Project Management eWorkbook

Practice Problem Solutions

Overview

Practice Problem Solutions

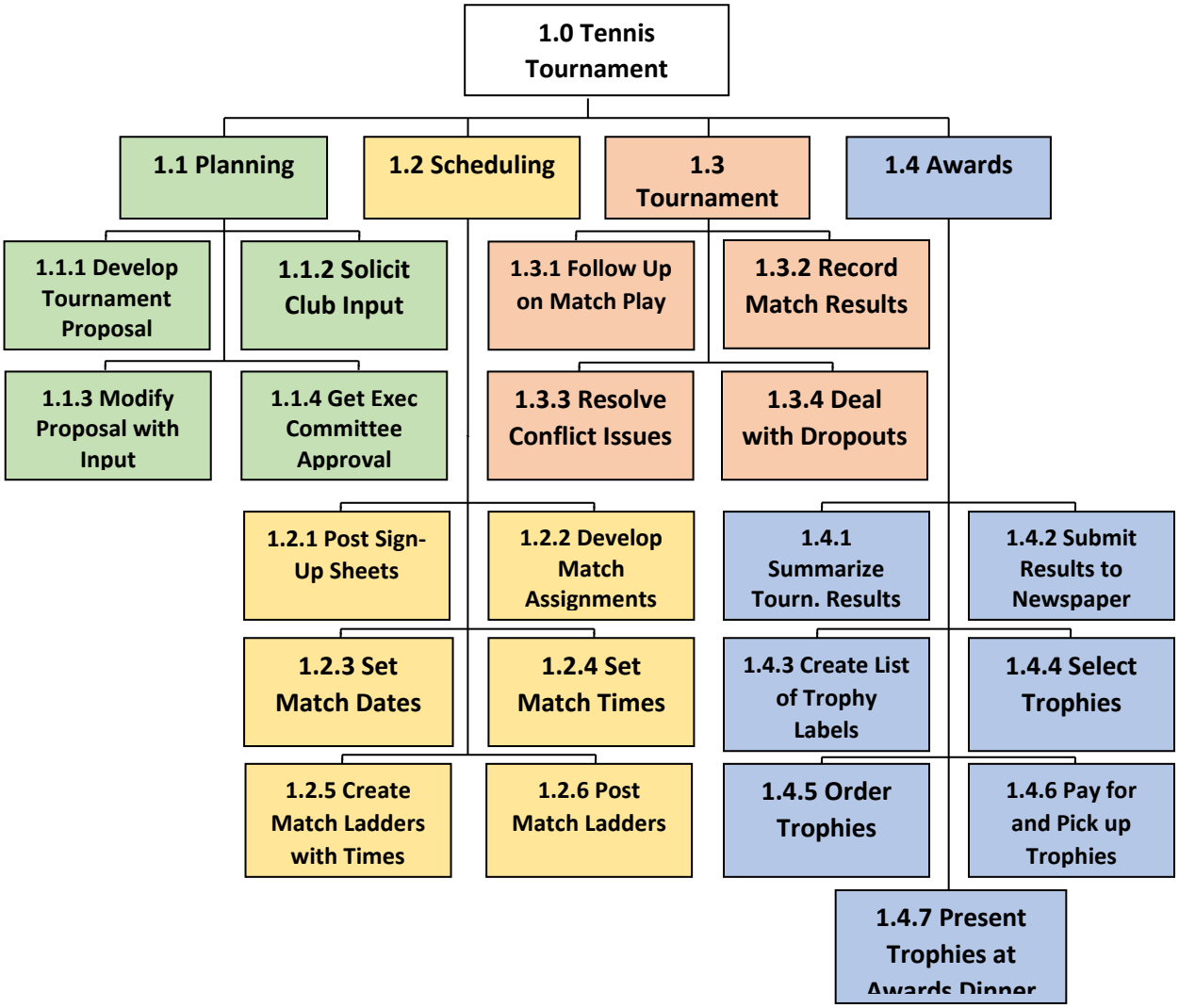
This file contains the solutions to all practice problems from Chapters 4 and 5 of the *Project Management eWorkbook*. Normally students practice working the problems without the solutions being right in front of them. Providing the solutions in the appendix allows students to compare their solution to the correct answer. This gives students a chance to gain confidence with their solutions or discover their mistakes without assistance. Enabling students to discover their own errors reinforces the learning process. If they are unable to understand the solution, they can formulate specific questions for their instructor. Instructors then only need to deal with students that cannot understand the solution and even then, students should be able to identify the area of their confusion. This reduces workload and allows efficient use of class time.

