Operations Management

Course:
Introductory to Operations Management
MGT 300

Instructor:
Steven Yourstone

University of New Mexico
Business

McGraw-Hill/Irwin
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McGraw-Hill Primis Online

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CHAPTER 3
PROJECT MANAGEMENT

Review and Discussion Questions

1. What was the strangest project that you have been involved in? Give examples of the following as they pertain to the project: the work breakdown structure, tasks, subtasks, and work package. Were you on the critical path? Did it have a good project manager?

Obviously, the answer will vary. Remember that the project could be in a non-profit environment as well. School plays, fund-raisers, and social events could all be examples of projects.

2. What are some reasons project scheduling is not done well?

Several problems with project scheduling are discussed at the end of the chapter. The uncertainties inherent in the activities comprising the network of any project make it necessary to update the schedule on a regular basis. Maintaining accurate time and cost estimates is often difficult and frustrating. Managing this evolving process requires a discipline that is not always available.

3. Discuss the graphic presentations in Exhibit 3.3. Are there any other graphic outputs you would like to see if you were project manager?

The various graphs and charts presented are typical of the graphical techniques for presenting the necessary data. Most are adaptable to computer programming. The major requirements in the graphics package include planned activities related to time, a milestone chart to show major achievements, a breakdown to show how funds were spent plus a plot of actual completion versus planned.

4. Which characteristics must a project have for critical path scheduling to be applicable? What types of projects have been subjected to critical path analysis?

Project characteristics necessary for critical path scheduling to be applicable are:

a. Well-defined jobs whose completion marks the end of the project.

b. The jobs of tasks are independent in that they may be started, stopped, and conducted separately within a given sequence.

c. The jobs or tasks are ordered in that they must follow each other in a given sequence.

d. An activity once started is allowed to continue without interruption until it is completed.

A wide variety of projects have used critical path analysis. Some industries that more commonly use this approach include aerospace, construction, and computer software.

5. What are the underlying assumptions of minimum-cost scheduling? Are they equally realistic?

The underlying assumptions of minimum cost scheduling are that it costs money to expedite a project activity and it costs money to sustain or lengthen the completion time of the project.

While both assumptions are generally realistic, it often happens that there are little or no out-of-pocket costs associated with sustaining a project. Personnel are often shifted between projects, and in the short run there may be no incentive to compete a project in "normal time."

6. "Project control should always focus on the critical path." Comment.

In many project situations, it is not the activities on the critical path which cause problems, but rather noncritical activities, which, for various reasons, become critical. In the context of PERT, it may turn out that the activities on the critical path have small variances associated with them and can be treated as near certain. At the same time, activities off the critical path may have extremely large variances and, in fact, if not closely monitored, may delay the project. Thus, while project control must keep track of critical path activities, it may be more useful to focus on those activities which are not on the critical path but, for one reason or another, have a high degree of uncertainty associated with them.

Along these lines, some authors have suggested that the critical path approach should be replaced by a critical activity approach in which simulation is used to estimate which activities are likely to become sources of project delay. These activities, rather than critical path, would become the focus of managerial control.

Additionally, the critical path focuses on the time or schedule aspects of the projects. Certain activities could be "critical" because of cost or quality considerations.

7. Why would subcontractors for a government project want their activities on the critical path? Under what conditions would they try to avoid being on the critical path?

