# Chapter 06
# Developing a Project Plan

**Multiple Choice Questions**

1. Information to develop a project network is collected from the
A. Organization breakdown structure
B. Work breakdown structure
C. Budget
D. Project proposal
E. Responsibility matrix

2. Which of the following represents an activity on an AON project network?
A. An arrow
B. A line
C. A node
D. Both A and B are correct
E. A, B, and C are all correct

3. Arrows on an AON project network represent:
A. An activity
B. Project flow
C. Dependency
D. Both B and C are correct
E. Both A and B are correct

4. When translated into a project network, a work package will become
A. A single activity
B. One or more activities
C. A milestone
D. A critical path
E. An arrow

5. Which of the following is provided by a project network but not by the work breakdown structure?
A. Dependencies
B. Sequencing
C. Interrelationships
D. Both A and B are correct
E. A, B, and C are all correct

6. On a project network, the activity times are derived from the
A. Organization breakdown structure
B. Work packages
C. Budget
D. Project proposal
E. Responsibility matrix

7. Part of a project is to *Develop Product Specifications*. This is best classified as a(n)
A. Event
B. Path
C. Activity
D. Node
E. Milestone

8. An activity that has more than one dependency arrow flowing into it is termed a(n)
A. Parallel activity
B. Critical path
C. Burst activity
D. Merge activity
E. Independent activity

9. The critical path in a project network is the
A. Shortest path through the network
B. Longest path through the network
C. Network path with the most difficult activities
D. Network path using the most resources
E. Network path with the most merge activities

10. A/an _____ activity has more than one dependency arrow flowing from it.
A. Parallel
B. Critical path
C. Burst
D. Merge
E. Independent

11. An item on a project network is *Design Software Completed*. This is best described as a(n)
A. Event
B. Path
C. Activity
D. Node
E. Milestone

12. Activities which can take place at the same time are termed
A. Parallel activity
B. Critical path
C. Burst activity
D. Merge activity
E. Independent activity

13. A sequence of connected, dependent activities is termed a(n)
A. Critical path
B. Parallel path
C. Activity chain
D. Path
E. Dependent chain

14. An AON project network uses which of the following basic building blocks?
A. Arrows
B. Bars
C. Nodes
D. Both A and C are correct
E. A, B, and C are all correct

15. Which of the following is <u>not</u> one of the basic rules to follow when developing project networks?
A. An activity cannot begin until all preceding activities have been completed
B. Each activity must have a unique identification number
C. Conditional statements are allowed but looping statements are not allowed
D. An activity identification number must be larger that that of any preceding activities
E. Networks flow from left to right

16. _____ activities must be completed immediately before a particular activity.
A. Merge
B. Burst
C. Predecessor
D. Successor
E. Critical

17. _____ activities are to be completed immediately following a particular activity.
A. Merge
B. Burst
C. Predecessor
D. Successor
E. Critical

18. The forward pass in project network calculations determines the
A. Earliest time's activities can begin
B. Earliest time's activities can be finished
C. Duration of the project
D. Both A and B are correct
E. A, B, and C are all correct

19. The backward pass in project network calculations determines the
A. Latest time's activities can begin
B. Earliest time's activities can be finished
C. Critical path
D. Both A and C are correct
E. A, B, and C are all correct

20. Which of the following correctly calculates the early finish for an activity?
A. LS + DUR
B. ES + DUR
C. LF + DUR
D. ES + SL
E. LF + SL

21. Which of the following correctly calculates the late start for an activity?
A. EF - DUR
B. ES - DUR
C. LF - DUR
D. ES - SL
E. LF - SLACK

22. The amount of time an activity can be delayed and yet not delay the project is termed
A. Total slack
B. Free slack
C. Critical float
D. Float pad
E. Slip pad

23. Which of the following will correctly calculate the total slack in an activity?
A. LS - ES
B. LF - EF
C. LS - LF
D. LF - ES
E. Both A and B are correct

24. The laying pipe example in the text illustrates the concept of
A. Laddering
B. Hammock activities
C. Critical path
D. Concurrent engineering
E. Forward pass

25. Using a special color copy machine for a tradeshow publication illustrates the concept of
A. Laddering
B. Hammock activities
C. Critical path
D. Concurrent engineering
E. Forward pass

26. If, for some reason, the project must be expedited to meet an earlier date, which of the following actions would the project manager take first?
A. Check to see which activities cost the least
B. Check to see which activities have the longest duration
C. Check to see which activities are on the critical path
D. Check to see which activities have the most slack
E. Check to see which activities have the highest risk

27. Typically an activity on a project network represents
A. A single work package
B. One or more tasks from a work package
C. Several work packages
D. A sub-deliverable
E. A cost account

28. Project network logic errors include which of the following?
A. Activities with less than 1 day duration
B. Sequences such as "if test successful build prototype, if failure redesign"
C. A sequence such as B succeeds A, C succeeds B, A succeeds C
D. Both B and C are network logic errors
E. A, B, and C are all network logic errors

29. Which company utilized concurrent engineering to design a new line of cars and in the process completed its development six months ahead of schedule?
A. General Motors
B. Chrysler
C. Ford
D. Nissan
E. Toyota

30. The minimum amount of time a dependent activity must be delayed to begin or end is referred to as:
A. Hammock
B. Laddering
C. Lag
D. Cushion
E. Buffer

31. The requirement for a freshly poured foundation to cure before beginning construction is an example of which of the following type of lag?
A. Start to Start
B. Start to Finish
C. Finish to Finish
D. Finish to Start
E. Any of these could be correct

32. Concurrent engineering is a good example of good use of
A. Start to Start lags
B. Start to Finish lags
C. Finish to Finish lags
D. Finish to Start lags
E. Any of these could be correct

33. If testing cannot be completed any earlier than four days after the prototype is built, which of the following type of lag exists?
A. Start to Start
B. Start to Finish
C. Finish to Finish
D. Finish to Start
E. Any of these could be correct

34. Which of the following represents an activity on an AOA project network?
A. An arrow
B. A line
C. A node
D. Both A and B are correct
E. A, B, and C are all correct