Providing the solutions to practice problems ahead of time makes them "worked examples" rather than purely practice problems. Some academics consider the study of "worked examples" to be a more efficient and effective study approach over working practice problems. Including the solutions also increases the value of the practice problems in the online environment. Students having difficulty with a problem can identify their area of concern and pose questions online. This online feedback gives instructors or student peers the opportunity to resolve issues in the online environment without using classroom time.

The solutions are listed by topic using the same codes as in the *Project Management eWorkbook*. This chapter includes solutions to 70 practice problems covering the following seven topics: 4.2, 4.3, 4.4, 4.5, 5.2, 5.3, and 5.4.

4.2 Work Breakdown Structure Practice Solutions

1) Create a two-level WBS for a tennis tournament using an organizational chart format and coding. Solution is as follows:



2) Create a two-level WBS for an office picnic using document outline format and coding. The document outline format is also referred to as an indentured list and is most prevalent in project management software, since it is easily presented in a spreadsheet format. In this problem only the Level One phases are designated and students must create their own second level activities. Solution shows Level One and students must create Level Two.

1 Office Picnic
1.1 Park Facilities
1.1.1
1.1.2
1.1.3
1.2 Attendees
1.2.1
1.2.2
1.2.3
1.3 Safety
1.3.1
1.3.2
1.3.3
1.4 Food
1.5 Games

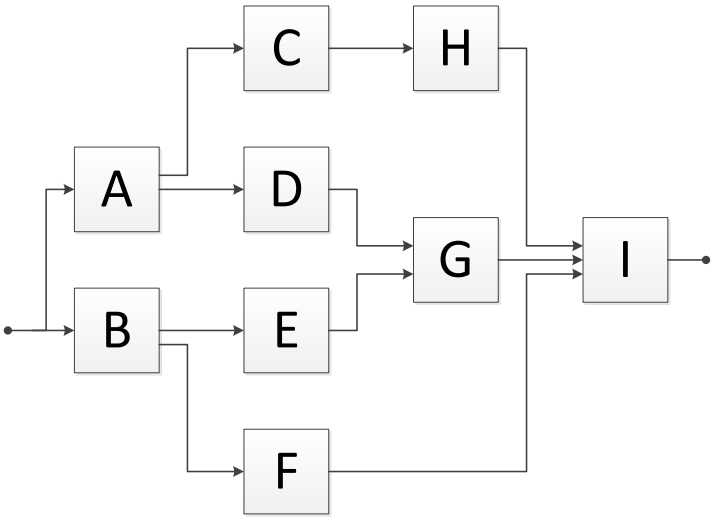
3) Create a two-level WBS for your sister's wedding with proper coding. The format is at the student's discretion. In Problem 3 students create both Level One and Level Two activities; thus, each answer will be unique. The previous two problems should aid students in preparing for this problem. Since all answers are unique, a solution is not provided.

4.3 Network Practice Solutions

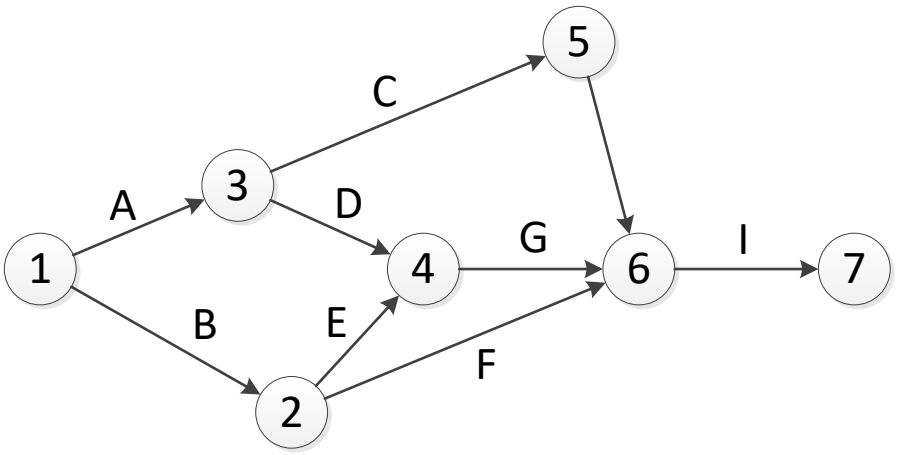
1) Construct AON and AOA network diagrams for the precedence relationships shown in the following chart.

