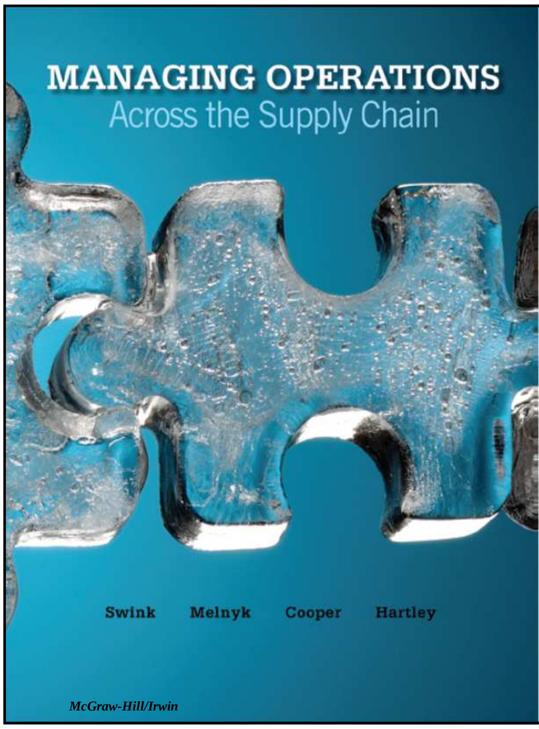

CHAPTER SIXTEEN

SUPPLEMENT

Advanced Methods for Project Scheduling

Learning Objectives

1. Understand and apply logic for crashing projects
2. Schedule projects using probabilistic task time estimates

Advanced Project Scheduling Techiniques

- ***Crashing***: adding resources to efficiently speed up a project
- ***Probabilistic Scheduling***: using statistics to model uncertainty in estimating various project outcomes

16S–3

Project Crashing

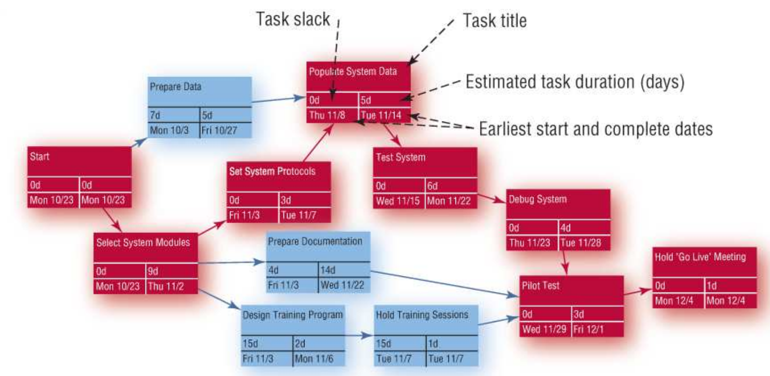

FIGURE 16S-1 Network Diagram for Planning System Implementation Project

Figure 16S-1

16S–4

Project Crashing

Step in crashing a project:

1. List the crash costs for each task in the project.
2. Choose the task or combination of tasks on the critical. path that has the lowest crash cost, and reduce that task's duration by one period.
3. Update the lengths of all affected paths in the network. Identify any paths that have become critical.
4. Repeat the process until the plan meets the required deadline or until the cost of reducing the project length exceeds the benefit.

Project Crashing

TABLE 16S-1 Crash Schedule for Planning System Installation Project

Task	Current Planned Duration	Minimum Duration	Crash Cost per Day
*Select System Modules	9	6	$1200
Prepare Data	5	4	$ 200
*Set System Protocols	3	1	$ 500
*Populate System Data	5	3	$ 700
Prepare Documentation	14	10	$ 400
Design Training Program	2	2	——
Hold Training Sessions	1	1	——
*Test System	6	3	$ 600
*Debug System	4	2	$ 800
*Pilot Test	3	2	$ 900
*Hold "Go Live" Meeting	1	1	——

