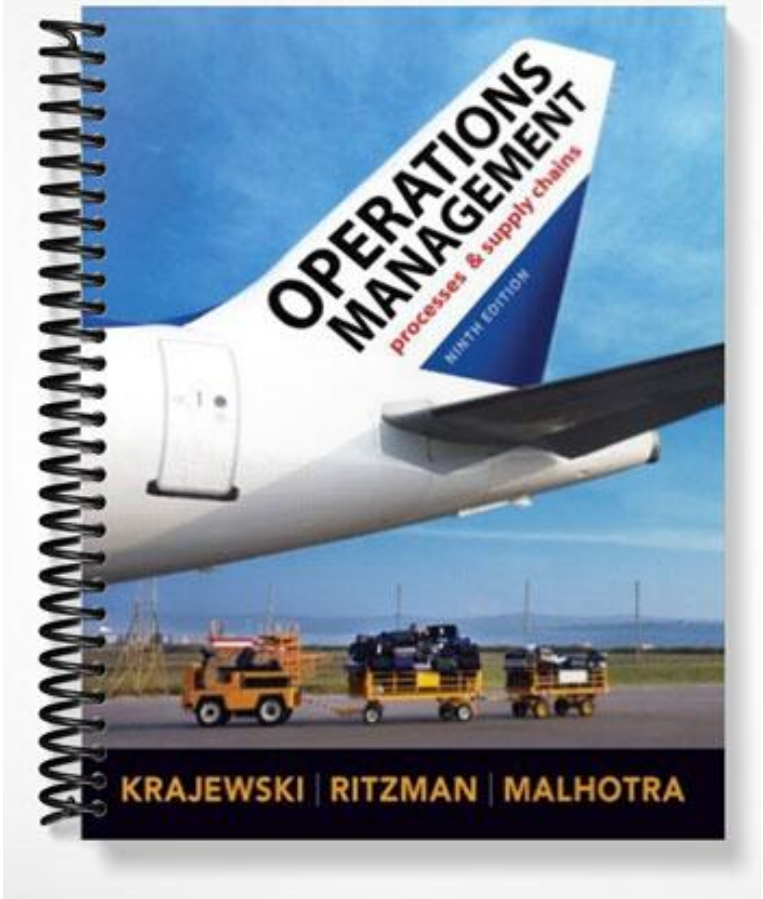
TEST BANK


OPERATIONS MANAGEMENT
processes & supply chains
NINTH EDITION
KRAJEWSKI | RITZMAN | MALHOTRA

TRUE/FALSE. Write 'T' if the statement is true and 'F' if the statement is false.

1) A project is an interrelated set of activities that has a definite starting and ending point. 1) _____

2) Projects often cut across organizational lines. 2) _____

3) Projects, and the application of project management, facilitate the implementation of operations strategy. 3) _____

4) Project managers should be able to organize a set of disparate activities. 4) _____

5) A pure project organizational structure houses the project in a specific functional area. 5) _____

6) Scope creep is one of the primary causes of project failure. 6) _____

7) The work breakdown structure is a statement of all work that has to be completed. 7) _____

8) The network diagram is a planning method that is designed to depict the relationships between activities. 8) _____

9) A relationship that determines the sequence for undertaking activities is a precedence relationship. 9) _____

10) A critical path is any sequence of activities between a project's start and finish. 10) _____

11) The earliest start time is never the same as the latest start time. 11) _____

12) To obtain the latest start and latest finish time, we must work forward through the network. 12) _____

13) A Gantt chart is a project schedule that superimposes project activities on a time line. 13) _____

14) Risk is a measure of the probability and consequences of not reaching a defined project goal. 14) _____

15) The optimistic time is the probable time required to perform the activity. 15) _____

16) The normal cost is the amount of money it normally takes to complete an activity faster than its normal time. 16) _____

17) A project manager should stop crashing a project if the time budget has been met or if the crash costs have exceeded the savings in indirect and penalty costs. 17) _____

18) A risk-management plan contains all identified risks to a project plus the ways that they can be circumvented. 18) _____

19) The phase of project management that takes the most resources is the execution phase. 19) _____

20) Project close out consists of a) completing the remaining deliverables and b) paying the final bills. 20) _____

MULTIPLE CHOICE. Choose the one alternative that best completes the statement or answers the question.

21) Which one of these steps in implementing changes comes first? 21) _____
A) Evaluate performance B) Define scope
C) Identify opportunity D) Document the process

22) The project's objective statement should contain: 22) _____
A) scope, time frame, and allocated resources.
B) manpower and methods.
C) slack time and activities.
D) activities, completion times, and incentives.

23) The Project Manager for the installation of new equipment in a plant is likely to do all of the following EXCEPT: 23) _____
A) delegate the responsibility for making tough decisions to the members of the project team.
B) plan team meetings to review progress.
C) resolve conflicts between individual team members.
D) work with the Engineering Manager to gain additional machine design resources.

24) A member of a project team that is implementing a new credit card payment process at a bank has direct responsibility to do all of the following EXCEPT: 24) _____
A) ensure that the project has appropriate resources for the job to be completed.
B) be called upon to share their expertise in credit card payment processes.
C) help solve project problems that spill over into areas outside their expertise.
D) be sensitive to conflicts between other team members and help resolve them.

25) A project organization structure where team members are assigned to the project and work exclusively for the project manager is called: 25) _____
A) a fixed structure. B) a pure project structure.
C) a matrix structure. D) a Functional structure.

26) In an activity-on-node [AON] network, the nodes represent _____, whereas the arcs represent _____. 26) _____
A) precedence relationships; time
B) activities; time
C) activities; precedence relationships
D) events; activities

27) In a network diagram, an activity: 27) _____

A) should always be something the company has had experience with.
B) must always have a single, precise estimate for the time duration.
C) is the smallest unit of work effort consuming both time and resources that a project manager can schedule and control.
D) is the largest unit of work effort consuming both time and resources that a project manager can schedule and control.

28) Activity times for a project are estimated by all but which of the following methods? 28) _____
A) Estimates using learning curve models to improve replications and estimate accuracy
B) Managerial opinions based on similar prior experiences
C) Statistical methods based on actual past experience
D) Methods-Time Measurement (MTM) data, which includes predetermined time estimates for different activities

29) A project has three paths. A□B□C has a length of 25 days. A□D□C has a length of 15 days. Finally, A□E□C has a length of 20 days. Which one of the following statements is TRUE? 29) _____
A) A□D□C is the critical path.
B) A□B□C has the most slack.
C) The expected duration of this project is 25 + 15 + 20 = 60 days.
D) The expected duration of this project is 25 days.

30) The earliest start time for an activity is equal to the: 30) _____
A) largest late finish time of all of its immediate predecessors.
B) largest earliest finish time of all of its immediate predecessors.
C) smallest earliest finish time of all of its immediate predecessors.
D) smallest late start time of any of its immediate predecessors.