Activity	A	B	C	D	E	F	G	H	I
Predecessors	-	-	A	A	B	B	D,E	C	F,G,H

AON Solution



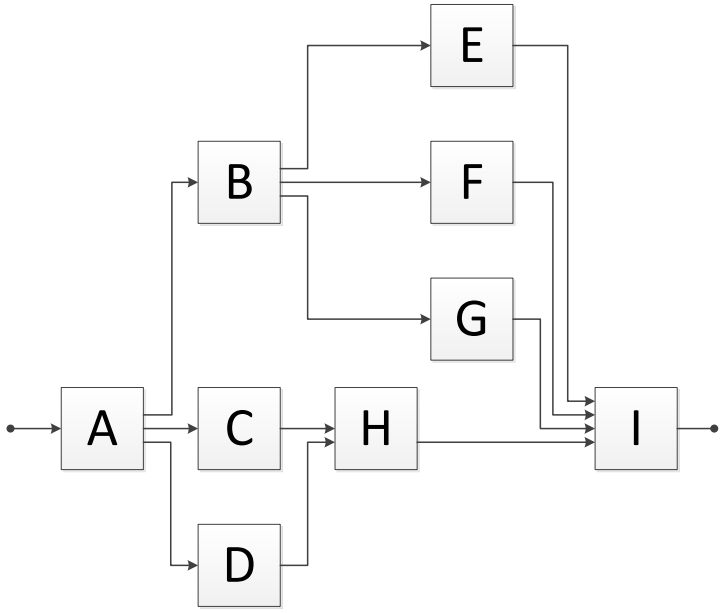
AOA Solution



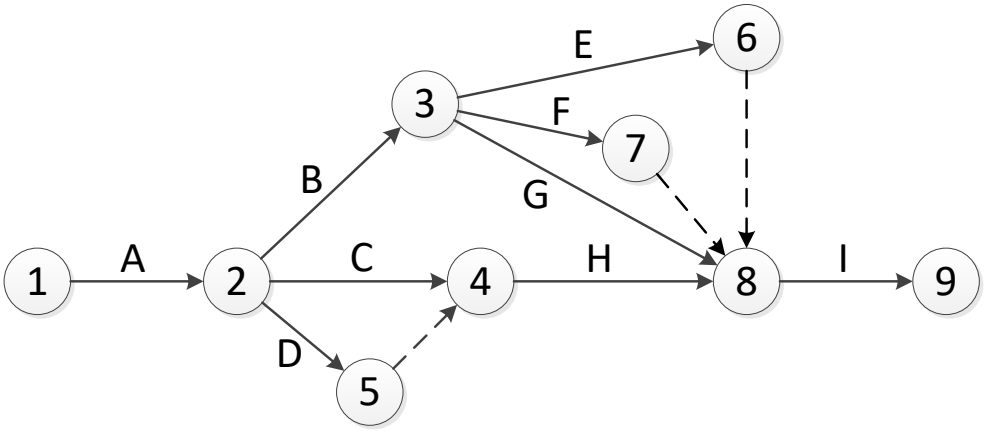
2) Construct AON and AOA network diagrams for the precedence relationships shown in the following chart.

Activity	A	B	C	D	E	F	G	H	I
Predecessors	-	A	A	A	B	B	B	C,D	E,F,G,H

AON Solution



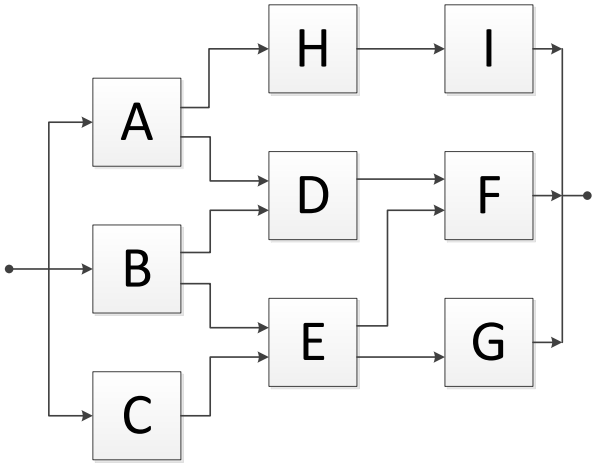
AOA Solution



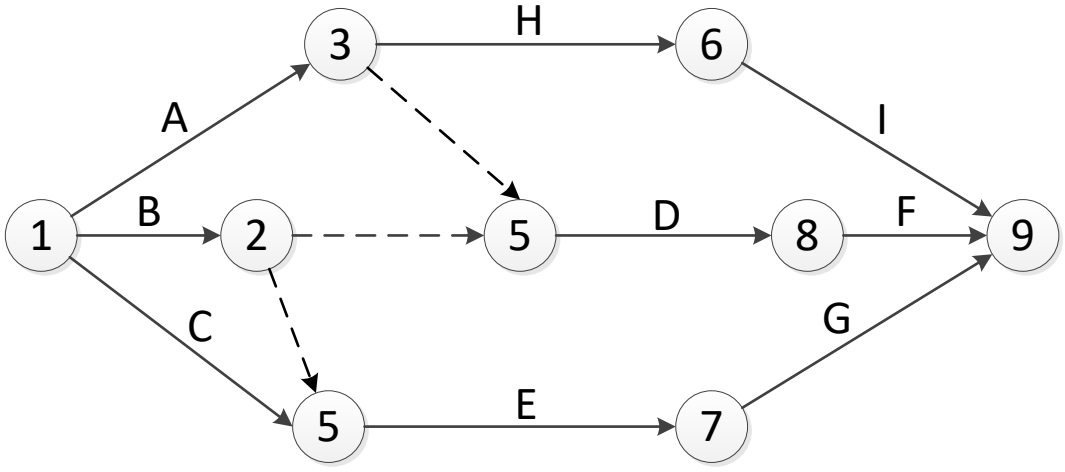
3) Construct AON and AOA network diagrams for the precedence relationships shown in the following chart.

