

## **TRUE/FALSE**

1. To make a forecast which is accurate over time requires historical data.
2. Time-series models attempt to predict the future by using historical data.
3. An exponential forecasting method is a time-series forecasting method
4. One of the most popular qualitative forecasting methods is the Delphi technique.
5. A scatter diagram is useful to determine if a relationship exists between two variables.
6. Mean absolute deviation (MAD) is simply the sum of forecast errors.
7. Four components of time series are trend, moving average, exponential smoothing, and seasonality.
8. In a weighted moving average, the weights assigned must sum to 1.
9. An advantage of exponential smoothing over a simple moving average is that exponential smoothing requires us to retain less data.
10. A seasonal index must be between  $-1$  and  $+1$ .

## **MULTIPLE CHOICE**

11. Which of the following statements about scatter diagrams is true?
  - (a) Time is always plotted on the Y axis.
  - (b) It can depict the relationship among three variables simultaneously.
  - (c) It is helpful when forecasting with qualitative data.
  - (d) The variable to be forecasted is placed on the Y axis.
  - (e) It is not a good tool for understanding time-series data.
12. Given the MAD for the following forecast is 4.0 what is the forecast value in period 4?

Period	Forecast	Actual
1	15	11
2	20	13
3	25	21
4		23

- (a) 24
  - (b) 30
  - (c) 23
  - (d) 33
  - (e) none of the above
13. Given that the MSE for the following forecast is 9.5, what is the forecast value in period 3?

Period	Forecast	Actual
1	100	95
2	110	108
3		123
4	130	130

- (a) 108  
(b) 118  
(c) 128  
(d) 115  
(e) none of the above
14. Daily demand for newspapers for the last 10 days has been as follows: 12, 13, 16, 15, 12, 18, 14, 12, 13, 15. Forecast sales for the next day using a three-day weighted moving average where the weights are 3, 1, and 1 (the highest weight is for the most recent number).
- (a) 12.8  
(b) 13.0  
(c) 70.0  
(d) 14.0  
(e) none of the above
15. Enrollment in a particular class for the last four semesters has been 120, 126, 110, and 130. Develop a forecast of enrollment next semester using exponential smoothing with an  $\alpha = 0.2$ . Assume that an initial forecast for the first semester was 120 (so the forecast and the actual were the same).
- (a) 118.96  
(b) 121.17  
(c) 130  
(d) 120  
(e) none of the above
16. A tracking signal was calculated for a particular set of demand forecasts. This tracking signal was positive. This would indicate that
- (a) demand is greater than the forecast.  
(b) demand is less than the forecast.  
(c) demand is equal to the forecast.  
(d) the MAD is negative.  
(e) none of the above

## PROBLEMS

17. Given the following gasoline data

Quarter	Year 1	Year 2
1	150	156
2	140	148
3	185	201
4	160	174

- (a) Compute the seasonal index for each quarter.  
(b) Suppose we expect year 3 to have annual demand of 800, what is the forecast value for each quarter in year 3?

### **True/False**

- 7.1 In the term linear programming, the word programming comes from the phrase *computer programming*.
- 7.2 Management resources that need control include machinery usage, labor volume, money spent, time used, warehouse space used, and material usage.
- 7.3 An LP formulation always requires finding the maximum value of an objective while simultaneously maximizing usage of the resource constraints.
- 7.4 In an LP problem, the maximization of profit and minimization of cost are done simultaneously.
- 7.5 The set of solution points that satisfies all of a linear programming problem's constraints simultaneously is defined as the feasible region in graphical linear programming.
- 7.6 An objective function is necessary in a maximization problem but is not required in a minimization problem.
- 7.7 The solution to a linear programming problem must always lie on a constraint.
- 7.8 One converts a minimization problem to a maximization problem by reversing the direction of all constraints.
- 7.9 Anytime we have an isoprofit line that is parallel to a constraint, we have the possibility of multiple solutions.
- 7.10 If the isoprofit line is not parallel to a constraint, then the solution must be unique.

### **MULTIPLE CHOICE**

- 7.11 A feasible solution to a linear programming problem

- (a) must satisfy all of the problem's constraints simultaneously.
  - (b) need not satisfy all of the constraints, only the non-negativity constraints.
  - (c) must not be a corner point of the feasible region.
  - (d) must give the minimum possible profit.
- 7.12 When appropriate, the optimal solution to a maximization linear programming problem can be found by graphing the feasible region and
- (a) finding the profit at every corner point of the feasible region to see which one gives the highest value.
  - (b) moving the isoprofit lines towards the origin in a parallel fashion until the last point in the feasible region is encountered.
  - (c) locating the point that is highest on the graph.
  - (d) none of the above
  - (e) all of the above
- 7.13 Adding a constraint to a linear programming (maximization) problem may result in, but is not necessarily limited to,
- (a) a decrease in the value of the objective function.
  - (b) an increase in the value of the objective function.
  - (c) no change to the objective function.
  - (d) either (c) or (a) depending on the constraint.
  - (e) either (c) or (b) depending on the constraint.
- 7.14 If one changes the contribution rates in the objective function of an LP,
- (a) the feasible region will change.
  - (b) the slope of the isoprofit or iso-cost line will change.
  - (c) the optimal solution to the LP is sure to no longer be optimal.
  - (d) all of the above
  - (e) none of the above
- 7.15 In order for a linear programming problem to have a unique solution, the solution must exist
- (a) at the intersection of the non-negativity constraints.
  - (b) at the intersection of a non-negativity constraint and a resource constraint.
  - (c) at the intersection of the objective function and a constraint.
  - (d) at the intersection of two or more constraints.
  - (e) none of the above
- 7.16 In a cost minimization LP problems, solution is found by graphing the feasible region and
- (a) moving the isocost line away from the origin to the top right corner of the region
  - (b) finding the minimum profit at every corner point of the region
  - (c) locating the center point of the feasible region
  - (d) finding the intersection of isocost line and the isoprofit line
  - (e) finding the cost at the corner points and taking the minimum value