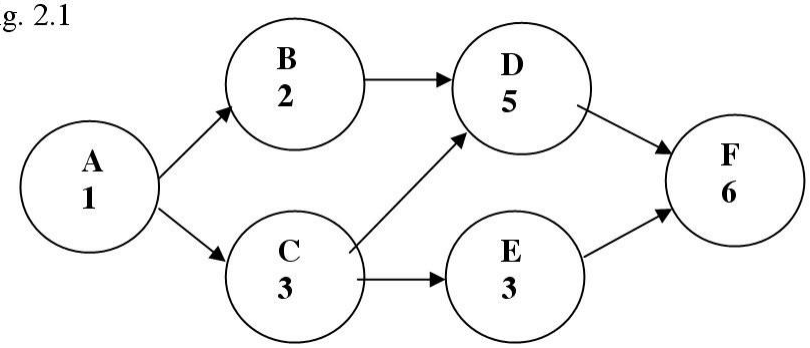
31) Assume that activity G has the following times: 31) _____
Early start time = 7 days
Early finish time = 13 days
Late start time = 15 days
Late finish time = 21 days
Which of the following statements is TRUE about activity G?
A) Activity G takes 2 days to complete.
B) Activity G takes 14 days to complete.
C) Activity G is on the critical path.
D) Activity G has a slack time of 8 days.

32) Activity slack is defined as: 32) _____
A) earliest start time minus latest start time.
B) latest start time minus earliest start time.
C) earliest finish time minus latest finish time.
D) latest finish time minus earliest start time.

33) Which one of the following best describes the critical path of a PERT/CPM network? 33) _____
A) The sequence of activities between a project's start and finish that takes the longest time to complete

B) The set of activities that has no precedence relationships
C) The sequence of activities that has the lowest normal activity cost
D) The sequence of activities between a project's start and finish that has the maximum amount of activity slack

Fig. 2.1



34) For the network shown in Fig. 2.1, which of the following is the critical path? 34) _____
A) ABEF B) ACDF C) ACEF D) ABCDEF

35) For the network shown in Fig. 2.1, what is the project duration? 35) _____
A) 13 B) 14 C) 15 D) 6

Figure to accompany Table 2.1

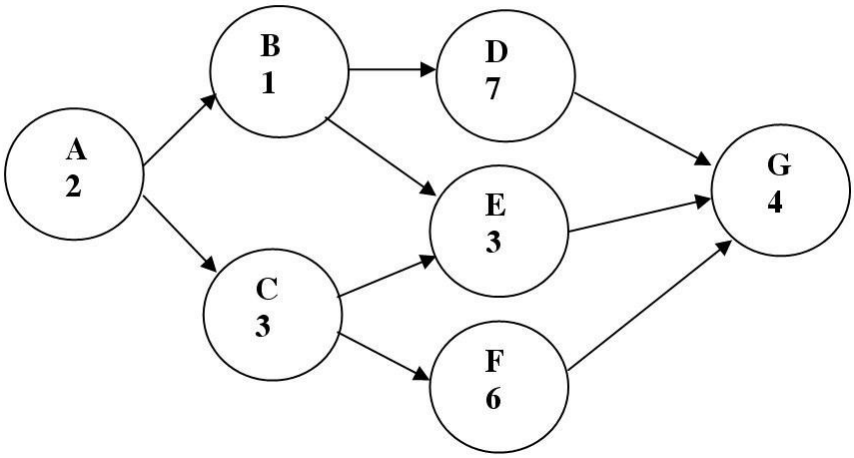


Table 2.1

ACTIVITY	ACTIVITY TIME	EARLIEST START	EARLIEST FINISH	LATEST START	LATEST FINISH	SLACK
A	2	0		0	2	0
B	1	2	3	3	4	1
C	3	2	5	2	5	0
D	7	3	10	4	11	
E	3	5	8		11	3
F		5	11	5	11	0
G	4	11	15	11	15	0

36) Using the information shown in Table 2.1, what is the slack time for activity D? 36) _____
A) 1 B) 7 C) 4 D) 6

37) Using the information shown in Table 2.1, what is the earliest finish time for activity A? 37) _____

A) 2 B) 0 C) 4 D) 3

38) Using the information shown in Table 2.1, what is the latest start time for activity E? 38) _____

A) 8 B) 3 C) 2 D) 5

39) Using the information shown in Table 2.1, what is the activity time for activity F? 39) _____

A) 6 B) 11 C) 5 D) 1

40) Which one of the following is the critical path? 40) _____

A) ABEG B) ACFG C) ACEG D) ABDG

41) Using the information shown in Table 2.1, what is the project duration? 41) _____

A) 15 B) 14 C) 10 D) 12

42) When using the beta probability distribution to estimate activity times, which of the following statements is TRUE? 42) _____

A) The project manager is usually the only person involved in making time estimates because obtaining estimates from workers involved in the activities would result in inconsistent estimates.
B) The larger the difference between most pessimistic time and most optimistic time for an activity, the smaller will be the variance of that time estimate.
C) The beta distribution is used as a way of approximating a normal probability distribution for time estimates.
D) The use of most optimistic, most likely, and most pessimistic times for an activity will result in a determination of the expected times for that activity.

43) When using the beta distribution for estimating activity times: 43) _____

A) an advantage is that the mode of the distribution is always equidistant from the end points of the distribution.
B) the most likely time estimate becomes the mean of the distribution.
C) the most likely time estimate can be positioned anywhere between the optimistic and pessimistic time estimates.
D) we assume that the standard deviation is one-third the range between the optimistic and pessimistic time estimates.

44) Following are four sets of most optimistic, most likely, and most pessimistic times (in weeks) for an activity. Which one of the four sets will have a mean estimated time equal to the most likely time? 44) _____

A) 1, 9, 9 B) 1, 5, 5 C) 1, 1, 9 D) 1, 5, 9

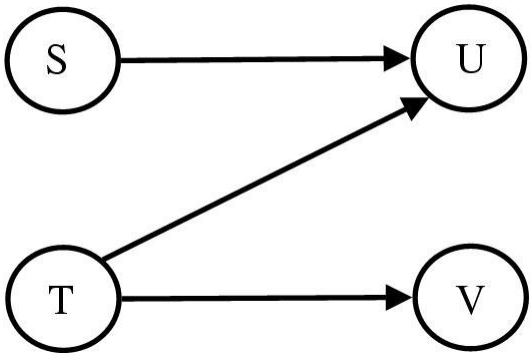
45) To calculate the probability of completing a project by a certain date: 45) _____

A) we assume that the activity durations are independent of each other so that the normal distribution can be used.
B) the expected completion time of the project is taken to be the sum of the activity times on the shortest path.
C) the variance of the distribution of project completion times is taken

to be one-sixth the difference between the latest finish time and the earliest finish time of the last activity in the project.

D) we need only the parameters of the beta distribution for the finish node of the diagram.

Fig. 2.2



46) Which one of the following statements regarding Figure 2.2 is TRUE? 46) _____

A) Activity U cannot begin until activities S and T have been completed.
B) Activity V cannot begin until activity S has been completed.
C) Activity S cannot finish until activity T finishes.
D) Activity T cannot begin until activity U is completed.

47) If a project has exactly one critical path, which one of the following statements is TRUE? 47) _____

A) Activities on the critical path cannot be crashed.
B) Crashing an activity on the critical path will always result in a reduced total project completion time.
C) Crashing an activity on the critical path will always result in an increase in total project profits.
D) The best schedule is one in which all activities are crashed as much as possible.

48) Which one of the following conditions violates the assumptions of PERT/CPM networks? 48) _____

A) There can be more than one critical path in a network.
B) Two activities tied together by an arc are overlapping and can be worked on simultaneously.
C) Some activities can have zero variance.
D) Costs increase linearly as activity time is reduced below its normal time.

49) Which one of the following statements is TRUE? 49) _____

A) PERT/CPM assumes that two activities tied together by a precedence relationship cannot be worked on simultaneously.
B) Crashing an activity on the critical path will always result in an increase in total project profits.
C) The path in a network having the minimum slack is the shortest path in the network.
D) There is never more than one critical path in a network.