Activity	A	B	C	D	E	F	G	H	I
Predecessors	-	-	-	A,B	B,C	D,E	E	A	H

AON Solution



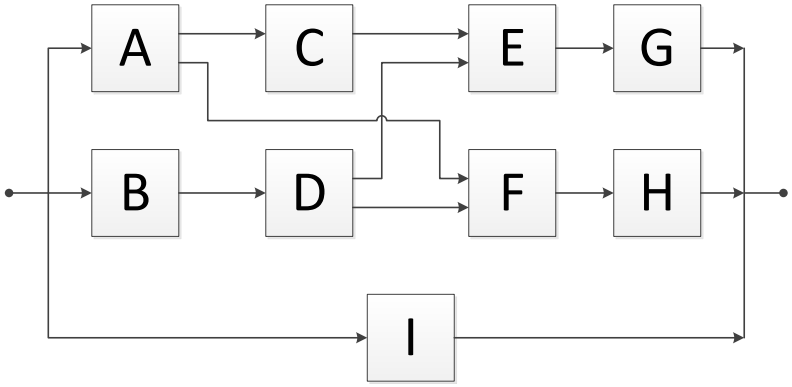
AOA Solution



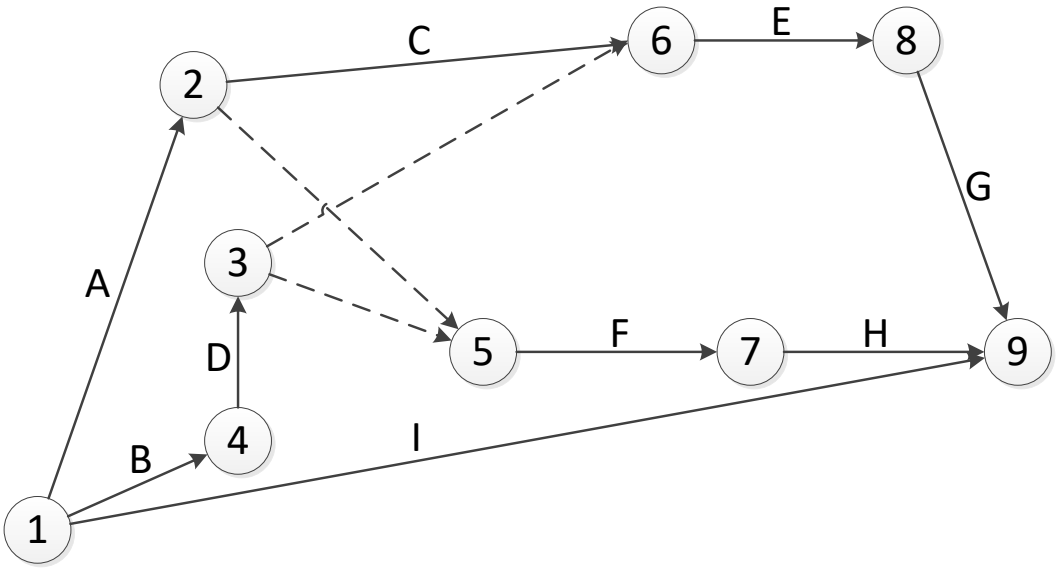
4) Construct AON and AOA network diagrams for the precedence relationships shown in the following chart.