35. Nodes on an AON project network represent:
A. An activity
B. An event
C. Responsibility
D. Both B and C are correct
E. Both A and B are correct

**Fill in the Blank Questions**

36. A(n) _____ is an element in the project that consumes time.
_____

37. The activity time estimates used to build a project network are derived from _____.
_____

38. A _____ is an activity that has more than one predecessor.
_____

39. In a _____ the delaying of any activity will delay the completion of the project by the same amount.
_____

40. Activities that can take place at the same time if the manager wishes them to are called _____.
_____

41. A (n) _____ represents a point in time when an activity is started or completed and does not consume time.
_____

42. A (n) _____ has more than one successor activity.
_____

43. The _____ approach to creating project networks has come to dominate most projects.
_____

44. In a project network, _____ (recycling through a set of activities) is not permitted.
_____

45. In a project network, _____ indicate precedence and flow.
_____

46. The _____ method for creating project networks is sometimes called the Precedence Diagram Method.
_____

47. Activities that must occur immediately before a given activity are called _____ activities.
_____

48. Activities that must immediately follow a given activity are called _____ activities.
_____

49. Activities that can occur while an activity is taking place are called _____ activities.
_____

50. The _____ calculates the earliest times that activities can be started or finished.
_____

51. The _____ calculates the critical path and determines how long an activity can be delayed without delaying the project.
_____

52. An activity is on the critical path if its _____ is the lowest in the network.
_____

53. _____ can never be negative and applies only to the last activity in a single chain of activities.
_____

54. A(n) _____ is the minimum amount of time a dependent activity must be delayed to begin or end.
_____

55. In the _____ technique, an activity with a long duration is broken into smaller segments so that the following activities can begin sooner.
_____

56. _____ is defined as the difference between the EF of an activity and the ES of the activity that follows it.

_____

57. _____ reflects the likelihood the original critical path(s) will change once the project is initiated.

_____

58. A _____ lag exists if debug cannot begin until two days after coding has started and that coding must be completed four days before debug can be completed.

_____

59. The _____ lag is the most typical type of lag that is encountered in developing networks.

_____

60. A _____ activity is frequently used to identify the use of fixed resources or costs over a segment of the project.

_____

**True / False Questions**

61. An activity includes only one work package.
True  False

62. Project networks are built using nodes and arrows.
True  False

63. The WBS identifies dependencies, the sequencing of activities, and the timing of activities.
True False

64. The critical path is the shortest path through a network and indicates activities that cannot be delayed without delaying the project.
True False

65. An activity is an element of the project that always requires time but may or may not require resources.
True False

66. The two approaches used to develop project networks are AOA and AON.
True False

67. In an AOA network an activity is represented by a box.
Refer to Appendix 6.1
True False

68. In developing a project network, each activity should have a unique identification number that is smaller than the identification numbers of activities that follow it.
True False

69. In developing a project network, neither looping statements nor conditional statements are permitted.
True False

70. Experience suggests that when there are multiple starts, a common start node should not be used to indicate a clear project beginning on the network. Similarly, a single project end node can be used to indicate a clear ending.
True False

71. Burst activities have more than one activity immediately following it (more than one dependency arrow flowing from it).
True False

72. It is acceptable for arrows to cross one another in a network diagram.
True False

73. The forward pass through a project network determines the critical path.
True False

74. The backward pass though a project network determines how long an activity can be delayed without impacting the completion date of the project.
True False

75. Different activities along the same path can have different total slack.
True False

76. By definition, the critical path always has zero slack.
True False

77. It is possible to have more than one critical path at the same time.
True False

78. Free slack applies to an entire project network.
True  False

79. Gantt charts are popular because they represent an easy-to-understand, clear picture on a time-scaled horizon.
Refer to Figure 6.12
True  False

80. Lags are used to break larger activities into smaller segments so that activities that follow can be started earlier.
True  False

81. Only activities that occur at the end of a chain of activities can have free slack.
True  False

82. Lags can be use to constrain the start and finish of an activity.
True  False

**Short Answer Questions**

83. Identify and discuss the two major reasons for the integration of work packages into the project network failing in actual practice.

84. What are the two approaches used to develop project networks and identify the differences between them?

85. What are the eight rules to follow in developing project networks?

86. In the network computation process what is a *forward pass* and what three things does it determine?

87. In the network computation process what is a *backward pass* and what four things does it determine?

88. What is total slack and how do you determine it?

89. What is a Gantt chart and what advantages does it have over project networks?

90. What is the laddering approach to project networks and why would you use this approach?

91. What is a lag and why would you need to use one?

92. What is a hammock activity and give an example?

93. What is the Concurrent Engineering Approach and why should project managers be aware of it?

94. Identify and briefly describe the four types of lags giving an example for each type.

# Chapter 06 Developing a Project Plan Answer Key

**Multiple Choice Questions**

1. Information to develop a project network is collected from the
A. Organization breakdown structure
**B.** Work breakdown structure
C. Budget
D. Project proposal
E. Responsibility matrix

The network is developed from the information collected for the WBS and is a graphic flow chart of the project job plan.

*AACSB: Reflective Thinking*
*Bloom's: Comprehension*
*Learning Objective: Developing the Project Network*
*Level: Easy*

2. Which of the following represents an activity on an AON project network?
A. An arrow
B. A line
**C.** A node
D. Both A and B are correct
E. A, B, and C are all correct

The two approaches used to develop project networks are known as activity-on-node (AON) and activity-on-arrow (AOA). Both methods use two building blocks— the arrow and the node. Their names derive from the fact that the former uses a node to depict an activity.

*AACSB: Reflective Thinking*
*Bloom's: Knowledge*
*Learning Objective: Constructing a Project Network*
*Level: Easy*

3. Arrows on an AON project network represent:
A. An activity
B. Project flow
C. Dependency
**D.** Both B and C are correct
E. Both A and B are correct

The node depicts an activity, and the arrow shows dependency and project flow.

*AACSB: Reflective Thinking*
*Bloom's: Knowledge*
*Learning Objective: From Work Package to Network*
*Level: Medium*

4. When translated into a project network, a work package will become
A. A single activity
**B.** One or more activities
C. A milestone
D. A critical path
E. An arrow

Work packages from the WBS are used to build the activities found in the project network. An activity can include one or more work packages. The activities are placed in a sequence that provides for orderly completion of the project.