7.17 Consider the following linear programming problem:

$$\begin{array}{ll} \text{Maximize} & 4X + 10Y \\ \text{Subject to:} & 3X + 4Y \leq 480 \\ & 4X + 2Y \leq 360 \\ & \text{all variables} \geq 0 \end{array}$$

The feasible corner points are (48, 84), (0,120), (0,0), (90,0). What is the maximum possible value for the objective function?

- (a) 1032
- (b) 1200
- (c) 360
- (d) 1600
- (e) none of the above

7.18 Consider the following linear programming problem:

$$\begin{array}{ll} \text{Maximize} & 5X + 6Y \\ \text{Subject to:} & 4X + 2Y \leq 420 \\ & 1X + 2Y \leq 120 \\ & \text{all variables} \geq 0 \end{array}$$

Which of the following points (X,Y) is not feasible?

- (a) (50,40)
- (b) (20,50)
- (c) (60,30)
- (d) (90,10)
- (e) none of the above

7.19 Consider the following linear programming problem:

$$\begin{array}{ll} \text{Minimize} & 20X + 30Y \\ \text{Subject to} & 2X + 4Y \leq 800 \\ & 6X + 3Y \geq 300 \\ & X, Y \geq 0 \end{array}$$

The optimum solution to this problem occurs at the point (X,Y).

- (a) (0,0).
- (b) (50,0).
- (c) (0,100).
- (d) (400,0).
- (e) none of the above

7.20 Consider the following linear programming problem:

$$\begin{array}{ll} \text{Maximize} & 12X + 10Y \\ \text{Subject to:} & 4X + 3Y \leq 480 \\ & 2X + 3Y \leq 360 \\ & \text{all variables} \geq 0 \end{array}$$

Which of the following points (X,Y) is feasible?

- (a) (10,120)
- (b) (120,10)
- (c) (30,100)

- (d) (60,90)
- (e) none of the above

7.21 Consider the following linear programming problem:

$$\begin{aligned} &\text{Maximize} && 5X + 6Y \\ &\text{Subject to:} && 4X + 2Y \leq 420 \\ &&& 1X + 2Y \leq 120 \\ &&& \text{all variables} \geq 0 \end{aligned}$$

Which of the following points (X,Y) is not in the feasible region?

- (a) (30,30)
  - (b) (60,40)
  - (c) (100,5)
  - (d) (20,40)
  - (e) none of the above
- 7.22 Solve the following linear programming problem using the corner point method:
- $$\begin{aligned} &\text{Maximize} && 3X + 5Y \\ &\text{Subject to:} && 4X + 4Y \leq 48 \\ &&& 1X + 2Y \leq 20 \\ &&& Y \geq 2 \\ &&& X, Y \geq 0 \end{aligned}$$

### Problems

7.23 Two advertising media are being considered for promotion of a product. Radio ads cost \$400 each, while newspaper ads cost \$600 each. The total budget is \$7,200 per week. The total number of ads should be at least 15. There should be at least 2 of each type. Each newspaper ad reaches 6,000 people, while each radio ad reaches 2,000 people. The company wishes to reach as many people as possible while meeting all the constraints stated.

- (a) How many ads of each type should be placed?
- (b) What is the maximum exposure in number of people?

7.24. A fabric firm has received an order for cloth specified to contain at least 45 lbs of cotton and 25 lbs of silk. The cloth can be woven out of any suitable mix of two yarns, A and B. Material A costs \$3 per pound and B costs \$2 per pound. They contain the following proportions of cotton and silk by weight.

Yarn	Cotton %	Silk %
A	30	50
B	60	10

- (a) What quantities of A and B yarns should be used to minimize the cost of this order?
- (b) What is the minimum cost of production.

