else or seeking tutoring.

1. In a balanced Transportation problem
 - A. the total number of transportation routes available equals the number of supply sources plus the number of demand destinations
 - B. the number of transportation routes actually used in the optimal solution equals the number of supply sources plus the number of demand destinations
 - C. the number of supply sources equals the number of demand destinations
 - D. the total volume of supply equals the total volume of demand
 - E. both C and D

2. A manufacturing company produces products at three factories designated as numbers 1, 2, and 3. The products are shipped to two demand destinations designated as A and B. For the coming month, production will be:
Factory 1 = 3,000 units; Factory 2 = 2,500 units; and Factory 3 = 4,200 units.
And for the coming month, demand will be:
Destination A = 4,500 units and Destination B = 6,000 units.
Which of the following is a correct linear programming constraint for this model?
 - A. $X_{2A} + X_{2B} = 2500$
 - B. $X_{2A} + X_{2B} \leq 2500$
 - C. $X_{1B} + X_{2B} + X_{3B} = 6000$
 - D. $X_{1B} + X_{2B} + X_{3B} \leq 6000$
 - E. $X_{1B} + X_{2B} + X_{3B} \geq 6000$

3. Suppose in a transportation model for cost, we wish to block a route (prohibit it from being used). Using QM we should assign to it a cost that is
 - A. Equal to zero
 - B. Very much smaller than that of the lowest route cost in the model
 - C. Very much larger than that of the highest route cost in the model
 - D. Equal to the lowest route cost in the model
 - E. Equal to the highest route cost in the model

4. A transportation model to minimize total shipping cost has four routes.

The unit cost per route is:

	Demand Location A	Demand Location B
Supply Source 1	14	16
Supply Source 2	22	19

The optimal solution is to ship units as follows:

	Demand Location A	Demand Location B
Supply Source 1	1,900	2,200
Supply Source 2		2,900

Then the average optimal cost per unit shipped is

- A. \$16.33
 - B. \$16.70
 - C. \$17.75
 - D. \$36.33
 - E. None of the above
5. A transshipment model consists of four supply sources, two transshipment points, and five ultimate demand destinations. Each supply source can ship to either transshipment point, and each transshipment point can ship to any ultimate demand destination. The number of decision variables needed for this model is
- A. 9
 - B. 18
 - C. 23
 - D. 80
 - E. None of the above
6. For problem number 5 above, how many constraints are necessary in the linear programming model not counting the nonnegativity constraint?
- A. 9
 - B. 11
 - C. 12
 - D. 18
 - E. 27

7. A transshipment model has two supply sources, (assigned numbers 1 and 2), one transshipment point (assigned number 3), and two demand locations (assigned numbers 4 and 5). Which is the correct constraint for the transshipment point in the linear programming model?
- $X_{13} + X_{23} = 0$
 - $X_{13} + X_{23} - X_{34} - X_{35} = 0$
 - $X_{13} + X_{23} = -X_{34} - X_{35}$
 - $X_{13} + X_{23} - X_{34} - X_{35} = 0$
 - Either C or D
8. Which of the following is true about the Assignment model but not true about the Transportation model?
- The coefficients of the decision variables in the objective function for the Assignment model must equal one.
 - In proper form for QM, the right hand side of the constraints in an Assignment model can include decision variables.
 - In an Assignment model, the supply at each source and the demand at each destination are limited to one unit.
 - In an Assignment model, the values of the coefficients of the decision variables in the constraints must be greater than one.
 - None of the above. There are no differences between these two models.
9. A machine shop owner wishes to assign each of three machinists (labeled 1, 2, and 3) to one of three machines (labeled A, B, and C) in order to maximize total profit per hour. For the mathematical model of this as a linear programming problem, which of the following is a correct constraint for this model?
- $X_{1A} + X_{1B} + X_{1C} = 1$
 - $X_{1A} + X_{1B} + X_{1C} \leq 1$
 - $X_{1A} + X_{1B} + X_{1C} \geq 1$
 - $X_{1A} + X_{2B} + X_{3C} = 1$
 - $\text{MAX } Z = X_{1A} + X_{2B} + X_{3C}$
10. In CPM/PERT, an activity that is on the critical path
- has equal values for "Latest Start" and "Earliest Start" ($LS = ES$)
 - has equal values for "Latest Finish" and "Earliest Finish" ($LF = EF$)
 - is used in calculating total project duration
 - has slack equal to zero
 - all of the above

11. In critical path management, which is a general rule for crashing activities?
- A. Crash the activities that are on the critical path
 - B. Crash the activities that are not on the critical path
 - C. Crash the activities having the greatest number of predecessor activities
 - D. Crash the activities having the greatest number of following activities
 - E. Crash the activities having the lowest crashing costs
12. Suppose a project activity has a normal cost of \$35,000 and a normal completion time of 12 weeks. The crash time for this activity is 8 weeks and the crash cost is \$38,000. Then in addition to normal cost, the extra cost of crashing this activity by 3 weeks is
- A. \$2,250
 - B. \$8,750
 - C. \$9,500
 - D. \$13,125
 - E. \$14,250
13. Suppose there are only four different paths through a network of project activities. The time required to pass through each path is:
- | | |
|--------|----------|
| Path 1 | 23 weeks |
| Path 2 | 28 weeks |
| Path 3 | 33 weeks |
| Path 4 | 41 weeks |
- Then which path is the critical path?
- A. Path 1
 - B. Path 2
 - C. Path 3
 - D. Path 4
 - E. Cannot determine from the information given
14. Using the probabilistic three-time-estimate method for activity times (assuming the Beta probability distribution), suppose we have for some activity an optimistic time estimate of 8 weeks, most likely of 12 weeks, and pessimistic of 28 weeks. Then the mean time for this activity is
- A. 8
 - B. 12
 - C. 14
 - D. 28
 - E. None of the above