*AACSB: Analytic*
*Bloom's: Comprehension*
*Learning Objective: From Work Package to Network*
*Level: Medium*

5. Which of the following is provided by a project network but not by the work breakdown structure?
A. Dependencies
B. Sequencing
C. Interrelationships
D. Both A and B are correct
**E.** A, B, and C are all correct

Project networks are developed from the WBS. The project network is a visual flow diagram of the sequence, interrelationships, and dependencies of all the activities that must be accomplished to complete the project.

*AACSB: Reflective Thinking*
*Bloom's: Knowledge*
*Learning Objective: From Work Package to Network*
*Level: Medium*

6. On a project network, the activity times are derived from the
A. Organization breakdown structure
**B.** Work packages
C. Budget
D. Project proposal
E. Responsibility matrix

Work packages from the WBS are used to build the activities found in the project network. An activity is an element in the project that consumes time—for example, work or waiting.

*AACSB: Analytic*
*Bloom's: Comprehension*
*Learning Objective: From Work Package to Network*
*Level: Difficult*

7. Part of a project is to *Develop Product Specifications*. This is best classified as a(n)
A. Event
B. Path
**C.** Activity
D. Node
E. Milestone

Activities usually represent one or more tasks from a work package. Descriptions of activities should use a verb/noun format: for example, develop product specifications.

*AACSB: Analytic*
*Bloom's: Knowledge*
*Learning Objective: Constructing a Project Network*
*Level: Medium*

8. An activity that has more than one dependency arrow flowing into it is termed a(n)
A. Parallel activity
B. Critical path
C. Burst activity
**D.** Merge activity
E. Independent activity

Merge activity is an activity that has more than one activity immediately preceding it (more than one dependency arrow flowing to it).

*AACSB: Reflective Thinking*
*Bloom's: Knowledge*
*Learning Objective: Constructing a Project Network*
*Level: Easy*

9. The critical path in a project network is the
A. Shortest path through the network
**B.** Longest path through the network
C. Network path with the most difficult activities
D. Network path using the most resources
E. Network path with the most merge activities

When this term is used, it means the path(s) with the longest duration through the network; if an activity on the path is delayed, the project is delayed the same amount of time.

*AACSB: Reflective Thinking*
*Bloom's: Comprehension*
*Learning Objective: Constructing a Project Network*
*Level: Medium*

10. A/an _____ activity has more than one dependency arrow flowing from it.
A. Parallel
B. Critical path
**C.** Burst
D. Merge
E. Independent

Burst activity is an activity has more than one activity immediately following it (more than one dependency arrow flowing from it).

*AACSB: Analytic*
*Bloom's: Comprehension*
*Learning Objective: Constructing a Project Network*
*Level: Easy*

11. An item on a project network is *Design Software Completed*. This is best described as a(n)
**A.** Event
B. Path
C. Activity
D. Node
E. Milestone

Event is a term used to represent a point in time when an activity is started or completed. It does not consume time.

*AACSB: Reflective Thinking*
*Bloom's: Knowledge*
*Learning Objective: Constructing a Project Network*
*Level: Easy*

12. Activities which can take place at the same time are termed
**A.** Parallel activity
B. Critical path
C. Burst activity
D. Merge activity
E. Independent activity

These are activities that can take place at the same time, if the manager wishes. However, the manager may choose to have parallel activities not occur simultaneously.

*AACSB: Analytic*
*Bloom's: Knowledge*
*Learning Objective: Constructing a Project Network*
*Level: Easy*

13. A sequence of connected, dependent activities is termed a(n)
A. Critical path
B. Parallel path
C. Activity chain
**D.** Path
E. Dependent chain

A Path is a sequence of connected, dependent activities.

*AACSB: Reflective Thinking*
*Bloom's: Knowledge*
*Learning Objective: Constructing a Project Network*
*Level: Easy*

14. An AON project network uses which of the following basic building blocks?
A. Arrows
B. Bars
C. Nodes
**D.** Both A and C are correct
E. A, B, and C are all correct

The two approaches used to develop project networks are known as activity-on-node (AON) and activity-on-arrow (AOA). Both methods use two building blocks— the arrow and the node.

*AACSB: Analytic*
*Bloom's: Knowledge*
*Learning Objective: Constructing a Project Network*
*Level: Easy*

15. Which of the following is not one of the basic rules to follow when developing project networks?
A. An activity cannot begin until all preceding activities have been completed
B. Each activity must have a unique identification number
**C.** Conditional statements are allowed but looping statements are not allowed
D. An activity identification number must be larger that that of any preceding activities
E. Networks flow from left to right

See List on Page 161.

*AACSB: Analytic*
*Bloom's: Comprehension*
*Learning Objective: Constructing a Project Network*
*Level: Medium*

16. _____ activities must be completed immediately before a particular activity.
A. Merge
B. Burst
**C.** Predecessor
D. Successor
E. Critical

Which activities must be completed immediately before this activity? These activities are called predecessor activities.

*AACSB: Reflective Thinking*
*Bloom's: Knowledge*
*Learning Objective: Activity-on-Node (AON) Fundamentals*
*Level: Easy*

17. _____ activities are to be completed immediately following a particular activity.
A. Merge
B. Burst
C. Predecessor
**D.** Successor
E. Critical

Which activities must immediately follow this activity? These activities are called successor activities.

*AACSB: Reflective Thinking*
*Bloom's: Knowledge*
*Learning Objective: Activity-on-Node (AON) Fundamentals*
*Level: Easy*

18. The forward pass in project network calculations determines the
A. Earliest time's activities can begin
B. Earliest time's activities can be finished
C. Duration of the project
D. Both A and B are correct
**E.** A, B, and C are all correct

The forward pass starts with the first project activity(ies) and traces each path (chain of sequential activities) through the network to the last project activity(ies).

*AACSB: Analytic*
*Bloom's: Comprehension*
*Learning Objective: Network Computation Process*
*Level: Medium*

19. The backward pass in project network calculations determines the
A. Latest time's activities can begin
B. Earliest time's activities can be finished
C. Critical path
**D.** Both A and C are correct
E. A, B, and C are all correct

See list on Page 165.

