CHAPTER 11

Project Management

TEACHING SUGGESTIONS

Teaching Suggestion 11.1: *Importance of PERT.*

PERT has rebounded and, due to PC software such as Microsoft Project, become a highly used quantitative analysis technique. It can be useful for organizations of all sizes and any individuals involved in planning and controlling projects. A good way to start this chapter is to discuss the capabilities of PERT. Students can be asked to contact a local firm (such as a builder) to ask about the use of PERT.

Teaching Suggestion 11.2: *Getting Students Involved with PERT.*

PERT is a technique that students can apply immediately. For example, students can be asked to use PERT to plan the courses they will need to take and the timing of taking these courses until graduation. Another approach would be to have students take a typical semester and use PERT to plan the term papers, exams, and assignments that must be finished to successfully complete the semester.

Teaching Suggestion 11.3: *Constructing a Network.*

One of the most difficult tasks of PERT or CPM is to develop an accurate network that reflects the true situation. Students should be given practice in this important aspect of network analysis as early as possible. Use the end-of-chapter problems. Students can be asked to develop their own networks. We can't stress enough the importance of drawing networks, since many students have a conceptual problem with the task.

Teaching Suggestion 11.4: *Using the Beta Distribution.*

PERT uses the beta distribution in estimating expected times and variances for each activity. As a matter of fact, it is questionable whether the beta distribution is appropriate. Students should be told that other distributions such as the normal curve can be used. A discrete probability distribution can also be used to determine expected times and variances. Instead of using optimistic, most likely, and pessimistic time estimates, an entire discrete distribution can be used to determine expected times and variances.

Teaching Suggestion 11.5: *Finding the Critical Path.*

Finding the critical path is not too difficult if the steps given in this chapter are followed. Students should be reminded that in making the forward pass *all* predecessor activities must be completed before any activity can be started. In the backward pass, students should be reminded that latest time is computed by making sure that the project would not be delayed for any activity. This means that *all* activities must be completed within the original project completion time.

Teaching Suggestion 11.6: *Project Crashing.*

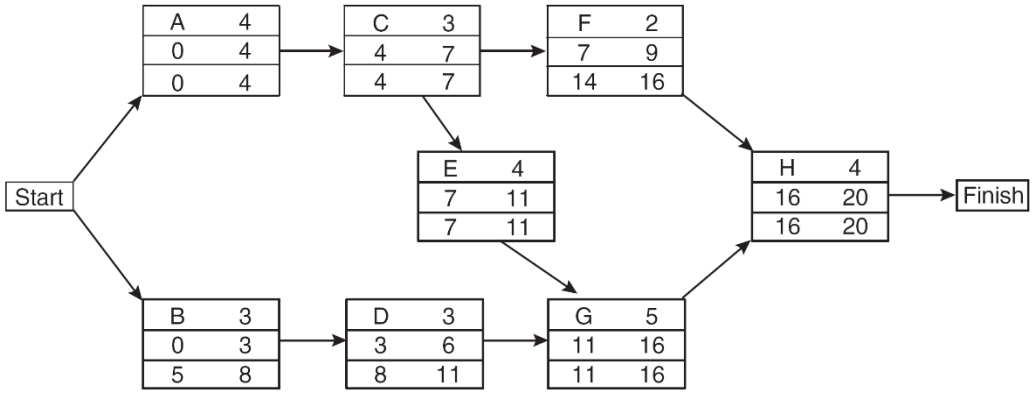
In manually performing project crashing, the critical path may change. In many cases, two or

more critical paths will exist after crashing. Students should be reminded of this problem. Fortunately, the linear programming approach or the use of PERT software, including QM for Windows, automatically takes care of this potential problem.

ALTERNATIVE EXAMPLES

Alternative Example 11.1: Sid Orland is involved in planning a scientific research project. The activities are displayed in the following diagram. Optimistic, most likely, and pessimistic time estimates are displayed in the following table.

Figure for Alternative Example 11.1



Activity	Optimistic	Most Likely	Pessimistic
A	3	4	5
B	3	3	3
C	2	3	4
D	1	3	5
E	4	4	4
F	2	2	2
G	4	5	6
H	3	4	5

The activities along the critical path and the total project completion times are shown in the figure. The solution is shown. As can be seen, the total project completion time is 20 weeks. Critical path activities are A, C, E, G, and H.

Activity	Mean	S.D.	Variance
A*	4	0.333	0.111
B	3	0.000	0.000
C*	3	0.333	0.111
D	3	0.667	0.444
E*	4	0.000	0.000
F	2	0.000	0.000
G*	5	0.333	0.111
H*	4	0.333	0.111

*Critical Path Activities

Expected Completion Time: 20

Alternative Example 11.2: Sid Orland would like to reduce the project completion time for the problem in Alternative Example 11-1 by 2 weeks. The normal and crash times and costs are presented in the table.

Activity	Immediate Predecessor	Time		Cost	
		Normal	Crash	Normal	Crash
A	—	4	3	$2,000	$3,000
B	—	3	3	3,000	3,000
C	A	3	2	5,000	6,000
D	B	3	2	5,000	5,500
E	C	4	3	8,000	10,000
F	C	2	2	2,000	2,000
G	D,E	5	3	3,000	4,000
H	F,G	4	4	4,000	4,000

From the table, the crash cost per week can be determined for each activity. This information is displayed in the following table.

Activity	Critical Path?	Crash Cost per Week
A	Yes	$1,000
B		0 or NA
C	Yes	$1,000
D		$500
E	Yes	$2,000
F		0 or NA
G	Yes	$500
H	Yes	0 or NA

Given this information, the least expensive way to reduce the project using an activity on the critical path is to reduce activity G by 2 weeks, for a total cost of $1,000 ($1,000 = 2 × $500).

SOLUTIONS TO DISCUSSION QUESTIONS AND PROBLEMS

11-1. There are six steps common to both PERT and CPM. They are:

1. Define the project and all of its significant activities or tasks.
2. Develop the relationships among the activities. Decide which activities must precedeothers.
3. Draw the network connecting all of the activities.
4. Assign time and/or cost estimates to each activity.
5. Compute the longest time path through the network; this is called the critical path.
6. Use the network to help plan, schedule, monitor, and control the project.

11-2. There are several major differences between PERT and CPM. With PERT, three estimates of activity time and completion are made. These are the optimistic, most likely, and pessimistic time estimates. From these estimates, the expected completion time and completion variance can be determined. CPM allows the use of crashing. This technique allows a manager to reduce the total project completion time by expending additional resources on activities within the network. CPM is used in determining the least-cost method of crashing a project or network.

11-3. An activity is a task that requires a fixed amount of time and resources to complete. An event is a point in time. Events mark the beginning and ending of activities. An immediate predecessor is an activity that must be completely finished before another activity can be started.

11-4. The time estimates in PERT are