50) In making an estimate of the most pessimistic time for an activity, a manager deliberately estimates this time too high (i.e., longer than it should be). What is the result of this action, assuming the beta distribution is being used to make time estimates? 50) _____

A) The variance of the activity will be smaller than it should be.
B) The beta distribution will be symmetric around its mean.
C) The most likely time for this activity will be larger than it should be.
D) The expected time for this activity will be larger than it should be.

Table 2.2

		Time (weeks)		
Activity	Immediate Predecessor(s)	Most Optimistic	Most Likely	Most Pessimistic
A	---	1	2	3
B	A	2	4	12
C	A	1	2	3
D	B	6	7	8
E	B,C	10	12	14
F	D	2	3	4
G	E,F	1	5	15
H	A	2	5	14

51) Using Table 2.2, what is the earliest expected time of completion of the whole project? 51) _____

A) Greater than 21 but fewer than or equal to 24 weeks
B) Fewer than or equal to 19 weeks
C) Greater than 24 weeks
D) Greater than 19 but fewer than or equal to 21 weeks

52) Using Table 2.2, which activity will have the largest amount of slack? 52) _____

A) Activity C B) Activity H
C) Activity F D) Activity A

53) Using Table 2.2, if the expected times for activities A, G, and H increased by 2, 3, and 4 weeks, respectively, by how many weeks would the project's earliest expected time of completion increase? 53) _____

A) Greater than 4 weeks but fewer than or equal to 6 weeks
B) Greater than 6 weeks
C) Greater than 2 weeks but fewer than or equal to 4 weeks
D) Fewer than or equal to 2 weeks

Table 2.3

Activity	Immediate Predecessor(s)	Time (weeks)		
		Most Optimistic	Most Likely	Most Pessimistic
A	---	2	4	6
B	---	1	4	7
C	A	2	2	2
D	B	1	7	10
E	D	2	4	6
F	E	1	2	3
G	C	3	4	17
H	D,G	3	7	11
I	D	8	9	10
J	F,H	4	5	6
K	I	1	1	1

54) Using Table 2.3, what is the earliest expected time of completion of the whole project? 54) _____

A) Greater than 22 but fewer than or equal to 23 days
B) Greater than 23 days
C) Fewer than or equal to 21 days
D) Greater than 21 but fewer than or equal to 22 days

55) Using Table 2.3, which activity is on the critical path? 55) _____

A) Activity F B) Activity G
C) Activity K D) Activity D

56) Using Table 2.3, if the project is due to be completed in 28 days, what is the probability that the project will be completed on or before the due date? 56) _____

A) Less than or equal to 75%
B) Greater than 95%
C) Greater than 85% but less than or equal to 95%
D) Greater than 75% but less than or equal to 85%

57) Using Table 2.3, if the project manager wants at least a 98% probability that the project will be completed on or before the due date, what is the shortest project due date that will satisfy the manager? 57) _____

A) Greater than 28 days but fewer than or equal to 30 days
B) Greater than 30 days but fewer than or equal to 32 days
C) Fewer than or equal to 28 days
D) Greater than 32 days

Table 2.4

Activity	Predecessor	Time(weeks)
A	--	**8**
B	**A**	**6**
C	--	**4**
D	**C**	**9**
E	**A**	**11**
F	**B**	**3**
G	**D,E,F**	**1**

58) Using Table 2.4, what is the earliest completion time for this project? 58) _____

A) 20 weeks B) 21 weeks C) 19 weeks D) 18 weeks

59) Using Table 2.4, what is the largest amount of slack that any activity in the project has? 59) _____

A) Two weeks B) Four weeks
C) Six weeks D) Zero weeks

60) Using Table 2.4, what is the minimum number of activities that would have to be delayed to cause an increase in the project's earliest completion date? 60) _____

A) One activity B) Four or more activities
C) Three activities D) Two activities

61) Using Table 2.4, what is the minimum number of activities that would have to be crashed to cause a decrease in the project's earliest completion date? 61) _____

A) One activity B) Two activities
C) Four or more activities D) Three activities

62) Using Table 2.4, what is the early start time for activity D? 62) _____

A) Week 0 B) Week 4 C) Week 7 D) Week 9

63) Using Table 2.4, what is the latest finish time for activity C? 63) _____

A) Week 8 B) Week 6 C) Week 4 D) Week 10

64) Using Table 2.4, what is the slack associated with activity B? 64) _____

A) 3 weeks
B) 1 week
C) 2 weeks
D) None of these is the correct activity slack for B.

Table 2.5

		All times in days		
Activity	**Predecessor**	**a**	**m**	**b**
A	**--**	**1**	**2**	**3**
B	**--**	**2**	**4**	**6**
C	**A**	**3**	**4**	**5**
D	**B**	**6**	**7**	**9**
E	**C**	**7**	**9**	**10**
F	**D**	**8**	**12**	**16**
G	**D**	**2**	**4**	**7**
H	**E,F**	**9**	**11**	**13**

65) Using Table 2.5, the expected time for activity C is: 65) _____

A) five days. B) three days.
C) more than five days. D) four days.

66) Using Table 2.5, what is the latest finish time for activity D? 66) _____

A) Between 6 and 8 days B) Between 8 and 10 days
C) Between 4 and 6 days D) More than 10 days

67) Using Table 2.5, what is the variance for activity F? 67) _____

A) 1.33 B) 2.69 C) 2.34 D) 1.78

68) Using Table 2.5, what is the standard deviation for the entire project? 68) _____
A) 1.08 B) 2.92 C) 1.71 D) 1.17

69) Using Table 2.5, what is the chance that the project will be completed within 32 days? 69) _____
A) About 10% B) About 40%
C) Not bloody likely D) About 25%

70) Using Table 2.5, which activity is on the critical path? 70) _____
A) Activity E B) Activity C
C) Activity H D) Activity A

Table 2.6

Activity	Predecessor	Time (days)
A	--	8
B	--	6
C	--	3
D	A,B	10
E	C	8
F	A	5
G	D,E	3
H	G	4

71) Using Table 2.6, what is the earliest completion time of this project? 71) _____
A) 27 days B) 25 days C) 23 days D) 29 days

72) Using Table 2.6, what is the latest start time for activity E? 72) _____
A) Day 14 B) Day 8 C) Day 12 D) Day 10

73) Using Table 2.6, what is the earliest that activity D can be finished? 73) _____
A) 18 days B) 8 days C) 25 days D) 13 days

74) Disaster strikes and activity F takes 20 days instead of the anticipated 5 days. Using Table 2.6, how much longer will the project last than initially estimated? 74) _____
A) 7 days B) 0 days C) 3 days D) 15 days

75) Using Table 2.6, every day the construction crew is on-site costs $1000. What activities would you consider crashing to reduce the project completion cost? 75) _____
A) Activity F
B) Activity E
C) Activity G
D) All of these activities would be candidates for crashing.