*AACSB: Analytic*
*Bloom's: Comprehension*
*Learning Objective: Network Computation Process*
*Level: Medium*

20. Which of the following correctly calculates the early finish for an activity?
A. LS + DUR
**B.** ES + DUR
C. LF + DUR
D. ES + SL
E. LF + SL

The early finish for activity = (ES + DUR).

*AACSB: Reflective Thinking*
*Bloom's: Comprehension*
*Learning Objective: Network Computation Process*
*Level: Medium*

21. Which of the following correctly calculates the late start for an activity?
A. EF - DUR
B. ES - DUR
**C.** LF - DUR
D. ES - SL
E. LF - SLACK

You subtract activity times along each path starting with the project end activity (LF - DUR = LS).

*AACSB: Reflective Thinking*
*Bloom's: Comprehension*
*Learning Objective: Network Computation Process*
*Level: Medium*

22. The amount of time an activity can be delayed and yet not delay the project is termed
**A.** Total slack
B. Free slack
C. Critical float
D. Float pad
E. Slip pad

Total slack tells us the amount of time an activity can be delayed and yet not delay the project. Stated differently, total slack is the amount of time an activity can exceed its early finish date without affecting the project end date or an imposed completion date.

*AACSB: Reflective Thinking*
*Bloom's: Comprehension*
*Learning Objective: Network Computation Process*
*Level: Easy*

23. Which of the following will correctly calculate the total slack in an activity?
A. LS - ES
B. LF - EF
C. LS - LF
D. LF - ES
**E.** Both A and B are correct

Total slack or float for an activity is simply the difference between the LS and ES (LS - ES = SL) or between LF and EF (LF - EF = SL).

*AACSB: Reflective Thinking*
*Bloom's: Comprehension*
*Learning Objective: Network Computation Process*
*Level: Easy*

24. The laying pipe example in the text illustrates the concept of
**A.** Laddering
B. Hammock activities
C. Critical path
D. Concurrent engineering
E. Forward pass

The assumption that all immediate preceding activities must be 100 percent complete is too restrictive for some situations found in practice. This restriction occurs most frequently when one activity overlaps the start of another and has a long duration. Under the standard finish-to-start relationship, when an activity has a long duration and will delay the start of an activity immediately following it, the activity can be broken into segments and the network drawn using a laddering approach so the following activity can begin sooner and not delay the work.

*AACSB: Analytic*
*Bloom's: Comprehension*
*Learning Objective: Extended Network Techniques to Come Closer to Reality*
*Level: Medium*

25. Using a special color copy machine for a tradeshow publication illustrates the concept of
A. Laddering
**B.** Hammock activities
C. Critical path
D. Concurrent engineering
E. Forward pass

Hammock activities are frequently used to identify the use of fixed resources or costs over a segment of the project. Typical examples of hammock activities are inspection services, consultants, or construction management services. A hammock activity derives its duration from the time span between other activities. For example, a special color copy machine is needed for a segment of a tradeshow publication project. A hammock activity can be used to indicate the need for this resource and to apply costs over this segment of the project.

*AACSB: Analytic*
*Bloom's: Comprehension*
*Learning Objective: Extended Network Techniques to Come Closer to Reality*
*Level: Medium*

26. If, for some reason, the project must be expedited to meet an earlier date, which of the following actions would the project manager take first?
A. Check to see which activities cost the least
B. Check to see which activities have the longest duration
**C.** Check to see which activities are on the critical path
D. Check to see which activities have the most slack
E. Check to see which activities have the highest risk

If for some reason the project must be expedited to meet an earlier date, it is possible to select those activities, or combination of activities, that will cost the least to shorten the project. Similarly, if the critical path is delayed and the time must be made up by shortening some activity or activities on the critical path to make up any negative slack, it is possible to identify the activities on the critical path that cost the least to shorten. If there are other paths with very little slack, it may be necessary to shorten activities on those paths also.

*AACSB: Reflective Thinking*
*Bloom's: Comprehension*
*Learning Objective: Using the Forward and Backward Pass Information*
*Level: Medium*

27. Typically an activity on a project network represents
A. A single work package
**B.** One or more tasks from a work package
C. Several work packages
D. A sub-deliverable
E. A cost account

Work packages from the WBS are used to build the activities found in the project network.

*AACSB: Reflective Thinking*
*Bloom's: Comprehension*
*Learning Objective: From Work Package to Network*
*Level: Medium*

28. Project network logic errors include which of the following?
A. Activities with less than 1 day duration
B. Sequences such as "if test successful build prototype, if failure redesign"
C. A sequence such as B succeeds A, C succeeds B, A succeeds C
**D.** Both B and C are network logic errors
E. A, B, and C are all network logic errors

One rule is that conditional statements such as "if test successful build proto, if failure redesign" are not permitted. Another rule that defeats the project network and computation process is looping. Looping is an attempt by the planner to return to an earlier activity.

*AACSB: Analytic*
*Bloom's: Comprehension*
*Learning Objective: Practical Considerations*
*Level: Medium*

29. Which company utilized concurrent engineering to design a new line of cars and in the process completed its development six months ahead of schedule?
A. General Motors
**B.** Chrysler
C. Ford
D. Nissan
E. Toyota

The traditional chainlike sequence of finish-to-start relationships is replaced by a series of start-to-start lag relationships as soon as meaningful work can be initiated for the next phase. Figure 6.17 summarizes the dramatic gains in time to market achieved by this approach. For example, this approach was used by Chrysler Corporation to design its new line of SC cars including the popular Neon sedan.

*AACSB: Reflective Thinking*
*Bloom's: Knowledge*
*Learning Objective: Extended Network Techniques to Come Closer to Reality*
*Level: Easy*

30. The minimum amount of time a dependent activity must be delayed to begin or end is referred to as:
A. Hammock
B. Laddering
**C.** Lag
D. Cushion
E. Buffer

A lag is the minimum amount of time a dependent activity must be delayed to begin or end.