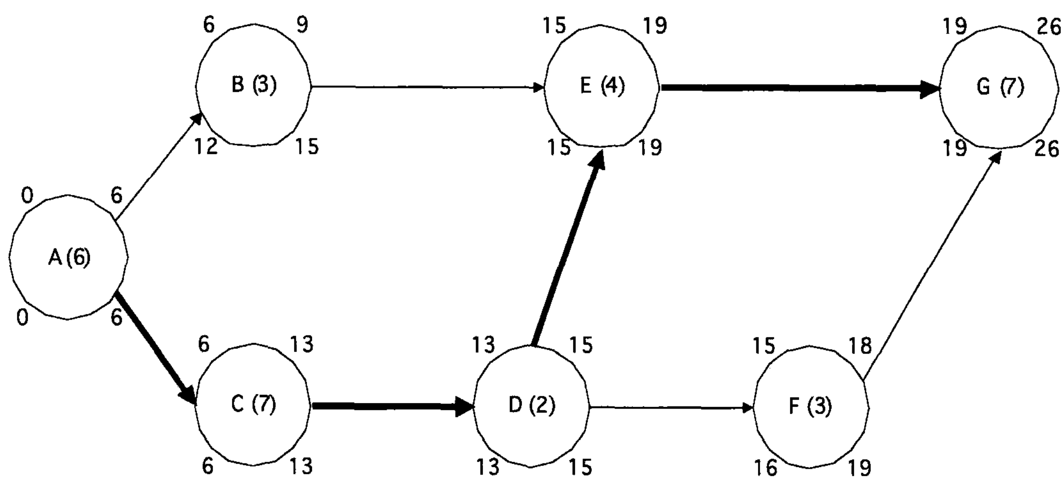
A subcontractor might want his activities on the critical path in situations where cost incentives are provided for early project completion. Since the critical path ultimately determines project length, it stands to reason that activities on the path would be the ones that would draw additional funds to expedite completion. A subcontractor might want his activities off the critical path because of some error on his part or because he doesn't want to be bothered by the close monitoring of progress which often goes with critical path activities.

Problems

Problem	Type of Problem			Difficulty	New Problem	Modified Problem	Check Figure in Appendix A
	CPM	PERT	Time/Cost				
1	Yes			Easy			
2	Yes			Easy			
3	Yes			Moderate			Yes
4	Yes			Moderate			
5		Yes		Moderate			
6	Yes			Moderate			Yes
7		Yes		Moderate			
8			Yes	Difficult			Yes
9	Yes			Moderate			
10			Yes	Difficult			
11			Yes	Difficult			
12		Yes		Moderate	Yes		
13		Yes		Moderate	Yes		
14			Yes	Moderate	Yes		
15			Yes	Difficult			

1.

a.



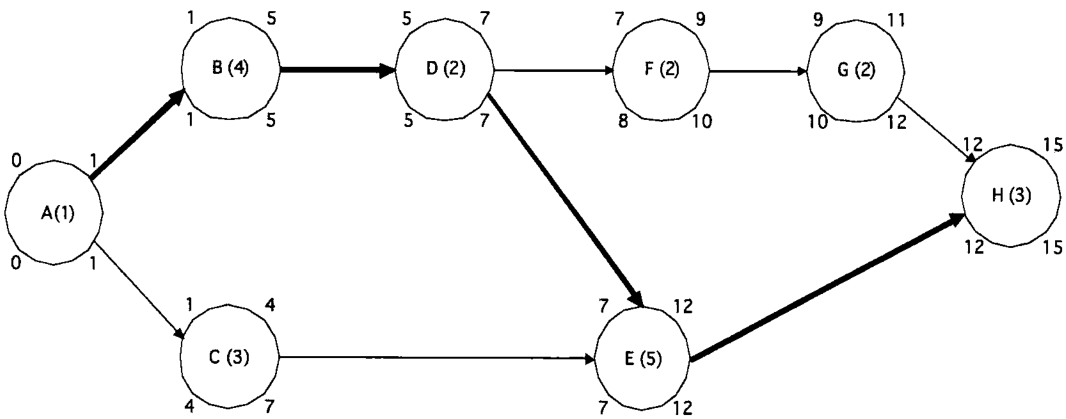
b. A-C-D-E-G, also shown in the network above as the bold path.

c. 26 weeks, 6+7+2+4+7.

d. 6 weeks, 15-9.

2.

a.