76) Using Table 2.6, how many days can activity C be delayed without changing the whole project's earliest completion time? 76) _____
A) 2 days B) 0 days C) 5 days D) 7 days

Table 2.7

Activity	Immediate Predecessor(s)	Time (weeks)
A	---	3
B	---	4
C	---	2
D	A	4
E	A,B	5
F	A,B,C	2
G	D,E	1
H	E	6
I	E,F	2
J	G,H,I	4
K	H,I	3
L	I	6

77) Using Table 2.7, what is the critical path for this project? 77) _____
A) B□E□H□J B) B□E□H□K
C) C□F□I□L D) A□E□G□J

78) Using Table 2.7, suppose activity D can be shortened from four days to one day. Assume all other activity times remain the same. How much shorter will the total project earliest completion time become? 78) _____
A) Three days B) Two days
C) Zero days D) One day

79) Using Table 2.7, suppose activity I is delayed, taking eight days to complete instead of two days. Assume all other activity times remain the same. How much longer will the total project earliest completion time become? 79) _____
A) One or two days B) Five or six days
C) Zero days D) Three or four days

80) Using Table 2.7, what is the latest start time for activity A? 80) _____
A) Day 0 B) Day 2
C) Day 1 D) Day 3 or later

Table 2.8

Activity	Immediate Predecessor(s)	Time (weeks)
A	---	3
B	---	4
C	A,B	5
D	A	6
E	C	4
F	D,E	2

81) Using Table 2.8, what is the earliest completion time of the project? 81) _____
A) Greater than 16 weeks
B) Greater than 10 weeks but fewer than or equal to 13 weeks
C) Fewer than or equal to 10 weeks
D) Greater than 13 weeks but fewer than or equal to 16 weeks

82) Using Table 2.8, what is the critical path of the above project? 82) _____

A) B□C□F B) A□C□E□F

C) A□D□F D) B□C□E□F

83) Using Table 2.8, what is the slack for activity A? 83) _____

A) 0 weeks B) 3 or more weeks

C) 2 weeks D) 1 week

Figure to accompany Table 2.9

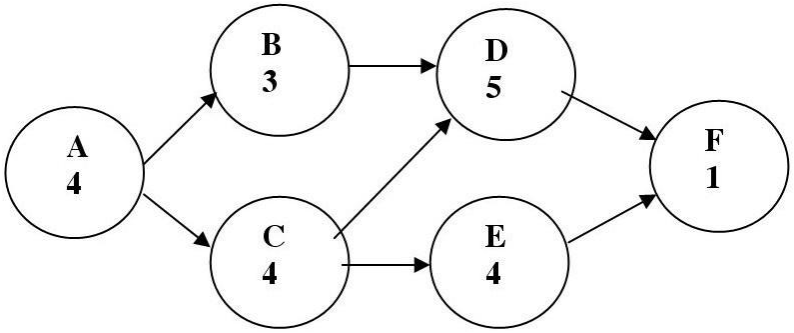


Table 2.9

ACTIVITY	NORMAL TIME	CRASH TIME	NORMAL COST ($000s)	CRASH COST ($000s)	AVAILABLE WEEKS OF CRASHING	CRASHING COST / WEEK
A	4	2	8	14		
B	3	2	9	11		
C	4	4	10	10		
D	5	3	10	15		
E	4	1	11	14		
F	1	1	6	6		

84) What is the critical path for the project shown in the above network and Table 2.9, using the normal times? 84) _____

A) A-B-C-D-E-F B) A-B-D-F

C) A-C-D-F D) A-C-E-F

Figure to accompany Table 2.9

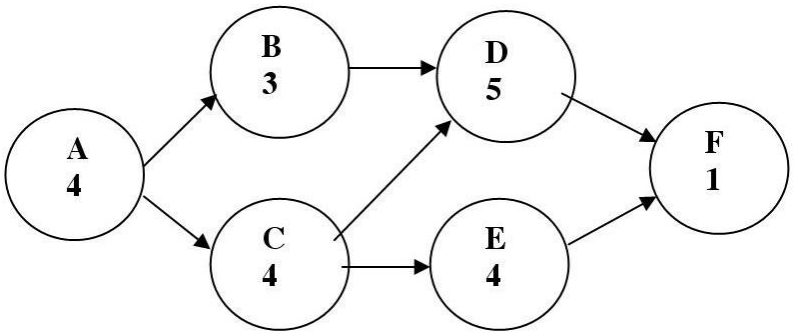


Table 2.9

ACTIVITY	NORMAL TIME	CRASH TIME	NORMAL COST ($000s)	CRASH COST ($000s)	AVAILABLE WEEKS OF CRASHING	CRASHING COST / WEEK

A	4	2	8	14		
B	3	2	9	11		
C	4	4	10	10		
D	5	3	10	15		
E	4	1	11	14		
F	1	1	6	6		

Determine the information missing from Table 2.9, then answer the following questions.

85) How many week(s) of crashing are available for activity D in Table 2.9? 85) _____
A) 0 B) 6 C) 1 D) 2

86) How many week(s) of crashing are available for activity B in Table 2.9? 86) _____
A) 2 B) 3 C) 1 D) 0

87) How many weeks of crashing are available for activity C in Table 2.9? 87) _____
A) 6 B) 0 C) 2 D) 1

88) What is the crashing cost per week for activity A in Table 2.9? 88) _____
A) $2,000
B) $4,000
C) $3,000
D) This activity cannot be crashed

89) What is the crashing cost per week for activity E in Table 2.9? 89) _____
A) $3,000
B) $4,000
C) $2,000
D) This activity cannot be crashed

90) What is the crashing cost per week for activity F in Table 2.9? 90) _____
A) $4,000
B) $2,000
C) $3,000
D) This activity cannot be crashed.

91) If a decision is made to crash activity D in Table 2.9 by one week, what is the cost for this one week of crashing? 91) _____
A) $2,000
B) $3,000
C) $2,500
D) This activity cannot be crashed.

92) Which activity should be crashed first for the project shown in Table 2.9? 92) _____
A) B B) A C) C D) D

Table 2.10

Activity	Predecessor	Normal Time (days)	Crashing Time (days)	Crashing Cost/day
A	--	**5**	**1**	**$200**

B	--	**7**	**1**	**$500**
C	--	**5**	**1**	**$200**
D	**A**	**10**	**2**	**$300**
E	**B**	**6**	**1**	**$400**
F	**A,C**	**7**	**2**	**$650**
G	**B**	**4**	**1**	**$500**
H	**E,D,G**	**6**	**1**	**$350**

93) Using Table 2.10, what is the critical path for this project using the normal times? 93) _____

A) B-G-H B) A-D-H C) B-E-H D) C-F

94) Using Table 2.10, what is the minimum completion time for this project after crashing? 94) _____

A) 19 days B) 21 days C) 17 days D) 23 days

95) Using Table 2.10, what is the minimum crashing cost to finish this project in 18 days? 95) _____

A) $1,150 B) $1,500 C) $850 D) $3,450

96) Using Table 2.10, what is the activity with the greatest amount of slack? 96) _____

A) C B) D C) A D) B

97) Using Table 2.10, what is the latest start time for activity E? 97) _____

A) Day 10 B) Day 9 C) Day 7 D) Day 8

98) Using Table 2.10, what is the earliest possible completion time for activity E after crashing? 98) _____

A) Day 11 B) Day 15 C) Day 13 D) Day 17

Table 2.11

Activity	Immediate Predecessor(s)	Time (weeks)	Cost to Crash 1 Week
A	---	2	$ 3,000
B	---	4	10,000
C	A	3	2,000
D	A	1	Impossible
E	B	3	10,000
F	C	1	Impossible
G	B,D	5	10,000
H	E	1	Impossible
I	F	3	3,000
J	C,G	2	6,000
K	I,J	1	Impossible
L	G,H	4	8,000

99) Using Table 2.11, what is the earliest completion time of this project without crashing? 99) _____