*AACSB: Reflective Thinking*
*Bloom's: Knowledge*
*Learning Objective: Extended Network Techniques to Come Closer to Reality*
*Level: Easy*

31. The requirement for a freshly poured foundation to cure before beginning construction is an example of which of the following type of lag?
A. Start to Start
B. Start to Finish
C. Finish to Finish
**D.** Finish to Start
E. Any of these could be correct

There are situations in which the next activity in a sequence must be delayed even when the preceding activity is complete. For example, removing concrete forms cannot begin until the poured cement has cured for two time units.

*AACSB: Reflective Thinking*
*Bloom's: Knowledge*
*Learning Objective: Extended Network Techniques to Come Closer to Reality*
*Level: Easy*

32. Concurrent engineering is a good example of good use of
**A.** Start to Start lags
B. Start to Finish lags
C. Finish to Finish lags
D. Finish to Start lags
E. Any of these could be correct

Concurrent Engineering, basically breaks activities into smaller segments so that work can be done in parallel and the project expedited. Start-to-start relationships can depict the concurrent engineering conditions and reduce network detail.

*AACSB: Analytic*
*Bloom's: Knowledge*
*Learning Objective: Extended Network Techniques to Come Closer to Reality*
*Level: Easy*

33. If testing cannot be completed any earlier than four days after the prototype is built, which of the following type of lag exists?
A. Start to Start
B. Start to Finish
**C.** Finish to Finish
D. Finish to Start
E. Any of these could be correct

The finish of one activity depends on the finish of another activity. For example, testing cannot be completed any earlier than four days after the prototype is complete.

*AACSB: Analytic*
*Bloom's: Knowledge*
*Learning Objective: Extended Network Techniques to Come Closer to Reality*
*Level: Easy*

34. Which of the following represents an activity on an AOA project network?
**A.** An arrow
B. A line
C. A node
D. Both A and B are correct
E. A, B, and C are all correct

The activity-on-arrow (AOA) uses an arrow to depict an activity.

*AACSB: Reflective Thinking*
*Bloom's: Knowledge*
*Learning Objective: From Work Package to Network*
*Level: Easy*

35. Nodes on an AON project network represent:
**A.** An activity
B. An event
C. Responsibility
D. Both B and C are correct
E. Both A and B are correct

The activity-on- node (AON) uses a node to depict an activity.

*AACSB: Reflective Thinking*
*Bloom's: Comprehension*
*Learning Objective: From Work Package to Network*
*Level: Medium*

**Fill in the Blank Questions**

36. A(n) _____ is an element in the project that consumes time.
**activity**

An activity is an element of the project that requires time. It may or may not require resources.

*AACSB: Analytic*
*Bloom's: Knowledge*
*Learning Objective: Constructing a Project Network*
*Level: Easy*

37. The activity time estimates used to build a project network are derived from _____.
**work packages**

A work package is defined independently of other work packages, has definite start and finish points, requires specific resources, includes technical specifications, and has cost estimates for the package.

*AACSB: Analytic*
*Bloom's: Knowledge*
*Learning Objective: Developing the Project Network*
*Level: Easy*

38. A _____ is an activity that has more than one predecessor.
**merge activity**

Merge activity is an activity that has more than one activity immediately preceding it (more than one dependency arrow flowing to it).

*AACSB: Reflective Thinking*
*Bloom's: Knowledge*
*Learning Objective: Constructing a Project Network*
*Level: Easy*

39. In a _____ the delaying of any activity will delay the completion of the project by the same amount.
**critical path**

Critical path means the path(s) with the longest duration through the network; if an activity on the path is delayed, the project is delayed the same amount of time.

*AACSB: Reflective Thinking*
*Bloom's: Knowledge*
*Learning Objective: Constructing a Project Network*
*Level: Easy*

40. Activities that can take place at the same time if the manager wishes them to are called _____.
**parallel activities**

Parallel activities are activities that can take place at the same time, if the manager wishes. However, the manager may choose to have parallel activities not occur simultaneously.

*AACSB: Reflective Thinking*
*Bloom's: Knowledge*
*Learning Objective: Constructing a Project Network*
*Level: Easy*

41. A (n) _____ represents a point in time when an activity is started or completed and does not consume time.
**event**

Event is used to represent a point in time when an activity is started or completed. It does not consume time.

*AACSB: Reflective Thinking*
*Bloom's: Knowledge*
*Learning Objective: Constructing a Project Network*
*Level: Easy*

42. A (n) _____ has more than one successor activity.
**burst activity**

Burst activity has more than one activity immediately following it (more than one dependency arrow flowing from it).

*AACSB: Analytic*
*Bloom's: Comprehension*
*Learning Objective: Constructing a Project Network*
*Level: Medium*

43. The _____ approach to creating project networks has come to dominate most projects.
**AON or activity-on-node**

In practice, the activity-on-node (AON) method has come to dominate most projects.

*AACSB: Analytic*
*Bloom's: Comprehension*
*Learning Objective: Constructing a Project Network*
*Level: Medium*

44. In a project network, _____ (recycling through a set of activities) is not permitted.
**looping**

Looping is not allowed (in other words, recycling through a set of activities cannot take place).

*AACSB: Analytic*
*Bloom's: Comprehension*
*Learning Objective: Constructing a Project Network*
*Level: Easy*

45. In a project network, _____ indicate precedence and flow.
**arrows**

The wide availability of personal computers and graphics programs has served as an impetus for use of the activity-on-node (AON) method (sometimes called the precedence diagram method). The dependencies among activities are depicted by arrows between the rectangles (boxes) on the AON network. The arrows indicate how the activities are related and the sequence in which things must be accomplished.

*AACSB: Reflective Thinking*
*Bloom's: Knowledge*
*Learning Objective: Activity-on-Node (AON) Fundamentals*
*Level: Easy*

46. The _____ method for creating project networks is sometimes called the Precedence Diagram Method.
**AON or activity-on-node**

The wide availability of personal computers and graphics programs has served as an impetus for use of the activity-on-node (AON) method (sometimes called the precedence diagram method).

*AACSB: Reflective Thinking*
*Bloom's: Knowledge*
*Learning Objective: Activity-on-Node (AON) Fundamentals*
*Level: Easy*

47. Activities that must occur immediately before a given activity are called _____ activities.
**predecessor**

Activities that must be completed immediately before an activity are called predecessor activities.