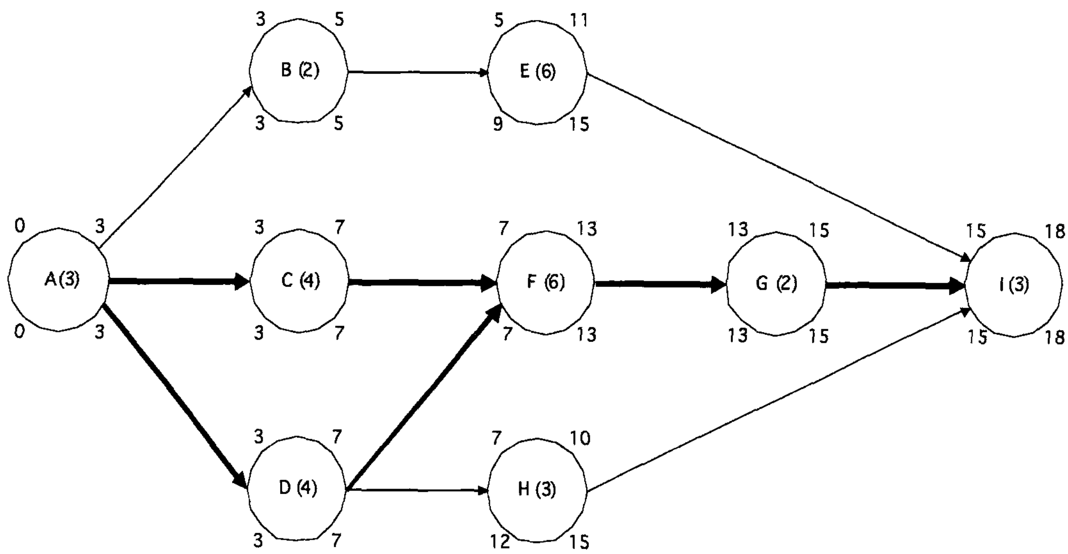
b. A-B-D-E-H, also shown in the network above as the bold path.

c. 15 weeks, 1+4+2+5+3.

d. C, 3 weeks; F, 1 week; and G, 1 week.

3.

a.



Note that G has both D and F as immediate predecessors. However, D is redundant because F has D as an immediate predecessor.

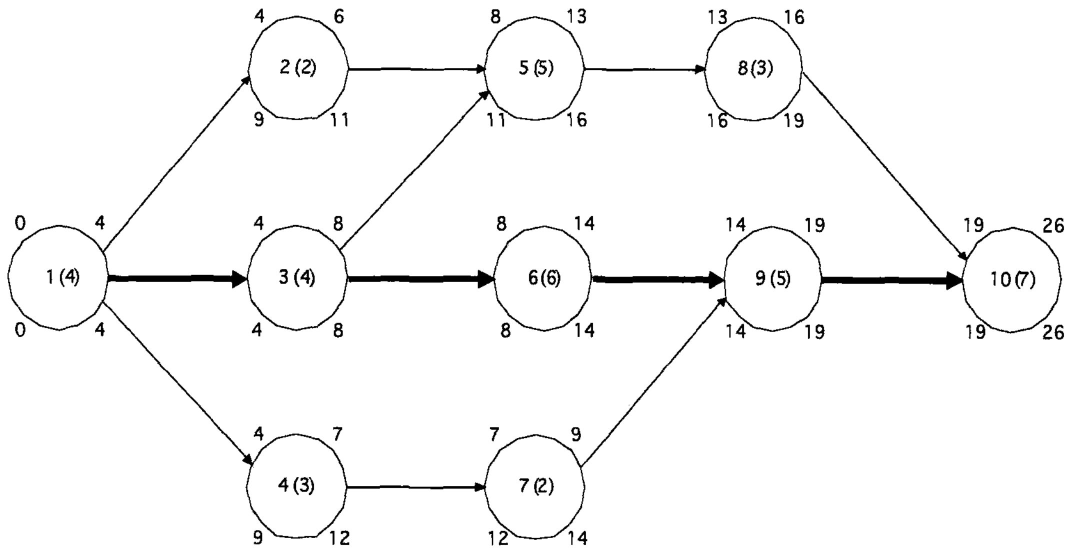
b. A-C-F-G-I, and A-D-F-G-I.

c. B is not on a critical path and has slack of 4; therefore, do not shorten as it will not change the project completion time. Shorten C, D, and G one week each. C and D are on parallel critical paths, reducing them will only reduce project completion time by 1 week.

d. A-C-F-G-I; and A-D-F-G-I. Project completion time is reduced from 18 to 16 weeks.