A) More than 12 weeks B) Fewer than 11 weeks

C) 12 weeks D) 11 weeks

100) Using Table 2.11, if activity B is crashed by 2 weeks, what is the new earli est

completi on time of the project? 100) ____

A) 12 weeks B) Fewer than 11 weeks
C) More than 12 weeks D) 11 weeks

101) Using Table 2.11, and assuming all activities except D, F, H, and K are available to be crashed, what is the minimum cost to be incurred in reducing the total project earliest completion time by one week? 101) _____

A) $6,000 B) $10,000 C) $8,000 D) $3,000

Table 2.12

		TIME (WEEKS)		COST ($)	
ACTIVITY	IMMEDIATE PREDECESSOR(S)	NORMAL	CRASH	NORMAL	CRASH
A	---	3	2	3,000	3,300
B	---	6	4	8,000	9,000
C	A	1	1	4,000	4,000
D	A	5	4	3,500	4,000
E	B	4	3	4,750	5,500
F	C	2	2	2,000	2,000
G	D	1	1	4,000	4,000
H	D,F	3	2	3,500	3,750
I	E,G	3	2	3,000	4,250
J	E	2	1	5,000	7,000

102) Using Table 2.12, what is the earliest completion time of this project if normal times are used for all activities? 102) _____

A) Fewer than 13 weeks B) 13 weeks
C) More than 14 weeks D) 14 weeks

103) Using Table 2.12, what is the minimum time schedule for this project? 103) _____

A) 8 weeks B) More than 9 weeks
C) Fewer than 8 weeks D) 9 weeks

104) Using Table 2.12, if the project completion time has to be reduced by one week, which of the following activities should be crashed to minimize the extra cost of earlier completion? 104) _____

A) Activity B B) Activity J
C) Activity H D) Activity E

105) Using Table 2.12, what is the difference, in dollars, between the minimum-time schedule and the schedule created by crashing all activities to their limits? Assume that there are no indirect or penalty costs. 105) _____

A) Less than or equal to $1,000
B) Greater than $3,000
C) Greater than $2000 but less than or equal to $3,000
D) Greater than $1000 but less than or equal to $2,000

106) Using Table 2.12, if the project's normal earliest completion time is to be reduced by two weeks, what is the minimum additional cost that will be incurred in achieving this two-week reduction? 106) _____

A) Greater than $1,500 but less than or equal to $2,000
B) Less than or equal to $1,000
C) Greater than $1,000 but less than or equal to $1,500
D) Greater than $2,000

Table 2.13 (All activity times for the project are in weeks.)

Activity	Optimistic Time	Most Likely Time	Pessimistic Time	Immediate Predecessor(s)
A	3	4	5	---
B	5	7	9	---
C	2	3	10	A
D	2	5	8	B
E	1	7	7	B
F	3	5	7	C,D
G	7	8	9	D,E
H	2	6	10	F

107) Using Table 2.13, what is the critical path of this project? 107) _____

A) B□D□F□H
B) A□C□F□H
C) B□D□G
D) B□E□G

108) Using Table 2.13, what is the expected time of completion of the project? 108) _____

A) 23 weeks
B) 22 weeks
C) Greater than 23 weeks
D) Fewer than 22 weeks

109) Using Table 2.13, what is the probability that the project will be completed in 24 or fewer weeks? 109) _____

A) Greater than 65% but less than or equal to 75%
B) Greater than 55% but less than or equal to 65%
C) Less than or equal to 55%
D) Greater than 75%

110) Using Table 2.13, if the expected time for activity E is changed to nine weeks, by how many weeks will the project's expected completion time increase? 110) _____

A) It will increase by two weeks.
B) It will increase by one week.
C) It will increase by three or more weeks.
D) It will not change.

You are responsible for managing a project with the following activities (times are given in weeks).
Table 2.14

Activity	Optimistic Time	Most Likely Time	Pessimistic Time	Immediate Predecessor(s)
A	2	5	14	---
B	8	11	14	---
C	5	7	9	A
D	6	9	12	A
E	1	3	5	D,B

111) Using Table 2.14, what is the critical path and expected completion time for this project? 111) _____

A) B□E; 14 weeks
B) A□D□E; 17 weeks
C) A□C; 18 weeks
D) A□D□E; 18 weeks

112) Using Table 2.14, which activity has the largest slack, and how large is that slack? 112) _____

A) Activity E; three weeks
B) Activity A; six weeks
C) Activity B; four weeks
D) Activity C; five weeks

113) Using Table 2.14, what is the probability of completing the project in 17 or fewer weeks? 113) _____

A) Less than or equal to 40%
B) Greater than 70%
C) Greater than 55% but less than or equal to 70%
D) Greater than 40% but less than or equal to 55%

114) Using Table 2.14, what is the probability that the project will take 16 or more weeks to complete? 114) _____

A) Greater than 70%
B) Greater than 55% but less than or equal to 70%
C) Greater than 40% but less than or equal to 55%
D) Less than or equal to 40%

115) Using Table 2.14, if the expected time for activity B is changed to 18 weeks, by how many weeks will the project's expected completion time increase? 115) _____

A) It will increase by more than four weeks.
B) It will not change.
C) It will increase by three or four weeks.
D) It will increase by one or two weeks.

You are responsible for managing a project with the following activities (times are given in days).
Table 2.15

Activity	Expected Time	Immediate Predecessor (s)
A	3	---
B	6	---
C	2	---
D	5	A
E	2	C
F	7	A
G	4	B,D,E

116) Using, Table 2.15, what is the critical path and expected completion time for this project? 116) _____

A) B-G; 10 days B) A-F; 12 days
C) A-D-G; 12 days D) C-E-G; 8 days

117) Using, Table 2.15, which of the following activities has the largest amount of slack? 117) _____

A) Activity E B) Activity F
C) Activity B D) Activity D

118) Assuming a beta distribution is being used, if the most pessimistic time for an activity increases by six weeks, what will happen to the expected time for that activity? 118) _____

A) It will increase by one week. B) It will increase by six weeks.
C) It will remain the same. D) It will decrease by one week.

119) The probability that a project will be completed by its earliest expected completion date is: 119) _____

A) 100 percent. B) 95 percent.
C) 50 percent. D) impossible to determine.

120) If the sum of the variances on the critical path (and all other network paths) is equal to zero, what is the probability that the project will be completed by its earliest expected completion date? 120) _____

A) 95 percent B) 100 percent
C) 50 percent D) It cannot be determined.

121) A project is currently scheduled to be finished on its normal earliest completion date. The project manager has the opportunity to earn a bonus if the project can be completed three weeks ahead of schedule. The increase in project direct costs related to crashing activities would be $40,000. Also, project indirect costs are $15,000 per week. What is the smallest bonus that the project manager should accept if he or she wants to avoid increasing overall project costs? 121) _____

A) Greater than $15,000
B) Greater than $5000 but less than or equal to $10,000
C) Greater than $10,000 but less than or equal to $15,000
D) Less than or equal to $5,000

122) You are given the following information about activity A: 122) _____

Normal time = 9 weeks
Crash time = 7 weeks
Normal cost = $20,000
Crash cost = $30,000

What will it cost to complete activity A in 8 weeks?

A) Greater than $27,000 but less than or equal to $30,000
B) Less than or equal to $24,000
C) Greater than $30,000
D) Greater than $24,000 but less than or equal to $27,000

123) You are given the following information about activity B: Cras h time = 5 we
Normal time = 9 weeks Cost

to crash per week = $2000
Crash cost = $41,000
What will it cost to complete activity B in 6 weeks? 123) ____

A) Less than or equal to $34,000
B) Greater than $38,000
C) Greater than $36,000 but less than or equal to $38,000
D) Greater than $34,000 but less than or equal to $36,000

124) You are given the following information about activity F: 124) _____

Normal time = 16 weeks
Crash time = 10 weeks
Crash cost = $45,000
Cost to crash per week = $2,000
What is the normal cost for activity F?