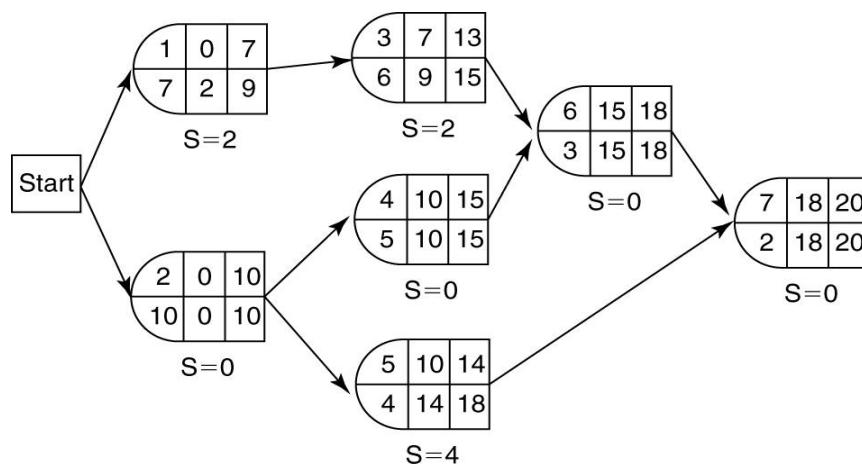
15. Suppose that the critical path through a project network is: A-C-E. Using the probabilistic three-time-estimate method for activity times (assuming the Beta probability distribution), the following results were calculated:

Activity	Mean time in weeks (mean duration)	Variance in times
A	20	4
C	42	16
E	38	16

Then the probability of completing the entire project in less than 91 weeks is

- A. 0.0668
- B. 0.1587
- C. 0.4013
- D. 0.8413
- E. 0.9332

Below is the network diagram for a project. Times are in weeks. **Use this information for questions 16 through 18.**



16. The life (duration) of the entire project is

- A. 7 weeks
- B. 14 weeks
- C. 18 weeks
- D. 20 weeks
- E. None of the above

17. The Late Finish for Activity 4 is 15 because
- A. It must be the same as the Early Finish
 - B. The Late Start of Activity 4 must be the same as the Early Finish for Activity 2
 - C. The Late Finish of Activity 4 must be the same as the Early Start for Activity 6
 - D. Activity 4 must finish no later than the Late Start of Activity 6
 - E. The Late Finish for Activity 4 must be the same as for Activity 3
18. The Critical Path is
- A. 1-3-6-7
 - B. 2-4-6-7
 - C. 2-5-7
 - D. 2-4-5-7
 - E. None of the above
- *****
19. Jon is considering two (mutually exclusive) investment alternatives. He can either invest in raw land or in an existing strip mall. If he invests in raw land, then in three years he will either sell it or else invest in an apartment complex to be built on the land, depending on the residential rental market at that time. If, on the other hand, he invests in a strip mall, in five years he will either sell it or else invest in expansion, depending on the commercial rental market that that time. The best way for Jon to visualize his decision process is as a
- A. Critical path network diagram
 - B. Transportation network diagram
 - C. Transshipment problem
 - D. Decision tree
 - E. Assignment problem
20. Which are characteristics of a “state of nature” as used in decision analysis?
- A. Does not determine the outcome of the decision
 - B. May occur in the future
 - C. Cannot be controlled by the decision maker
 - D. B and C
 - E. A, B, and C
21. In a decision analysis using a payoff table, which approach would be useful in negotiating what to pay an expert consultant to make the decision?
- A. Maximax Criterion
 - B. Minimax Criterion
 - C. Hurwicz Criterion
 - D. Expected Opportunity Loss (EOL)
 - E. Expected value of perfect information

22. A payoff table has three states of nature (S1, S2, and S3). Under the Equal Likelihood Criterion, what weights should be assigned to each?

- A. $S1 = 1/2$, $S2 = 1/2$, and $S3 = 1/2$
- B. $S1 = 1/3$, $S2 = 1/3$, and $S3 = 1/3$
- C. $S1 = 1/2$, $S2 = 1/4$, and $S3 = 1/4$
- D. $S1 = 1/2$, $S2 = 1/2$, and $S3 = 0$
- E. You cannot use this criterion for more than two states of nature

The following is a payoff table in profit for three decision alternatives (**A**, **B**, and **C**) under two states of nature (**S1** and **S2**). Probabilities have been assigned to each state of nature as shown.

Decision Alternatives	0.3 S1	0.7 S2
A	-400	800
B	600	-500
C	850	300

Use this information for questions 23 through 25 below.

23. Using the Maximin decision criterion, the profit for the best decision is

- A. -500
- B. 300
- C. 600
- D. 800
- E. 850

24. What would be the regret value if you pick Alternative **B** and **S2** occurs?

- A. -1300
- B. -300
- C. 300
- D. 1300
- E. None of the above

25. Using Expected Value as the decision criterion, the Expected Value of the best decision is

- A. 255
- B. 440
- C. 465
- D. 560
- E. None of the above