4.

a.

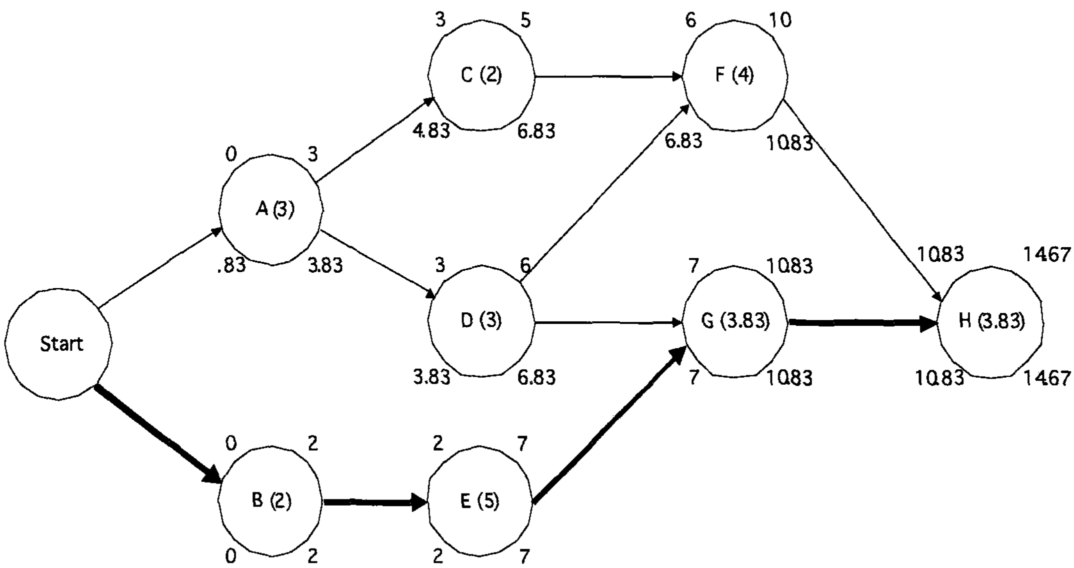


b. 1-3-6-9-10.

c. The most logical option would be to cut activity 3 by 3 weeks, and then reduce activity 6 or 9 by one week. This is the lowest cost option, and does not create an additional critical path. Another option would be to reduce activities 6 and 9 by a total of 3 weeks, and then reduce activity 3 by one week. This also has the same cost, but creates an additional critical path (1-3-5-8-10).

5.

a.