A) Less than $47,000 but greater than or equal to $40,000
B) Less than $55,000 but greater than or equal to $47,000
C) Less than $40,000
D) Greater than or equal to $55,000

125) A company could add $10,000 per week in revenues if the project depicted in Table 2.16 could be shortened. 125) _____

Table 2.16

Activity	Immediate Predecessor(s)	Time (weeks)
A	---	7
B	---	9
C	A	8
D	A,B	8
E	B	9
F	C	10
G	D,E	5
H	E	10
I	F,G	5

Four possible options exist to crash activities: crash A by one week at a cost of $6,000; crash C by two weeks at a cost of $15,000; crash E by one week at a cost of $2,000; and crash I one week at a cost of $7,000. What is the maximum amount of additional profit that can be made by crashing an option (or options)?

A) Greater than $12,000
B) Greater than $4000 but less than or equal to $8,000
C) Less than or equal to $4,000
D) Greater than $8000 but less than or equal to $12,000

126) A good risk management plan will contain which of these elements? 126) _____
A) A prediction of the impact of each risk on the project
B) The number of acceptable outcomes
C) The project manager's tolerance level for risk
D) The number of unacceptable outcomes

127) A plan that identifies key threats to a project and prescribes ways to circumvent them is called a: 127) _____
A) project plan. B) contingency plan.
C) risk management plan. D) backup plan.

128) Which of these is NOT one of the four categories of project risk? 128) _____
A) Strategic fit B) Operations
C) Cost/benefit D) Project team capability

129) Information accuracy relative to the completeness of the work breakdown structure and communication of timely information affect the: 129) _____
A) cost/benefit risk of a project.
B) service/product attribute risk of a project.
C) strategic fit risk of a project.
D) operations risk of a project.

SHORT ANSWER. Write the word or phrase that best completes each statement or answers the question.

130) A(n) _____ is an interrelated set of activities that has a definite starting and ending point and that results in a unique outcome for a specific allocation of resources. 130) _____

131) The _____ is a statement of all work that has to be completed. 131) _____

132) _____ determines the sequence for undertaking activities. 132) _____

133) The _____ is the sequence of activities between a project's start and finish that takes the longest time to complete. 133) _____

134) _____ is the maximum length of time that an activity can be delayed without delaying the entire project. 134) _____

135) The _____ is the shortest possible time to complete the activity. 135) _____

136) The _____ is determined by starting with the normal time schedule and crashing activities along the critical path in such a way that the costs of crashing do not exceed the savings in indirect and penalty costs. 136) _____

137) A(n) _____ identifies the key threats to a project and prescribes ways to work around them. 137) _____

138) The _____ is the shortest time in which an activity can be com pleted if all

goes exceptionally well. 138) ____
____
____

139) _____ occurs when the assumptions used to compute planned slack are invalid and activities are pushed beyond their planned latest start dates. 139) _____

140) To find the standard deviation of the critical path, you must first add the _____ of all activities on the critical path. 140) _____

141) The phase of project management that takes the most resources is the _____, during which managers focus on activities that pertain to deliverables. 141) _____

142) _____ is an attempt to reduce the peaks and valleys in resource needs by shifting the schedules of conflicting activities within their earliest and latest start dates. 142) _____

143) List the three main goals of a project. Use the example of a project to implement a new billing procedure for a small lawn mowing business, describe how project management principles help achieve these goals. 143) _____

144) What are the primary responsibilities of a Project Manager? Briefly describe these responsibilities for a project manager whose team is purchasing a new machine and installing it in a manufacturing process. 144) _____

145) What characteristics should be considered when selecting project team members? Briefly describe these characteristics for members of a project team assigned to improve a teller's job in a bank. 145) _____

146) Following the project defining and organizing phase, project planning involves five steps. List and briefly describe these five planning steps as applied to writing a term paper for an Operations Management class. 146) _____

147) Why is identifying which path is the critical path important in a project management? 147) _____

148) Why do managers want to know the slack of activities? 148) _____

149) Describe how time-cost tradeoffs for project activities should be identified and analyzed. 149) _____

150) What options do project managers have to alleviate resource problems? Briefly describe each method. 150) _____

ESSAY. Write your answer in the space provided or on a separate sheet of paper.

151) Draw the network corresponding to the following information. Also, complete the table, identify the critical path, and specify project completion time.

Activity	Immediate Predecessor(s)	Time (Weeks)
A	---	3
B	---	4
C	A	6
D	B	9
E	B	6
F	C,D	6
G	D,E	8
H	G,F	9

Activity	Earliest Start	Earliest Finish	Latest Start	Latest Finish	Slack
A					
B					
C					
D					
E					
F					
G					
H					

152) Consider the tasks, durations, and predecessor relationships in the following network. Draw the network and answer the questions that follow.

Activity Description	Immediate Predecessor(s)	Optimistic (Weeks)	Most Likely (Weeks)	Pessimistic (Weeks)
A	---	4	7	10
B	A	2	8	20
C	A	8	12	16
D	B	1	2	3
E	D, C	6	8	22
F	C	2	3	4
G	F	2	2	2
H	F	6	8	10
I	E, G, H	4	8	12
J	I	1	2	3

a. What is the expected time for activity B?
b. What is the variance for activity B?
c. Based on the calculation of estimated times, what is the critical path?
d. What is the estimated time of the critical path?
e. What is the activity variance along the critical path?
f. What is the probability of completion of the project before week 42?

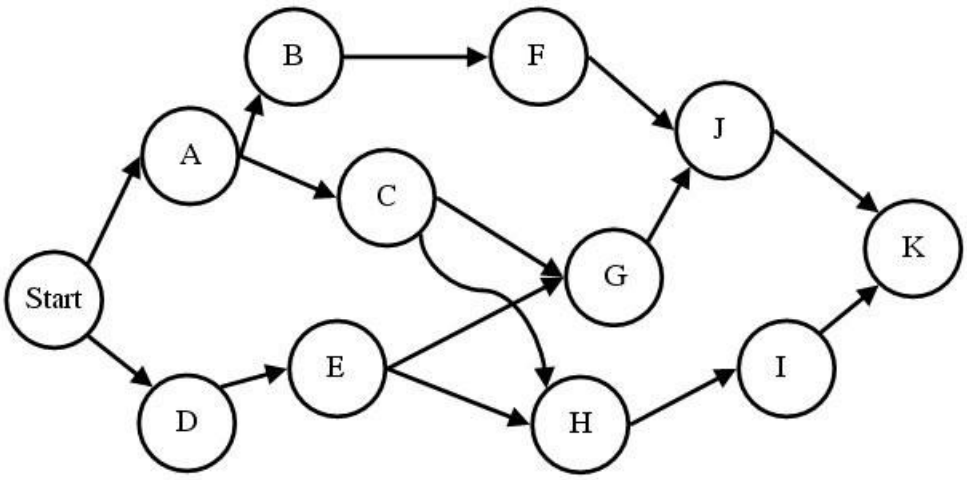
153) The following table contains a list of activities, with early- and late-start and finish times and crash costs for the network shown in the figure. All start and finish times

and crash costs are on a per-week basis. Each activity can be reduced by one week at the most.