Activity	A	B	C	D	E	F	G	H	I
Predecessors	-	-	A	B	D,C	A,D	E	F	-

AON Solution



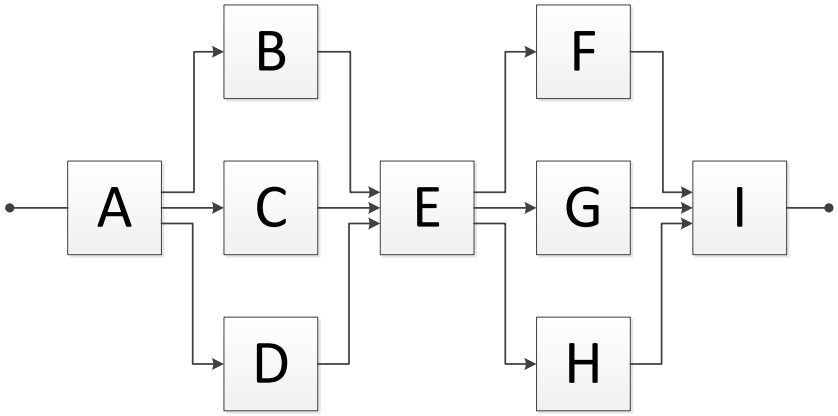
AOA Solution



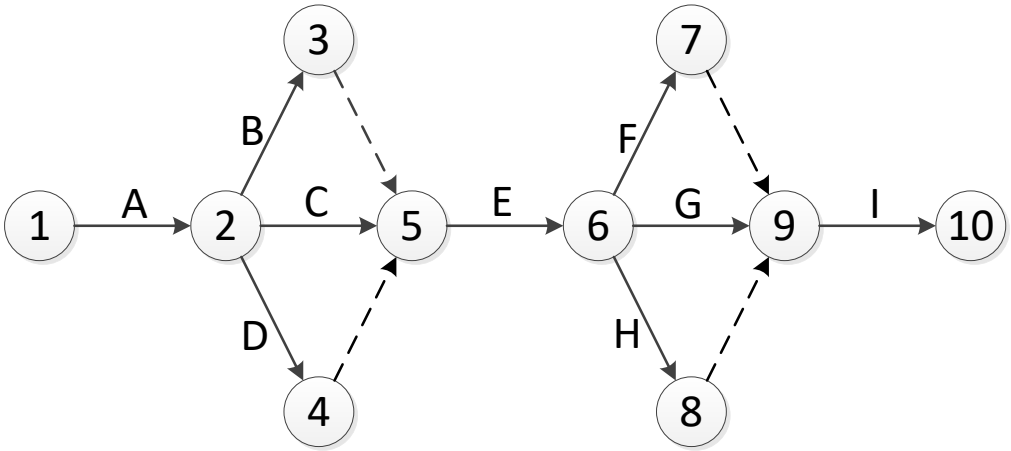
5) Construct AON and AOA network diagrams for the precedence relationships shown in the following chart.

Activity	A	B	C	D	E	F	G	H	I
Predecessors	-	A	A	A	B,C,D	E	E	E	F,G,H

AON Solution



AOA Solution



4.4 Durations and Milestones Practice Solutions

1. You are estimating the time to paint the interior rooms of your companies' High Point Hotel Complex, which contains 100 units. You have four hours to complete the estimate and submit it for developing next year's annual plan of unit availability. Two years ago a similar project to paint the interior of the Central Arms Hotel that included 80 units took eight weeks. What time would you estimate for the High Point Complex?

   $100\,\frac{units}{80}units\ \times 8\ weeks\ = \mathbf{10\ weeks}$ **Analogous Estimate**

2. You are a painting contractor estimating a project to paint the interior rooms of the 100-unit High Point Hotel Complex. The request for quote requires you to define the overall duration of the project and the maximum number of units that will be out of service during the project. Based on your experience a two-person crew can complete three typical hotel rooms in three days. You have a maximum resource base of six workers and plan to work six days a week. You decide to give your customer a variety of options to improve the desirability of your bid. Complete the following duration chart expressing duration in workdays and rounding any partial days to the next full day.

Max Out of Service	Project Duration	Resources
3 Rooms	**100 Work Days**	2 Painters
6 Rooms	**50 Work Days**	4 Painters
9 Rooms	**34 Work Days**	6 Painters

   This is a **Parametric Estimate**.

3. You are the project manager responsible for painting the interior rooms of the 100-unit High Point Hotel Complex. A maximum of six rooms can be out of service at any time. You plan to use a four-person crew working six days. You have worked with the four-person crew on similar projects in which traditionally completed 12 rooms in a week, with their best being 15 rooms per week and their worst being only 6 rooms per week. Your boss has asked for your best estimate on the workdays to complete the project. Round any partial days to the next whole day. This is a **Three Point Estimate**.

$$\text{Expected Duration} = \frac{15+(4\times12)+6}{6}\ = 11.5\ \text{rooms/week}$$

$$\text{Project Duration} = \frac{100}{11.5} = 8.69\ \text{weeks}\ \times 6\,\frac{\text{work days}}{\text{week}}\ = \mathbf{53\ work\ days}$$

4. You are developing the duration for an activity in which the most optimistic time to complete it is one day, the most likely time is two days, and the most pessimistic time is six days. What is your expected duration? What type of estimate does this represent?

$$\text{Expected Duration} = \frac{1+(4\times2)+6}{6} = 15 \div 6 = 2.5 \text{ days}$$

This is a "**Three Point**," also known as **PERT estimate or beta distribution**.