b. B-E-G-H

c. 14.67, 2.00+5.00+3.83+3.83

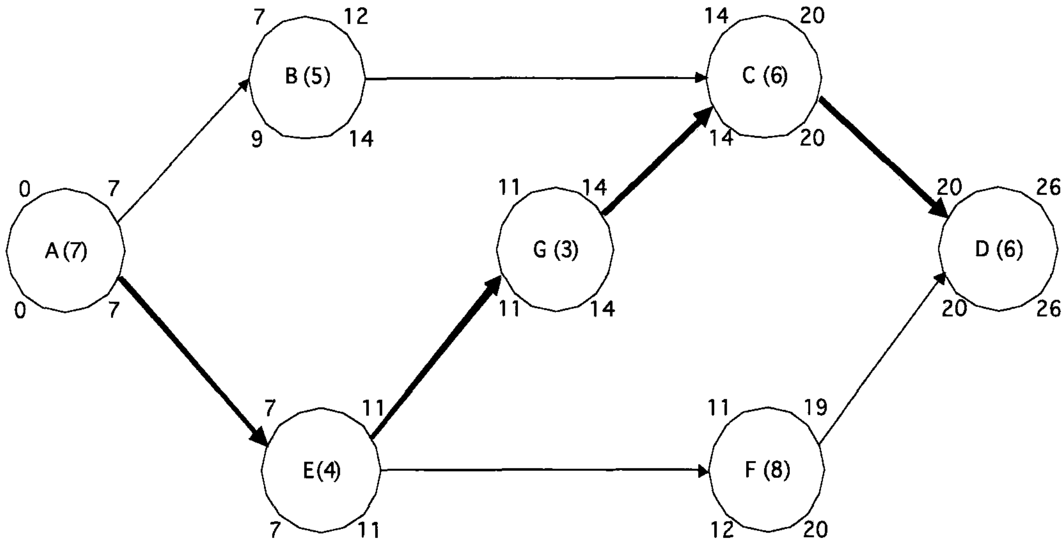
d. Variance of project completion time is found by adding the variances of activities on the critical path.

Activity	Variance
B	$[(3\text{-}1)/6]^2 =\ .11$
E	$[(11\text{-}3)/6]^2 = 1.78$
G	$[(6\text{-}1)/6]^2 =\ .69$
H	$[(5\text{-}2)/6]^2 =\ .25$
Total	2.83

$$Z = \frac{(16 - 14.67)}{\sqrt{2.83}} = .79$$

P(T<16) = .7852

6.



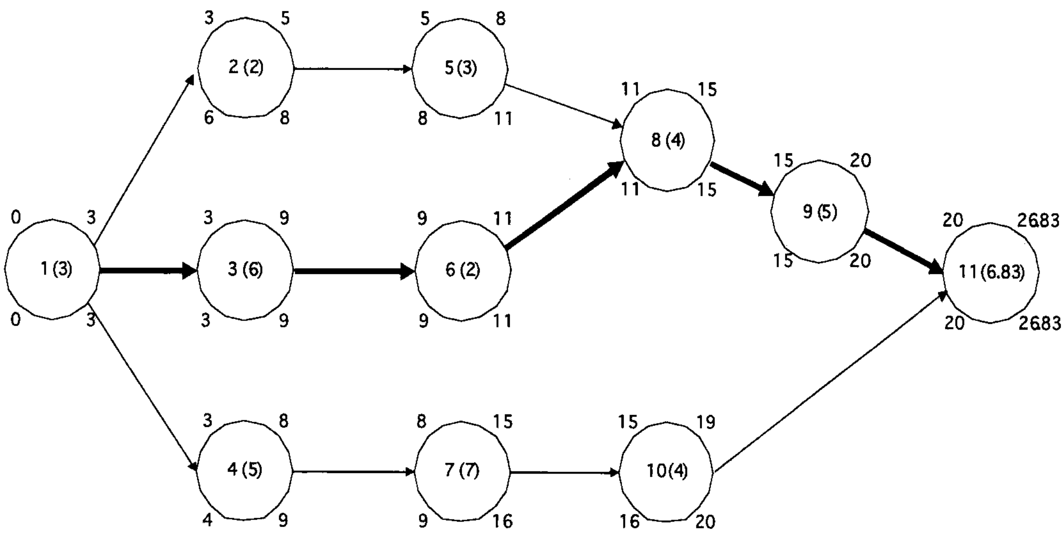
a. A-E-G-C-D.

b. 26 weeks.

c. No difference in completion date. B already has slack time of 2 and F has slack time of 1.

7. a.