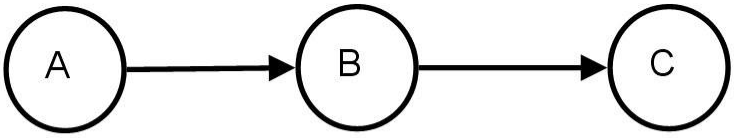
a. Determine the uncrashed activity lengths for activities A though K.

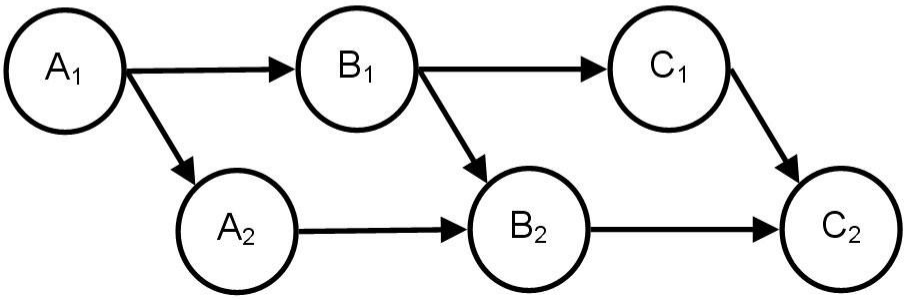
b. Determine the minimum completion cost for this project if each week carries a fixed cost of $1,000.

Activity	ES	EF	LS	LF	Crash Cost/week
A	0	5	0	5	$1,100
B	5	9	13	17	$250
C	5	11	5	11	$1,200
D	0	6	1	7	$350
E	6	10	7	11	$900
F	9	14	17	22	$875
G	11	17	16	22	$1,500
H	11	18	11	18	$500
I	18	26	18	26	$300
J	17	21	22	26	$625
K	26	34	26	34	$750



154) Consider a project that consists of three consecutive activities of equal length as shown in the network diagram. The project manager would like to complete the project as quickly as possible and realizes that the diagram's logic is misleading. Instead of waiting until activity A is completed before activity B can begin, he can actually begin activity B once activity A has begun. The same reasoning holds for the relationship between activity B and activity C. The project manager decides to divide each activity in half, a technique known as "laddering". The second diagram shows the new network logic. In this diagram, activity A is divided into activity A1 and A2 where A1 must be finished before A2 can begin and before B1 can begin. The manager still isn't satisfied with the completion time of the project. Derive an expression or draw a diagram that demonstrates the fastest possible completion time of the project.





155) Phoebe B. Beebee is constructing a canal for the annual canoe races and has identified eleven activities that are required to complete this important project. She calculated early and late start times and early and late finish times but spilled coffee all over her printout. Use the remaining information to reconstruct the table for Phoebe B. Beebee and her new canoe canal.

Activity	Predecessor	Length	Early Start	Late Start	Early Finish	Late Finish
A	--				12	
B	A	20				
C	A					
D	B, E			42		
E	C		28			42
F	E		42		50	
G	D		53	53		
H	G		70			
I	G			72		
J	F	4				
K	H, I, J			81		91

1) TRUE
2) TRUE
3) TRUE
4) TRUE
5) FALSE
6) TRUE
7) TRUE
8) TRUE
9) TRUE
10) FALSE
11) FALSE
12) FALSE
13) TRUE
14) TRUE
15) FALSE
16) FALSE
17) TRUE
18) TRUE
19) TRUE
20) FALSE
21) C
22) A
23) A
24) A
25) B
26) C
27) C
28) D
29) D
30) B
31) D
32) B
33) A
34) B
35) C
36) A
37) A
38) A
39) A
40) B
41) A
42) D
43) C
44) D
45) A
46) A
47) B
48) B
49) A
50) D
51) C

52) B
53) A
54) B
55) B
56) C
57) A
58) A
59) C
60) A
61) A
62) B
63) D
64) C
65) D
66) B
67) D
68) C
69) A
70) C
71) B
72) D
73) A
74) C
75) C
76) D
77) A
78) C
79) D
80) C
81) D
82) D
83) D
84) C
85) D
86) C
87) B
88) C
89) B
90) D
91) C
92) D
93) B
94) C
95) C
96) A
97) B
98) C
99) A
100) A
101) C
102) B
103) D

104) A
105) B
106) C
107) A
108) A
109) A
110) B
111) D
112) D
113) A
114) A
115) C
116) C
117) A
118) A
119) C
120) B
121) D
122) D
123) B
124) C
125) B
126) A
127) C
128) C
129) D
130) project
131) work breakdown structure (WBS)
132) Precedence relationship
133) critical path
134) Activity slack
135) crash time
136) minimum-cost schedule
137) risk-management plan
138) optimistic time
139) Negative slack
140) variances
141) execution phase
142) Resource leveling
143) Goals are: 1. Complete the project on time or earlier; 2. Complete it within budget; 3. Meet specs to satisfy the customer. Project Management is a systemized, phased approach to define, organize, plan, monitor and control a project to achieve these goals. Best answers will include these points, and explain them in the context of the lawn service billing procedure.
144) Best answers will include the following points, describing the manager's role in the purchase and installation of the new machine: 1. *Facilitator*: resolves conflicts; leads with a system view; blends project interaction, resources and deliverables with firm as a whole; 2. *Communicator*: informs senior management and other stakeholders of project's progress and need for additional resources; communicates with project team to achieve best performance; 3. *Decision Maker*: organize team meetings; define how team decisions will be made; determine how to communicate to senior management; make tough decisions if necessary.

145) Best answers should include the following in the context on the job improvement project: 1. *Technical Competence*: capable of completing tasks assigned to them; 2. *Sensitivity*: to interpersonal conflicts within the team; help mitigate these issues and any problems dealing with upper level management; 3. *Dedication*: capable of solving problems outside immediate expertise by involving others as needed; display persistence and initiative for completing the project in a timely fashion.

146) The following points should be included in the best answers: 1. *Define the work breakdown structure*: develop a list of all work to be completed on the project; 2. *Diagram the network*: develop a PERT/CPM diagram showing all activities and precedence requirements for the project; 3. *Develop the schedule*: define the project's critical path, duration, and earliest and latest start and finish times for each activity; 4. *Analyze cost□time trade-offs*: determine normal time and costs for the project, as well as crash time and costs; using project crashing techniques, find a minimum cost schedule for completing the project; 5. *Assess project risks*: develop a risk management plan, including such areas as strategic fit, service/product attributes, team capabilities and operations risks.

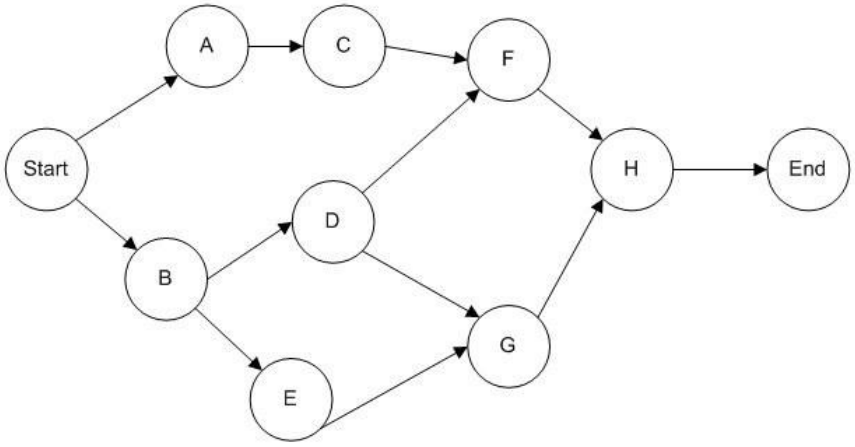
147) The critical path of activities determines the time duration of the project. Any slippage along the critical path means the project will be delayed. The critical path also defines the activities requiring the team's attention and focus to assure timely and cost effective completion of the project.