5. You are developing the duration for an activity in which the most optimistic time to complete it is two hours, the most likely time is six hours, and the most pessimistic time is twenty-two hours. What is your expected duration? What type of estimate does this represent?

$$\text{Expected Duration} = \frac{2+(4\times6)+22}{6} = 48 \div 6 = 8\ Hours$$

This is "**Three Point**," also known as **PERT estimate or beta distribution**.

6. Your cable crew is capable of laying 50 feet of cable per hour. How long will it take your crew to lay 10,000 feet of cable? What type of estimate does this represent?

$$\text{Duration} = 10000 \div 50 = 200\ Hours$$

This is a **Parametric estimate**.

4.5 Schedule Development Practice Solutions

Given the following independent tasks

Task	Workers Needed	Scheduled Days
1	2	1,2,3,4,5,6,7,8
2	1	7,8,9,10
3	1	1,2,3,4
4	1	1,2,3,4,5,6
5	1	11,12

1. Resource Smooth the activities in the above chart.

One possible answer is shown, and all correct answers use a maximum of three workers and finish in twelve days.

Resource Smooth												
Task	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
1	2	2	2	2	2	2	2	2				
2									1	1	1	1
3	1	1	1	1								
4					1	1	1	1	1	1		
5											1	1
Total	3	3	3	3	3	3	3	3	2	2	2	2

2. Resource level the activities in the above chart for two workers.

One possible answer is shown, and all correct answers use a maximum of two workers and finish in sixteen days.

Resource Level at 2 Workers																
Task	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**
1	2	2	2	2	2	2	2	2								
2									1	1	1	1				
3													1	1	1	1
4									1	1	1	1	1	1		
5															1	1
Total	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2

3. Resource smooth the activities in the above chart with 1 depending on 4. Note that the dependency caused the completion date to change. One possible answer is shown, and all correct answers use a maximum of three workers and finish in fourteen days.

Resource Smooth with 1 depending on 4														
Task	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**
1							2	2	2	2	2	2	2	2
2	1	1	1	1										
3											1	1	1	1
4	1	1	1	1	1	1								
5					1	1								
Total	2	2	2	2	2	2	2	2	2	2	3	3	3	3

4. Resource level the activities in the above chart for two workers with 1 depending on 4.

One possible answer is shown, and all correct answers use a maximum of two workers and finish in sixteen days.

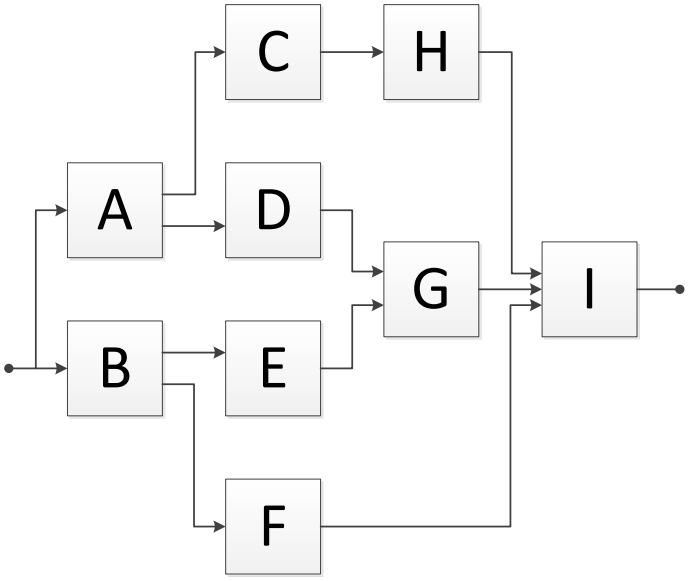
Resource Level at 2 Workers with 1 depending on 4																
Task	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**
1									2	2	2	2	2	2	2	2
2	1	1	1	1												
3					1	1	1	1								
4	1	1	1	1	1	1										
5							1	1								
Total	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2

5. Complete the chart below using the results from the above problems.

Parameters	**Original**	**After Smoothing**	**After Leveling**	**After Smoothing 1 depends on 4**	**After Leveling 1 depends on 4**
Max. # of Workers	4	3	2	3	2
Days to Complete	12	12	16	14	16

5.2 Schedule Control Practice Solutions

1) Fill out the Critical Path Data Table using the network and specified activity durations. Determine the project duration and critical path. All durations are in weeks.