*AACSB: Reflective Thinking*
*Bloom's: Knowledge*
*Learning Objective: Activity-on-Node (AON) Fundamentals*
*Level: Easy*

48. Activities that must immediately follow a given activity are called _____ activities.
**successor**

Activities that must immediately follow an activity are called successor activities.

*AACSB: Reflective Thinking*
*Bloom's: Knowledge*
*Learning Objective: Activity-on-Node (AON) Fundamentals*
*Level: Easy*

49. Activities that can occur while an activity is taking place are called _____ activities.
**parallel or concurrent**

Activities that can occur while an activity is taking place is known as a concurrent or parallel relationship.

*AACSB: Reflective Thinking*
*Bloom's: Knowledge*
*Learning Objective: Activity-on-Node (AON) Fundamentals*
*Level: Easy*

50. The _____ calculates the earliest times that activities can be started or finished.
**forward pass**

Forward Pass describes how soon can the activity start? (early start—ES) and how soon can the activity finish? (early finish—EF).

*AACSB: Reflective Thinking*
*Bloom's: Comprehension*
*Learning Objective: Network Computation Process*
*Level: Medium*

51. The _____ calculates the critical path and determines how long an activity can be delayed without delaying the project.
**backward pass**

The backwards pass which activities represent the critical path (CP). This is the longest path in the network which, when delayed, will delay the project and how long can the activity be delayed? (slack or float—SL).

*AACSB: Reflective Thinking*
*Bloom's: Comprehension*
*Learning Objective: Network Computation Process*
*Level: Medium*

52. An activity is on the critical path if its _____ is the lowest in the network.
**total slack**

Total slack tells us the amount of time an activity can be delayed and yet not delay the project. Stated differently, total slack is the amount of time an activity can exceed its early finish date without affecting the project end date or an imposed completion date.

*AACSB: Reflective Thinking*
*Bloom's: Comprehension*
*Learning Objective: Network Computation Process*
*Level: Medium*

53. _____ can never be negative and applies only to the last activity in a single chain of activities.
**Free slack**

Free slack is the amount of time and activity can be delayed without delaying any immediately following (successor) activity. Or, free slack is the amount of time an activity can exceed its early finish date without affecting the early start date of any successor(s). Free slack can never be negative.

*AACSB: Reflective Thinking*
*Bloom's: Comprehension*
*Learning Objective: Network Computation Process*
*Level: Medium*

54. A(n) _____ is the minimum amount of time a dependent activity must be delayed to begin or end.
**lag**

A lag is the minimum amount of time a dependent activity must be delayed to begin or end.

*AACSB: Reflective Thinking*
*Bloom's: Knowledge*
*Learning Objective: Extended Network Techniques to Come Closer to Reality*
*Level: Easy*

55. In the _____ technique, an activity with a long duration is broken into smaller segments so that the following activities can begin sooner.
**laddering**

The assumption that all immediate preceding activities must be 100 percent complete is too restrictive for some situations found in practice. This restriction occurs most frequently when one activity overlaps the start of another and has a long duration. Under the standard finish-to-start relationship, when an activity has a long duration and will delay the start of an activity immediately following it, the activity can be broken into segments and the network drawn using a laddering approach so the following activity can begin sooner and not delay the work.

*AACSB: Reflective Thinking*
*Bloom's: Comprehension*
*Learning Objective: Extended Network Techniques to Come Closer to Reality*
*Level: Medium*

56. _____ is defined as the difference between the EF of an activity and the ES of the activity that follows it.
**Free Slack (Float)**

See Figure 6.9 on Page 172.

*AACSB: Analytic*
*Bloom's: Comprehension*
*Learning Objective: Factors Influencing the Quality of Estimates*
*Level: Medium*

57. _____ reflects the likelihood the original critical path(s) will change once the project is initiated.
**Sensitivity**

Sensitivity reflects the likelihood the original critical path(s) will change once the project is initiated. Sensitivity is a function of the number of critical or near-critical paths.

*AACSB: Reflective Thinking*
*Bloom's: Comprehension*
*Learning Objective: Network Computation Process*
*Level: Medium*

58. A _____ lag exists if debug cannot begin until two days after coding has started and that coding must be completed four days before debug can be completed.
**combination**

More than one lag relationship can be attached to an activity. These relationships are usually start-to-start and finish-to-finish combinations tied to two activities. For example, debug cannot begin until two time units after coding has started. Coding must be finished four days before debug can be finished (see Figure 6.20 on page 181).

*AACSB: Reflective Thinking*
*Bloom's: Comprehension*
*Learning Objective: Extended Network Techniques to Come Closer to Reality*
*Level: Medium*

59. The _____ lag is the most typical type of lag that is encountered in developing networks.
**finish to start**

The finish-to-start relationship represents the typical, generic network However, there are situations in which the next activity in a sequence must be delayed even when the preceding activity is complete.

*AACSB: Reflective Thinking*
*Bloom's: Knowledge*
*Learning Objective: Extended Network Techniques to Come Closer to Reality*
*Level: Easy*

60. A _____ activity is frequently used to identify the use of fixed resources or costs over a segment of the project.
**hammock**

Hammock activities are frequently used to identify the use of fixed resources or costs over a segment of the project. Typical examples of hammock activities are inspection services, consultants, or construction management services. A hammock activity derives its duration from the time span between other activities. For example, a special color copy machine is needed for a segment of a tradeshow publication project. A hammock activity can be used to indicate the need for this resource and to apply costs over this segment of the project.

*AACSB: Reflective Thinking*
*Bloom's: Knowledge*
*Learning Objective: Extended Network Techniques to Come Closer to Reality*
*Level: Easy*

**True / False Questions**

61. An activity includes only one work package.
**FALSE**

Activities usually represent one or more tasks from a work package.

*AACSB: Reflective Thinking*
*Bloom's: Knowledge*
*Learning Objective: Constructing a Project Network*
*Level: Easy*

62. Project networks are built using nodes and arrows.
**TRUE**

The two approaches used to develop project networks are known as activity-on-node (AON) and activity-on-arrow (AOA). Both methods use two building blocks—the arrow and the node.