Job No.	a	m	b	ET	σ^2
1	2	3	4	3.00	.11
2	1	2	3	2.00	.11
3	4	5	12	6.00	1.78
4	3	4	11	5.00	1.78
5	1	3	5	3.00	.44
6	1	2	3	2.00	.11
7	1	8	9	7.00	1.78
8	2	4	6	4.00	.44
9	2	4	12	5.00	2.78
10	3	4	5	4.00	.11
11	5	7	8	6.83	.25



b. 1-3-6-8-9-11.

c. 26.83, 3.00+6.00+2.00+4.00+5.00+6.83

d. (1) No. Job 5 is not on the critical path; therefore, reducing it time by two days will not reduce project completion time.

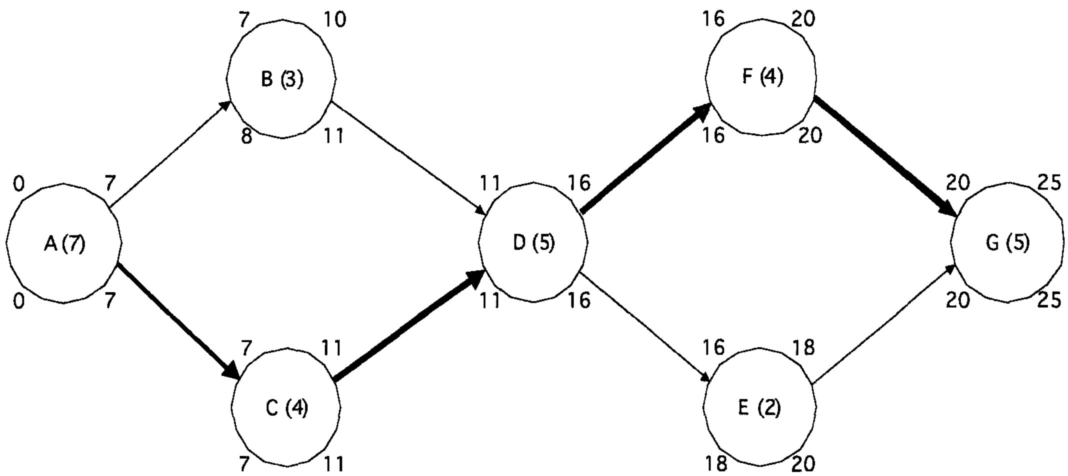
(2) No. Job 3 is on the critical path, but reducing it by two days shifts the critical path to (1-4-7-10-11), only saving one day. Therefore, $1,000 is saved in completion time at a cost of $1,500.

e. Variance of project completion time is found by summing the variances of activities on the critical path. (1-3-6-8-9-11), .11+1.78+.11+.44+2.78+.25=5.47.

$$Z = \frac{30 - 26.83}{\sqrt{5.47}} = 1.35$$

P(T>30) = .0885

8.



a. A-C-D-F-G

b.

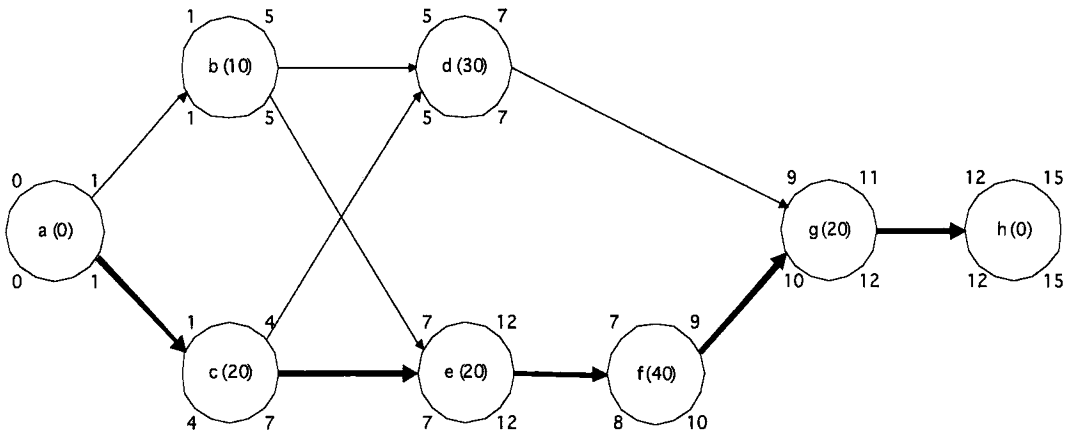
Activity	Normal Time (NT)	Crash Time (CT)	Normal Cost (NC)	Crash Cost (CC)	NT-CT	Cost/day to expedite
A	7	6	$7,000	$8,000	1	$1,000
B	3	2	5,000	7,000	1	2,000
C	4	3	9,000	10,200	1	1,200
D	5	4	3,000	4,500	1	1,500
E	2	1	2,000	3,000	1	1,000
F	4	2	4,000	7,000	2	1,500
G	5	4	5,000	8,000	1	3,000

