

DISCUSSION QUESTIONS AND PROBLEMS

Discussion Questions

- 13-1 What are some of the questions that can be answered with PERT and CPM?
- 13-2 What are the major differences between PERT and CPM?
- 13-3 What is an activity? What is an event? What is an immediate predecessor?
- 13-4 Describe how expected activity times and variances can be computed in a PERT network.
- 13-5 Briefly discuss what is meant by critical path analysis. What are critical path activities, and why are they important?
- 13-6 What are the earliest activity start time and latest activity start time? How are they computed?
- 13-7 Describe the meaning of slack and discuss how it can be determined.
- 13-8 How can we determine the probability that a project will be completed by a certain date? What assumptions are made in this computation?
- 13-9 Briefly describe PERT/Cost and how it is used.
- 13-10 What is crashing, and how is it done by hand?
- 13-11 Why is linear programming useful in CPM crashing?

Problems*

- 13-12 Sid Davidson is the personnel director of Babson and Willcount, a company that specializes in consulting and research. One of the training programs that Sid is considering for the middle-level managers of Babson and Willcount is leadership training. Sid has listed a number of activities that must be completed before a training program of this nature could be conducted. The activities and immediate predecessors appear in the following table:

ACTIVITY	IMMEDIATE PREDECESSORS
A	—
B	—
C	—
D	B
E	A, D
F	C
G	E, F

Develop a network for this problem.

- 13-13 Sid Davidson was able to determine the activity times for the leadership training program. He would like to determine the total project completion time and the

critical path. The activity times appear in the following table (see Problem 13-12):

ACTIVITY	TIME (DAYS)
A	2
B	5
C	1
D	10
E	3
F	6
G	8
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- 13-14 Jean Walker is making plans for spring break at the beaches in Florida. In applying techniques she learned in her quantitative methods class, she has identified the activities that are necessary to prepare for her trip. The following table lists the activities and the immediate predecessors. Draw the network for this project.

ACTIVITY	IMMEDIATE PREDECESSOR
A	—
B	—
C	A
D	B
E	C, D
F	A
G	E, F

- 13-15 The following are the activity times for the project in Problem 13-14. Find the earliest, latest, and slack times for each activity. Then find the critical path.

ACTIVITY	TIME (DAYS)
A	3
B	7
C	4
D	2
E	5
F	6
G	3

* Note: means the problem may be solved with QM for Windows; means the problem may be solved with Excel; and means the problem may be solved with QM for Windows and/or Excel.

13-16 Monohan Machinery specializes in developing weed-harvesting equipment that is used to clear small lakes of weeds. George Monohan, president of Monohan Machinery, is convinced that harvesting weeds is far better than using chemicals to kill weeds. Chemicals cause pollution, and the weeds seem to grow faster after chemicals have been used. George is contemplating the construction of a machine that would harvest weeds on narrow rivers and waterways. The activities that are necessary to build one of these experimental weed-harvesting machines are listed in the following table. Construct a network for these activities.

ACTIVITIES	IMMEDIATE PREDECESSORS
A	—
B	—
C	A
D	A
E	B
F	B
G	C, E
H	D, F

13-17 After consulting with Butch Radner, George Monohan was able to determine the activity times for constructing the weed-harvesting machine to be used on narrow rivers. George would like to determine ES, EF, LS, LF, and slack for each activity. The total project completion time and the critical path should also be determined. (See Problem 13-16 for details.) The activity times are shown in the following table:

ACTIVITY	TIME (WEEKS)
A	6
B	5
C	3
D	2
E	4
F	6
G	10
H	7

13-18 A project was planned using PERT with three time estimates. The expected completion time of the project was determined to be 40 weeks. The variance of the critical path is 9.

- (a) What is the probability that the project will be finished in 40 weeks or less?
- (b) What is the probability that the project takes longer than 40 weeks?

- (c) What is the probability that the project will be finished in 46 weeks or less?
- (d) What is the probability that the project will take longer than 46 weeks?
- (e) The project manager wishes to set the due date for the completion of the project so that there is a 90% chance of finishing on schedule. Thus, there would only be a 10% chance the project would take longer than this due date. What should this due date be?

13-19 Tom Schriber, a director of personnel of Management Resources, Inc., is in the process of designing a program that its customers can use in the job-finding process. Some of the activities include preparing resumés, writing letters, making appointments to see prospective employers, researching companies and industries, and so on. Some of the information on the activities is shown in the following table:

ACTIVITY	DAYS			IMMEDIATE PREDECESSORS
	a	m	b	
A	8	10	12	—
B	6	7	9	—
C	3	3	4	—
D	10	20	30	A
E	6	7	8	C
F	9	10	11	B, D, E
G	6	7	10	B, D, E
H	14	15	16	F
I	10	11	13	F
J	6	7	8	G, H
K	4	7	8	I, J
L	1	2	4	G, H

- (a) Construct a network for this problem.
- (b) Determine the expected time and variance for each activity.
- (c) Determine ES, EF, LS, LF, and slack for each activity.
- (d) Determine the critical path and project completion time.
- (e) Determine the probability that the project will be finished in 70 days or less.
- (f) Determine the probability that the project will be finished in 80 days or less.
- (g) Determine the probability that the project will be finished in 90 days or less.

13-20 Using PERT, Ed Rose was able to determine that the expected project completion time for the construction of a pleasure yacht is 21 months and the project variance is 4.

- (a) What is the probability that the project will be completed in 17 months or less?