*AACSB: Reflective Thinking*
*Bloom's: Knowledge*
*Learning Objective: Constructing a Project Network*
*Level: Easy*

63. The WBS identifies dependencies, the sequencing of activities, and the timing of activities.
**FALSE**

Networks provide the project schedule by identifying dependencies, sequencing, and timing of activities, which the WBS is not designed to do.

*AACSB: Reflective Thinking*
*Bloom's: Comprehension*
*Learning Objective: From Work Package to Network*
*Level: Medium*

64. The critical path is the shortest path through a network and indicates activities that cannot be delayed without delaying the project.
**FALSE**

Critical path means the path(s) with the longest duration through the network; if an activity on the path is delayed, the project is delayed the same amount of time.

*AACSB: Reflective Thinking*
*Bloom's: Comprehension*
*Learning Objective: Constructing a Project Network*
*Level: Medium*

65. An activity is an element of the project that always requires time but may or may not require resources.
**TRUE**

An activity is an element of the project that requires time. It may or may not require resources.

*AACSB: Reflective Thinking*
*Bloom's: Comprehension*
*Learning Objective: Constructing a Project Network*
*Level: Medium*

66. The two approaches used to develop project networks are AOA and AON.
**TRUE**

The two approaches used to develop project networks are known as activity-on-node (AON) and activity-on-arrow (AOA).

*AACSB: Reflective Thinking*
*Bloom's: Knowledge*
*Learning Objective: Constructing a Project Network*
*Level: Easy*

67. In an AOA network an activity is represented by a box.
Refer to Appendix 6.1
**FALSE**

The activity-on-arrow (AOA) approach also uses the arrow and node as network building blocks. However, in this approach the arrow represents an individual project activity that requires time. The length and slope of the arrow have no significance. The node represents an event; it is usually presented as a small circle.

*AACSB: Reflective Thinking*
*Bloom's: Comprehension*
*Learning Objective: Constructing a Project Network*
*Level: Medium*

68. In developing a project network, each activity should have a unique identification number that is smaller than the identification numbers of activities that follow it.
**TRUE**

Each activity should have a unique identification number. And that activity identification number must be larger than that of any activities that precede it.

*AACSB: Reflective Thinking*
*Bloom's: Comprehension*
*Learning Objective: Constructing a Project Network*
*Level: Medium*

69. In developing a project network, neither looping statements nor conditional statements are permitted.
**TRUE**

Looping is not allowed (in other words, recycling through a set of activities cannot take place). Also Conditional statements are not allowed (that is, this type of statement should not appear: If successful, do something; if not, do nothing).

*AACSB: Reflective Thinking*
*Bloom's: Comprehension*
*Learning Objective: Constructing a Project Network*
*Level: Medium*

70. Experience suggests that when there are multiple starts, a common start node should not be used to indicate a clear project beginning on the network. Similarly, a single project end node can be used to indicate a clear ending.
**FALSE**

Experience suggests that when there are multiple starts, a common start node can be used to indicate a clear project beginning on the network. Similarly, a single project end node can be used to indicate a clear ending.

*AACSB: Reflective Thinking*
*Bloom's: Comprehension*
*Learning Objective: Constructing a Project Network*
*Level: Medium*

71. Burst activities have more than one activity immediately following it (more than one dependency arrow flowing from it).
**TRUE**

Burst activities have more than one activity immediately following it (more than one dependency arrow flowing from it).

*AACSB: Reflective Thinking*
*Bloom's: Comprehension*
*Learning Objective: Factors Influencing the Quality of Estimates*
*Level: Easy*

72. It is acceptable for arrows to cross one another in a network diagram.
**TRUE**

Arrows on networks indicate precedence and flow. Arrows can cross over each other.

*AACSB: Reflective Thinking*
*Bloom's: Comprehension*
*Learning Objective: Constructing a Project Network*
*Level: Easy*

73. The forward pass through a project network determines the critical path.
**FALSE**

The forward pass starts with the first project activity(ies) and traces each path (chain of sequential activities) through the network to the last project activity(ies). The forward pass assumes every activity will start the instant in time when the last of its predecessors is finished.

*AACSB: Reflective Thinking*
*Bloom's: Comprehension*
*Learning Objective: Network Computation Process*
*Level: Medium*

74. The backward pass though a project network determines how long an activity can be delayed without impacting the completion date of the project.
**TRUE**

The backwards pass which activities represent the critical path (CP). This is the longest path in the network which, when delayed, will delay the project and how long can the activity be delayed (slack or float—SL).

*AACSB: Reflective Thinking*
*Bloom's: Comprehension*
*Learning Objective: Network Computation Process*
*Level: Medium*

75. Different activities along the same path can have different total slack.
**TRUE**

If slack of one activity in a path is used, the ES for all activities that follow in the chain will be delayed and their slack reduced. Use of total slack must be coordinated with all participants in the activities that follow in the chain.

*AACSB: Reflective Thinking*
*Bloom's: Knowledge*
*Learning Objective: Network Computation Process*
*Level: Medium*

76. By definition, the critical path always has zero slack.
**FALSE**

The critical path follows activity start and finish constraints that occur due to the use of the additional relationships available and the imposed lags.

*AACSB: Reflective Thinking*
*Bloom's: Comprehension*
*Learning Objective: Extended Network Techniques to Come Closer to Reality*
*Level: Medium*

77. It is possible to have more than one critical path at the same time.
**TRUE**

Critical path means the path(s) with the longest duration through the network; if an activity on the path is delayed, the project is delayed the same amount of time.

*AACSB: Reflective Thinking*
*Bloom's: Comprehension*
*Learning Objective: Constructing a Project Network*
*Level: Medium*

78. Free slack applies to an entire project network.
**FALSE**

Free slack is the amount of time and activity can be delayed without delaying any immediately following (successor) activity. Or, free slack is the amount of time an activity can exceed its early finish date without affecting the early start date of any successor(s).