First, lowest cost activities to crash are A and E at $1,000 per day. E is not on the critical path, therefore select A. Critical path remains the same. Second, lowest cost activity on the critical path is C. Crash activity C. The critical path remains the same. Third, D and F are next lowest cost activities on the critical path. Both have a cost of $1,500 per day. Select D then F or reverse the order (F then D). F can not be reduced by two day because it would cause E to become part of a critical path.

Summary of steps to reduce project by four days:

Step	Activity to crash	Cost to crash	Days saved
1	A	$1,000	1
2	C	1,200	1
3	D (or F)	1,500	1
4	F (or D)	1,500	1

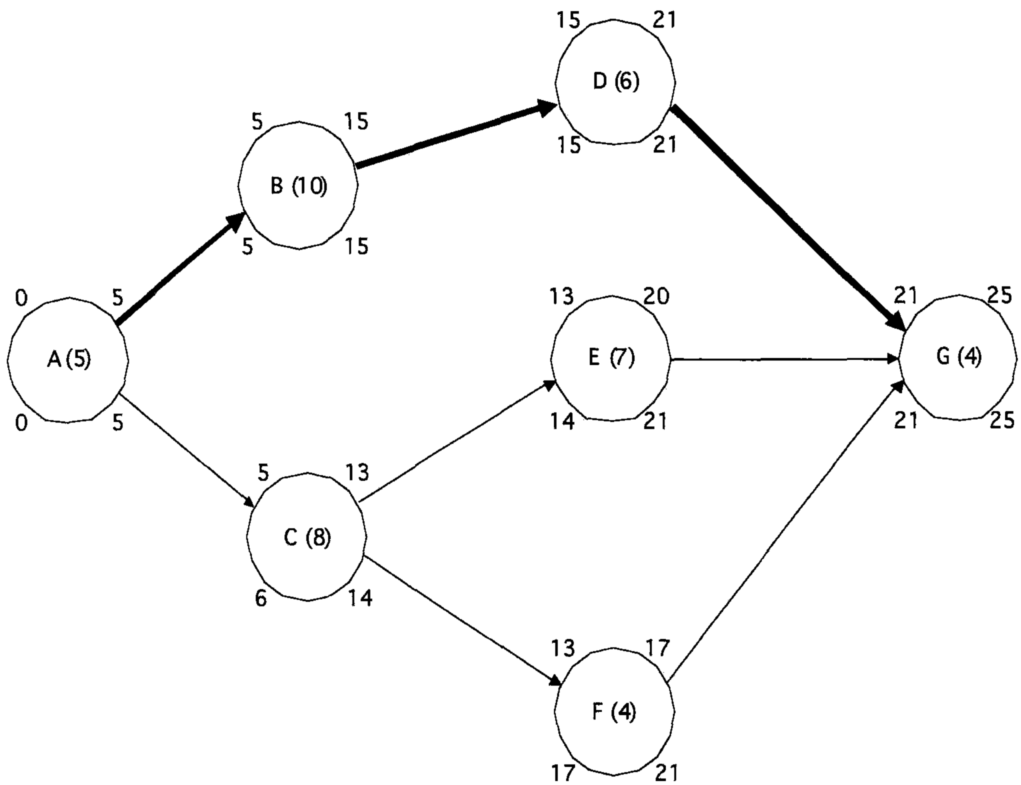
9.



a. 100 Hours.

b. b and d are not on the critical path. Their start can be delayed without delaying the start of any subsequent activities.