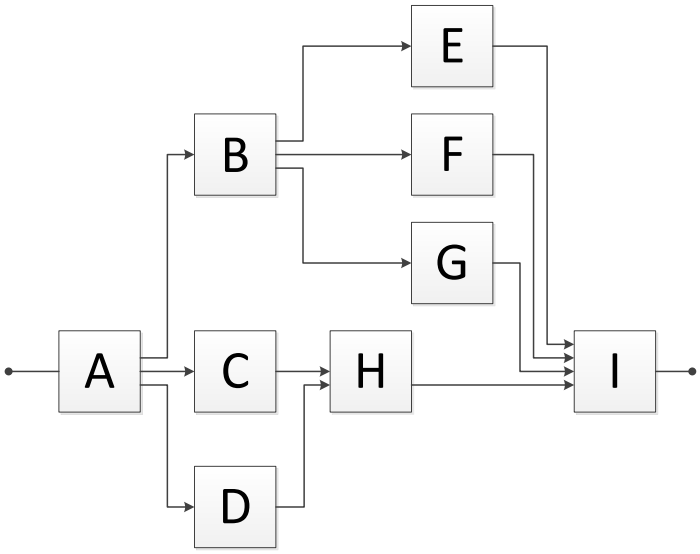


Critical Path Data Table Problem 1

Activity	Duration	Immediate	Earliest		Latest		Float	Critical
	Estimate	Predecessor	ES	EF	LS	LF	or Slack	Path
A	4	*	0	4	5	9	5	
B	6	*	0	6	0	6	0	X
C	6	A	4	10	21	27	17	
D	9	A	4	13	9	18	5	
E	12	B	6	18	6	18	0	X
F	3	B	6	9	30	33	24	
G	15	D,E	18	33	18	33	0	X
H	6	C	10	16	27	33	17	
I	9	F,G,H	33	42	33	42	0	X

Project Duration = 42 Weeks Critical Path: BEGI

2) Fill out the Critical Path Data Table using the network and specified activity durations. Determine the project duration and critical path. All durations are in weeks.

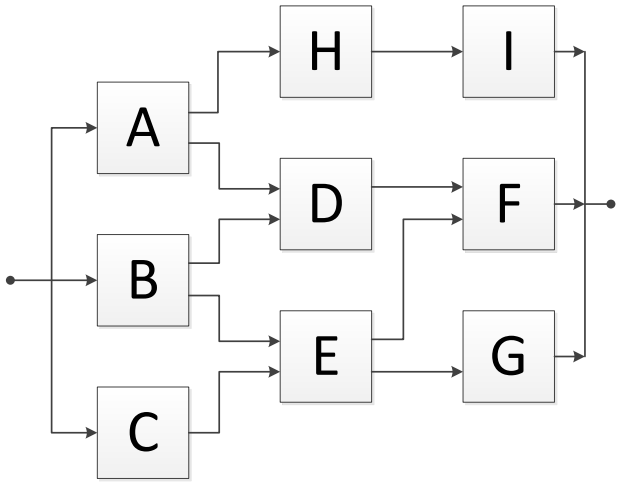


Critical Path Data Table Problem 2

Activity	Duration	Immediate	Earliest		Latest		Float	Critical
	Estimate	Predecessor	ES	EF	LS	LF	or Slack	Path
A	5	*	0	5	0	5	0	X
B	3	A	5	8	5	8	0	X
C	2	A	5	7	8	10	9	
D	4	A	5	9	6	10	3	
E	1	B	8	9	11	12	9	
F	4	B	8	12	8	12	0	X
G	3	B	8	11	9	12	3	
H	2	C,D	9	11	10	12	3	
I	1	E,F,G,H	12	13	12	13	0	X

Project Duration = 13 weeks **Critical Path: ABFI**

3) Fill out the Critical Path Data Table using the network and specified activity durations. Determine the project duration and critical path. All durations are in weeks.