## TRUE/FALSE

1. A PERT or CPM network shows activities and activity sequences. T / F
2. Before drawing a PERT or CPM network, we must identify all activities and their predecessors. T / F
3. CPM is a probabilistic analysis of managing a project. T / F
- 4.. In PERT, the earliest start time for an activity is equal to the latest of the earliest finish times of all of its immediate predecessors. T / F
5. The optimistic time is the greatest amount of time that could be required to complete an activity. T / F
6. PERT was developed for a project for which activity or task times were uncertain. T / F
7. CPM was developed for use in managing projects that are repeated and about which we have good information about activity or task completion times. T / F
8. One of the limiting assumptions of PERT is that for any activity to start, all of its immediate predecessors must be complete. T / F
9. Slack is the time an activity can be delayed without impacting the completion time of the project. T / F
10. The variance of the project completion time is equal to the sum of the variances of all the activities. T / F

## **Multiple Choice**

11. The critical path of a network is the
  - (a) shortest time path through the network.
  - (b) path with the fewest activities.
  - (c) path with the most activities.
  - (d) longest time path through the network.
  - (e) none of the above
12. PERT
  - (a) assumes we do not know ahead of time what activities must be completed.
  - (b) allows computation of the program's evaluation.
  - (c) is a network technique that uses three time estimates for each activity in a project.
  - (d) is a deterministic network technique that allows for project crashing.
  - (e) none of the above

13. Given an activity's optimistic, most likely, and pessimistic time estimates of 4, 5, and 12 days respectively, compute the PERT time for this activity.
- (a) 5
  - (b) 6
  - (c) 7
  - (d) 12
  - (e) none of the above
14. Given an activity's optimistic, most likely, and pessimistic time estimates of 2, 10, and 20 days respectively, compute the PERT variance for this activity.
- (a) 3
  - (b) 6
  - (c) 9
  - (d) 18
  - (e) none of the above
15. Given an activity's optimistic, most likely, and pessimistic time estimates of 3, 5, and 15 days, respectively, compute the PERT standard deviation for this activity.
- (a) 2
  - (b) 4
  - (c) 5
  - (d) 15
  - (e) none of the above

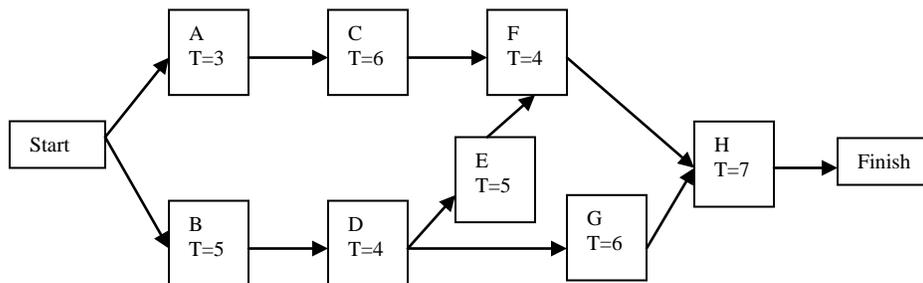
**The following table provides information for questions 16,17,18**

Table 13-1		
The following represents a project with known activity times. All times are in weeks.		
Activity	Immediate Predecessor	Time
A	-	4
B	-	3
C	A	2
D	B	7
E	C, D	4
F	B	5

16. Using the data in Table 13-1, what is the minimum possible time required for completing the project?
- (a) 8
  - (b) 14
  - (c) 25
  - (d) 10
  - (e) none of the above
17. Using the data in Table 13-1, what is the latest possible time that C may be started without delaying completion of the project?
- (a) 0
  - (b) 4
  - (c) 8
  - (d) 10
  - (e) none of the above
18. According to Table 13-1, compute the slack time for activity D.
- (a) 0
  - (b) 5
  - (c) 3
  - (d) 6
  - (e) none of the above

The following figure (Fig 13-1) is to be used as data for problems 19,20,21,22

Fig. 13-1



19. Given the network in Figure 13-1, the critical path is
- (a) A,C,F,H
  - (b) B,D,E,F,H
  - (c) A,C,E,G,H

- (d) B,D,G,E,F,H
- (e) none of the above

20. Given the network in Figure 13-1, the time to complete those activities on the critical path is expected to be

- (a) 20
- (b) 22
- (c) 25
- (d) 26
- (e) none of the above

21. Given the network shown in Figure 13-1, assume that completion of B is delayed by two days. What happens to the project?

- (a) The critical path is extended by two days.
- (b) The start of activity F is delayed by two days.
- (c) The start of activity E is delayed by two days.
- (d) all of the above
- (e) none of the above

22. Given the network shown in Figure 13-1 and the following information, what is the variance of the critical path?

Activity	Expected time	Variance
A	3	2
B	5	3
C	6	3
D	4	1
E	4	1
F	4	2
G	6	2
H	7	2

- (a) 16
- (b) 7
- (c) 9
- (d) 8
- (e) none of the above

PROBLEMS:

23. A project was planned with three time estimates using PERT.

The expected completion time is 40 weeks. The variance of critical path is 9.

a) What is the probability that the project will be finished within 46 weeks

b) The project manager would like to determine a due date with 90% probability to achieve.  
What will be the duration set for the project

24. The following costs have been estimated for the activities in a project

Activity	Immediate Predecessor	Time in weeks	Cost in \$
A	-----	8	8,000
B	-----	4	12,000
C	A	3	6,000
D	B	5	15,000
E	C, D	6	9,000
F	C, D	5	10,000
G	F	3	6,000

Construct a cost schedule based on latest start time.