148) Managers monitor activity slack reports to identify activities that have fallen behind schedule or are dangerously close to doing so. Also, activities with large amounts of slack might afford a reduction in resources so that other activities behind schedule can catch up.

149) There are always time-cost tradeoffs in project management situations. Overall project length is driven by the length of the critical path, so if it is necessary to finish the project more quickly, the activities that should be shortened are those on the critical path. Whether the goal is to reduce the project's length to avoid a penalty, meet a deadline, or to reach an incentive, the cheapest activities on the critical path should be attacked first. If the objective is to minimize costs, then the project manager should reduce the critical path by expediting activities until the increase in direct costs exceeds the savings that can be gained. If the objective is to finish the project in a certain number of days, the project manager must continue to reduce activity lengths until that target is reached regardless of expense.

150) The methods are resource leveling, resource allocation, and resource acquisition. Resource leveling attempts to reduce the peaks and valleys in resource needs by shifting the schedules of conflicting activities within their earliest and latest start dates. Resource allocation attempts to shift resources from activities with slack to those on the critical path where resources are overloaded. Resource acquisition adds more of an overloaded resource to maintain the schedule of activity.

151)

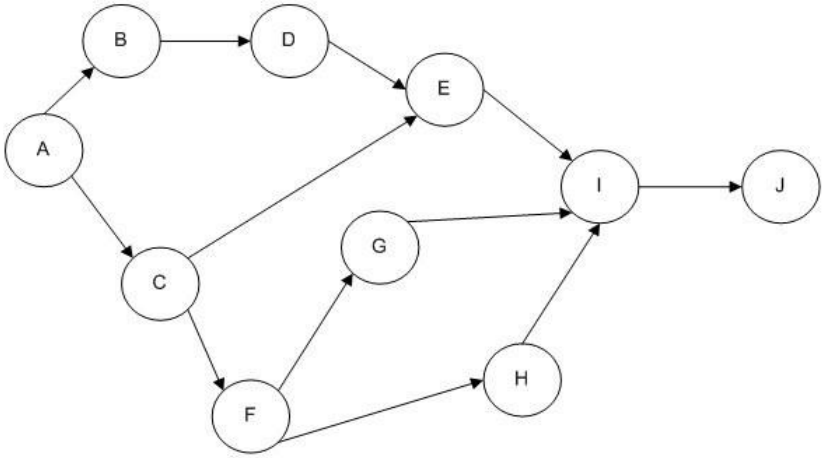


Activity	Earliest	Earliest	Latest	Latest	Slack

	F	13	19	15	21	2
A	G	13	21	13	21	0
I	H	21	30	21	30	0
C	3	9	9	15	6	
D	4	11	11	18	0	
E	4	10	7	13	3	

Critical path is B-D-G-H-J and project completion time is 30 weeks.

152)



a. $t_e = \frac{a + 4(m) + b}{6}$ = 9 weeks

b. $\sigma^2 = \left[\frac{(b-a)}{6}\right]^2 = \left[\frac{(20-2)}{6}\right]^2 = 9.00$

c. A□C□F□H□I□J

d. 40 Weeks

e. 1 + 1.78 + .11 + .44 + 1.78 + .11 = 5.22

f. $z = \frac{T - T_e}{\sqrt{\sigma^2}} = \frac{42 - 40}{\sqrt{5.22}}$ = .875 ; therefore, the probability from the standard normal table is approximately .81. Note that the variability of some non-critical path activities is large. Consideration might be given to those paths.

Activity	a	m	b	Expected Time	Variance
A	4	7	10	7	1
B	2	8	20	9	9
C	8	12	16	12	1.78
D	1	2	3	2	0.11
E	6	8	22	10	7.11
F	2	3	4	3	0.11
G	2	2	2	2	0
H	6	8	10	8	0.44
I	4	8	12	8	1.78
J	1	2	3	2	0.11

153) a. Activity lengths for A-K can be found by subtracting the early start of each activity from the late start of each activity.
The activity lengths appear in this table:

Activity	Length	LS	LF	Crash Cost/week
A	5	0	5	$1,100
B	4	13	17	$250
C	6	5	11	$1,200
D	6	1	7	$350
E	4	7	11	$900
F	5	17	22	$875
G	6	16	22	$1,500
H	7	11	18	$500
I	8	18	26	$300
J	4	22	26	$625
K	8	26	34	$750

b. The critical path is ACHJK = 34 weeks. Other paths are DEHIK = 33; ACGJK = 29; DEGJK = 28; and ABHJK = 26. With a fixed cost of $1,000/week, the initial cost is 34 weeks @ $1,000 = $34,000.
The cheapest critical-path activity is I @ $300, so reducing I from 8 weeks to 7 weeks costs $300 but saves $1,000, resulting in a net savings of $700.
The next cheapest critical-path activity is H @ $500, so reducing H from 7 weeks to 6 weeks costs $500 but saves $1,000, for a net savings of $500.
The next cheapest critical-path activity is K @ $750, so reducing K from 8 weeks to 7 weeks costs $750 but saves $1,000, for a net savings of $250.
The other two activities on the critical path are more expensive to crash than the penalty cost, so the cheapest completion time is 34 weeks - 3 weeks (I, H, K) = 31 weeks for a cost of $31,000 plus the crash costs of $300 + $500 + $750 = $32,550.

154) The original length of the project is A+B+C. When laddering is performed the first time, the project length becomes A1+B1+C1+C2; this is because A2 can be performed concurrently with B1 and B2 can be performed concurrently with C1. Alternatively, you can choose to focus on the completion of activity A and indicate that the new project length is A1+A2+B2+C2 (or even A1+B1+B2+C2).
If the activities are divided again, the project length will be A1+B1+C1+C2+C3+C4; because A2, A3, A4, B2, B3, and B4 can be performed concurrently with other activities.
In general, the project can be viewed as the length of C plus the waiting time while completing the length of subdivided activities A and B. As the number of iterations of laddering these activities becomes large, the length of sub-activity A1 and B1 becomes small, effectively reducing project length to the length of activity C.
Expressed mathematically where P is the project length:

Without laddering $P = A + B + C$

1st ladder $P = \frac{A}{2} + \frac{B}{2} + C$

2nd ladder $P = \frac{A}{4} + \frac{B}{4} + C$

Subsequent $P = \lim_{n \to \infty} \left(\frac{A}{2^n} + \frac{B}{2^n} + C \right) = C$

A Gantt chart showing two halvings of the activities is shown below. The three activities were 4 days long before laddering and are now are effectively twelve activities that are each one day in length.

	Activity Finish Time					
Activity	**1**	**2**	**3**	**4**	**5**	**6**
A1						
A2						
A3						
A4						
B1						
B2						
B3						
B4						
C1						
C2						
C3						
C4						

155) The completed table appears below:

Task	Predecessor	Length	Early Start	Late Start	Early Finish	Late Finish
A	--	12	0	0	12	12
B	A	20	12	22	32	42
C	A	16	12	12	28	28
D	B, E	11	42	42	53	53
E	C	14	28	28	42	42
F	E	8	42	69	50	77
G	D	17	53	53	70	70
H	G	11	70	70	81	81
I	G	9	70	72	79	81
J	F	4	50	77	54	81
K	H, I, J	10	81	81	91	91