*Task is on the critical path

Table 16S-1

Project Crashing

TABLE 16S-2 Summary of Crash Plan for the Planning System Installation Project

	Activity to Crash	Crash Cost	Critical Path Length	Notes:
0			31 days	No tasks crashed
1	Set System Protocols	$ 500	30 days	Cheapest task on critical path
2	Set System Protocols	$ 500	29 days	Cannot crash this task any further
3	Test System	$ 600	28 days	Cheapest task on critical path
4	Test System	$ 600	27 days	Prepare Documentation becomes on a critical path
5	Pilot Test	$ 900	26 days	Crashing this task reduces both critical paths. Planned deadline met.
	Total Cost:	$3100		

Table 16S-2

Project Crashing

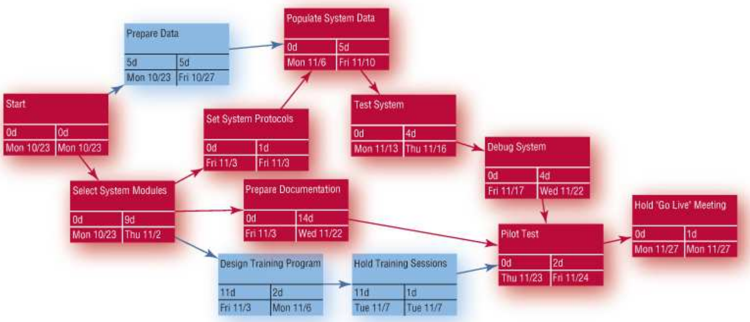

FIGURE 16S-2 Planning System Installation Project Crashed to 26 Days

Figure 16S-2

Probabilistic Estimates

- ***Best Case***: estimate of task time if all goes as planned
- ***Most Likely***: most probable task time
- ***Worst Case***: estimate of task time if all possible delays are realized

Probabilistic Estimates

TABLE 16S-3 Probabilistic Time Estimates for the Planning System Installation Project

Task	Best Case Duration	Most Likely Duration	Worst Case Duration
*Select System Modules	7	9	15
Prepare Data	4	5	10
*Set System Protocols	2	3	5
*Populate System Data	3	5	7
Prepare Documentation	10	14	16
Design Training Program	2	2	3
Hold Training Sessions	1	1	2
*Test System	4	6	8
*Debug System	2	4	6
*Pilot Test	2	3	4
*Hold "Go Live" Meeting	1	1	1

*Task is on the critical path

Table 16S-3

Probabilistic Estimates

$$t_i = \frac{worst + (4 * most\ likly) + best}{6}$$

$$\sigma_i = \frac{(worst - best)}{6}$$

$$t_{path} = \Sigma t_i$$

$$\sigma_{path} = \sqrt{\Sigma \sigma_i^2}$$

$$z = (target\ completion\ time - t_{path}) / \sigma_{path}$$

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Probabilistic Estimates

TABLE 16S-4
Expected Duration and Standard Deviations for Planning System Installation Project

Task	Best Case Duration	Most Likely Duration	Worst Case Duration	Expected Duration	Standard Deviation
*Select System Modules	7	9	15	9.67	1.33
Prepare Data	4	5	10	5.67	1
*Set System Protocols	2	3	5	3.17	0.5
*Populate System Data	3	5	7	5	0.67
Prepare Documentation	10	14	16	13.67	1
Design Training Program	2	2	3	2.17	0.17
Hold Training Sessions	1	1	2	1.17	0.17
*Test System	4	6	8	6	0.67
*Debug System	2	4	6	4	0.67
*Pilot Test	2	3	4	3	0.33
*Hold "Go Live" Meeting	1	1	1	1	0

*Task is on the critical path

Table 16S-4

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Probabilistic Estimates

The most likely time for completion is day 31, and it must be done day 33. Given the previous data, what is the probability we will be on time?

t_i = (15 + 4 * 9 + 7) / 6 = 9.67 days

σ_i = (15-7) / 6 = 1.33 days

t_{path} = 9.67 + 3.17 + 5 + 6 + 4 + 3 + 1 =31.84 days

σ_{path} = 1.86 days

z = (33 – 31.84) / 1.86 = .624 or **73%** (from z table)

Example 16S-2

Advanced Project Management Summary

1. There are time-cost trade-offs.
2. The probability of finishing a task or a project on time can be calculated.