*AACSB: Reflective Thinking*
*Bloom's: Knowledge*
*Learning Objective: Network Computation Process*
*Level: Medium*

79. Gantt charts are popular because they represent an easy-to-understand, clear picture on a time-scaled horizon.
Refer to Figure 6.12
**TRUE**

See Figure 6.12 on Page 176.

*AACSB: Reflective Thinking*
*Bloom's: Knowledge*
*Learning Objective: Practical Considerations*
*Level: Easy*

80. Lags are used to break larger activities into smaller segments so that activities that follow can be started earlier.
**FALSE**

When activities of long duration delay the start or finish of successor activities, the network designer normally breaks the activity into smaller activities to avoid the long delay of the successor activity. Use of lags can avoid such delays and reduce network detail.

*AACSB: Reflective Thinking*
*Bloom's: Comprehension*
*Learning Objective: Extended Network Techniques to Come Closer to Reality*
*Level: Medium*

81. Only activities that occur at the end of a chain of activities can have free slack.
**TRUE**

Free slack occurs at the last activity in a chain of activities. In many situations the "chain" can have only one link.

*AACSB: Reflective Thinking*
*Bloom's: Knowledge*
*Learning Objective: Network Computation Process*
*Level: Medium*

82. Lags can be use to constrain the start and finish of an activity.
**TRUE**

Lags can be used to constrain the start and finish of an activity.

*AACSB: Reflective Thinking*
*Bloom's: Comprehension*
*Learning Objective: Extended Network Techniques to Come Closer to Reality*
*Level: Medium*

**Short Answer Questions**

83. Identify and discuss the two major reasons for the integration of work packages into the project network failing in actual practice.

1. different people are used to define work packages and the network, and 2. the WBS is poorly constructed and not deliverable/output oriented.

*AACSB: Analytic*
*Bloom's: Comprehension*
*Learning Objective: Developing the Project Network*
*Level: Medium*

84. What are the two approaches used to develop project networks and identify the differences between them?

1. activity-on-node; where nodes depict activities and the arrows show flow and dependencies and 2. activity-on-arrow; where nodes represent events and achievement of the activities is represented by the arrow connecting the nodes.

*AACSB: Analytic*
*Bloom's: Comprehension*
*Learning Objective: Constructing a Project Network*
*Level: Medium*

85. What are the eight rules to follow in developing project networks?

1. flow left to right, 2. activities cannot begin until all predecessors have been completed, 3. arrows indicate precedence and flow, 4. each activity should have a unique identification number, 5. activity ID numbers must be larger than preceding ID number, 6. looping is not permitted, 7. conditional statements are not permitted, and 8. create a common start node for multiple start activities.

*AACSB: Analytic*
*Bloom's: Synthesis*
*Learning Objective: Constructing a Project Network*
*Level: Difficult*

86. In the network computation process what is a *forward pass* and what three things does it determine?

Starting with the first activity, each path is traced forward through the network, adding times until the end of the project. This determines 1. how soon each activity can start, 2. how soon each activity can finish, and 3. how soon the entire project can be completed.

*AACSB: Analytic*
*Bloom's: Synthesis*
*Learning Objective: Network Computation Process*
*Level: Difficult*

87. In the network computation process what is a *backward pass* and what four things does it determine?

Starting with the last activity, each path is traced backward through the network, subtracting times until the beginning of the project. This determines 1. how late each activity can start, 2. how late each activity can finish, 3. the critical path, and 4. how long can each activity be delayed without changing the completion date.

*AACSB: Analytic*
*Bloom's: Synthesis*
*Learning Objective: Network Computation Process*
*Level: Difficult*

88. What is total slack and how do you determine it?

Slack is the amount of time specific activities can be delayed without causing the project to miss its completion date. It is calculated by subtracting the Early Start date from the Late Start date (SL = LS-ES) or subtracting the Early Finish date from the Late Finish date (SL = LF-EF).

*AACSB: Analytic*
*Bloom's: Comprehension*
*Learning Objective: Network Computation Process*
*Level: Medium*

89. What is a Gantt chart and what advantages does it have over project networks?

Gantt charts are bar charts where activities are displayed as bars on a horizontal time-scale. They are easy-to-read and provide a clear overview of the project schedule and progress against that schedule.

*AACSB: Analytic*
*Bloom's: Comprehension*
*Learning Objective: Practical Considerations*
*Level: Medium*

90. What is the laddering approach to project networks and why would you use this approach?

In laddering, lengthy activities are segmented into small pieces so that successor activities can begin prior to the completion of the initial activity. This effectively reduces the overall project time. The text used a laying pipeline example to illustrate.

*AACSB: Analytic*
*Bloom's: Comprehension*
*Learning Objective: Extended Network Techniques to Come Closer to Reality*
*Level: Medium*

91. What is a lag and why would you need to use one?

A lag is the minimum amount of time a dependent activity must be delayed to begin or end. They occur during laddering and avoid delays and they are also used to constraint the start and finish of an activity.

*AACSB: Analytic*
*Bloom's: Comprehension*
*Learning Objective: Extended Network Techniques to Come Closer to Reality*
*Level: Medium*

92. What is a hammock activity and give an example?

A hammock activity identifies the use of a resource over a segment of the project. Thus its duration is determined by the duration of other activities. The example used in the text was for a color copier during specific phases of a project.

*AACSB: Analytic*
*Bloom's: Comprehension*
*Learning Objective: Extended Network Techniques to Come Closer to Reality*
*Level: Medium*

93. What is the Concurrent Engineering Approach and why should project managers be aware of it?

The chainlike sequence of finish-to-start relationships is replaced by a series of start-to-start lag relationships as soon as meaningful work can be initiated for the next phase. The resulting overlap of tasks slightly increases risk but results in a much shorter schedule.

*AACSB: Analytic*
*Bloom's: Synthesis*
*Learning Objective: Extended Network Techniques to Come Closer to Reality*
*Level: Difficult*

94. Identify and briefly describe the four types of lags giving an example for each type.

1. Finish-to-Start, 2. Start-to-Start, 3. Finish-to-Finish, 4. Start-to-Finish.

*AACSB: Analytic*
*Bloom's: Synthesis*
*Learning Objective: Extended Network Techniques to Come Closer to Reality*
*Level: Difficult*