10.



a. A-B-D-G, 25 weeks, 5+10+6+4.

b.

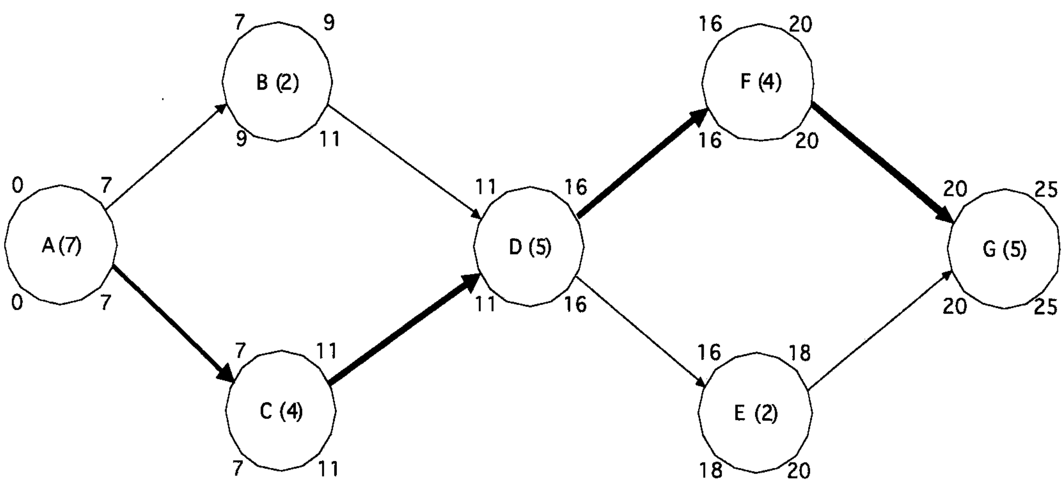
Activity	Normal Time (NT)	Normal Cost (NC)	Crash Time (CT)	Crash Cost (CC)	NT-CT	Cost/week to expedite
A	5	$7,000	3	$13,000	2	$3,000
B	10	12,000	7	18,000	3	2,000
C	8	5,000	7	7,000	1	2,000
D	6	4,000	5	5,000	1	1,000
E	7	3,000	6	6,000	1	3,000
F	4	6,000	3	7,000	1	1,000
G	4	7,000	3	9,000	1	2,000

First, reduce D (lowest cost activity on the critical path) by one week. This adds an additional critical path with activities C and E in it. Second, crash activity G by one week. Critical paths remain the same. Third, crash activity A by one week at a cost of $3,000, which is the least expensive.

Summary of activities crashed:

Step	Activity	Cost to crash	Weeks reduced
1	D	$1,000	1
2	G	2,000	1
3	A	3,000	1
Total cost		$6,000	

11.



a. A-C-D-F-G.

b. 25 weeks, 7+4+5+4+5.

c. B, 2weeks; E, 2 weeks.

Activity	Normal Time (NT)	Crash Time (CT)	Normal Cost (NC)	Crash Cost (CC)	NT-CT	Cost/week to expedite
A	7	6	$7,000	$8,000	1	1,000
B	2	1	5,000	7,000	1	2,000
C	4	3	9,000	10,200	1	1,200
D	5	4	3,000	4,500	1	1,500
E	2	1	2,000	3,000	1	1,000
F	4	2	4,000	7,000	2	1,500
G	5	4	5,000	8,000	1	3,000

First, shorten activity A by one week at a cost of $1,000. This is the lowest cost/week activity on the critical path. Second, shorten activity C by one week at a cost of $1,200. This is the next lowest cost/week activity on the critical path.