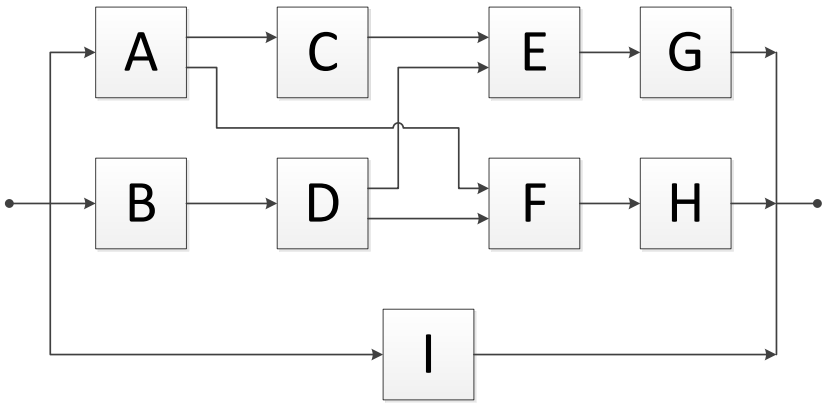


Critical Path Data Table Problem 3

Activity	Duration	Immediate	Earliest		Latest		Float	Critical
	Estimate	Predecessor	ES	EF	LS	LF	or Slack	Path
A	2	*	0	2	1	3	1	
B	3	*	0	3	0	3	0	X
C	2	*	0	2	4	6	4	
D	4	A,B	3	7	3	7	0	X
E	1	B,C	3	4	6	7	3	
F	3	D,E	7	10	7	10	0	X
G	2	E	4	6	8	10	4	
H	4	A,B	2	6	5	9	3	
I	1	H	6	7	9	10	3	

Project Duration = 10 weeks **Critical Path: BDF**

4) Fill out the Critical Path Data Table using the network and specified activity durations. Determine the project duration and critical path. All durations are in weeks.

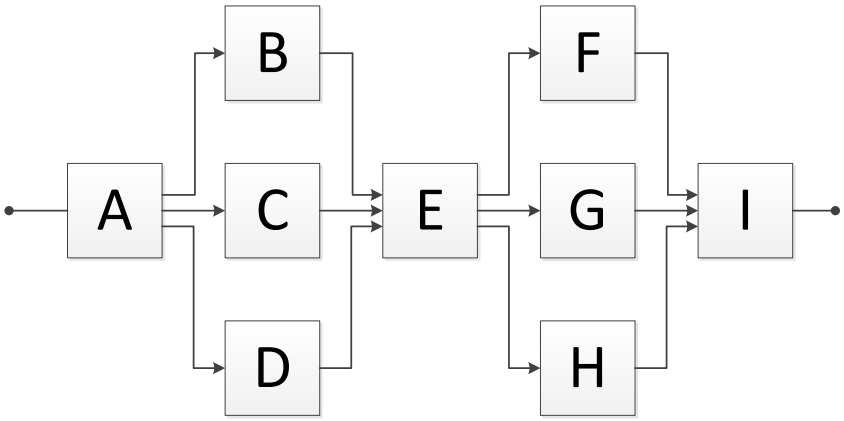


Critical Path Data Table Problem 4

Activity	Duration	Immediate	Earliest		Latest		Float	Critical
	Estimate	Predecessor	ES	EF	LS	LF	or Slack	Path
A	3	*	0	3	1	4	1	
B	3	*	0	3	0	3	0	X
C	2	A	3	5	4	6	1	
D	3	B	3	6	3	6	0	X
E	4	D,C	6	10	6	10	0	X
F	3	A,D	6	9	8	11	2	
G	5	E	10	15	10	15	0	X
H	4	F	9	13	11	15	2	
I	10	*	0	10	5	15	5	

Project Duration = 15 weeks **Critical Path: BDEG**

5) Fill out the Critical Path Data Table using the network and specified activity durations. Determine the project duration and critical path. All durations are in weeks.



Critical Path Data Table Problem 5

Activity	Duration	Immediate	Earliest		Latest		Float	Critical
	Estimate	Predecessor	ES	EF	LS	LF	or Slack	Path
A	1	*	0	1	0	1	0	X
B	2	A	1	3	3	5	2	
C	3	A	1	4	2	5	1	
D	4	A	1	5	1	5	0	X
E	1	B,C,D	5	6	5	6	0	X
F	4	E	6	10	6	10	0	X
G	3	E	6	9	7	10	1	
H	4	E	6	10	6	10	0	X
I	1	F,G,H	10	11	10	11	0	X

Project Duration = 11 Weeks Critical Path: ADEFI and ADEHI

6) Based on the following table, calculate the ES, EF, LS, LF times and slack for each activity. In addition, identify the critical path and the amount of time needed to complete the project. All durations are in weeks.

Critical Path Data Table Problem 6

Activity	Duration	Immediate	Earliest		Latest		Float	Critical
	Estimate	Predecessor	ES	EF	LS	LF	or Slack	Path
A	3	*	0	3	0	3	0	X
B	4	A	3	7	7	11	4	
C	8	A	3	11	3	11	0	X
D	4	B,C	11	15	11	15	0	X
E	2	D	15	17	15	17	0	X
F	2	E	17	19	17	19	0	X
G	5	F	19	24	19	24	0	X
H	4	F	19	23	20	24	1	
I	3	G,H	24	27	24	27	0	X

Project Duration = 27 Weeks **Critical Path: ACDEFGI**

7) Based on the following table, calculate the ES, EF, LS, LF times and slack for each activity. All durations are in weeks. Is it possible to complete the project within the original expectation of 27 weeks? Identify the activities to concentrate on to recover schedule.

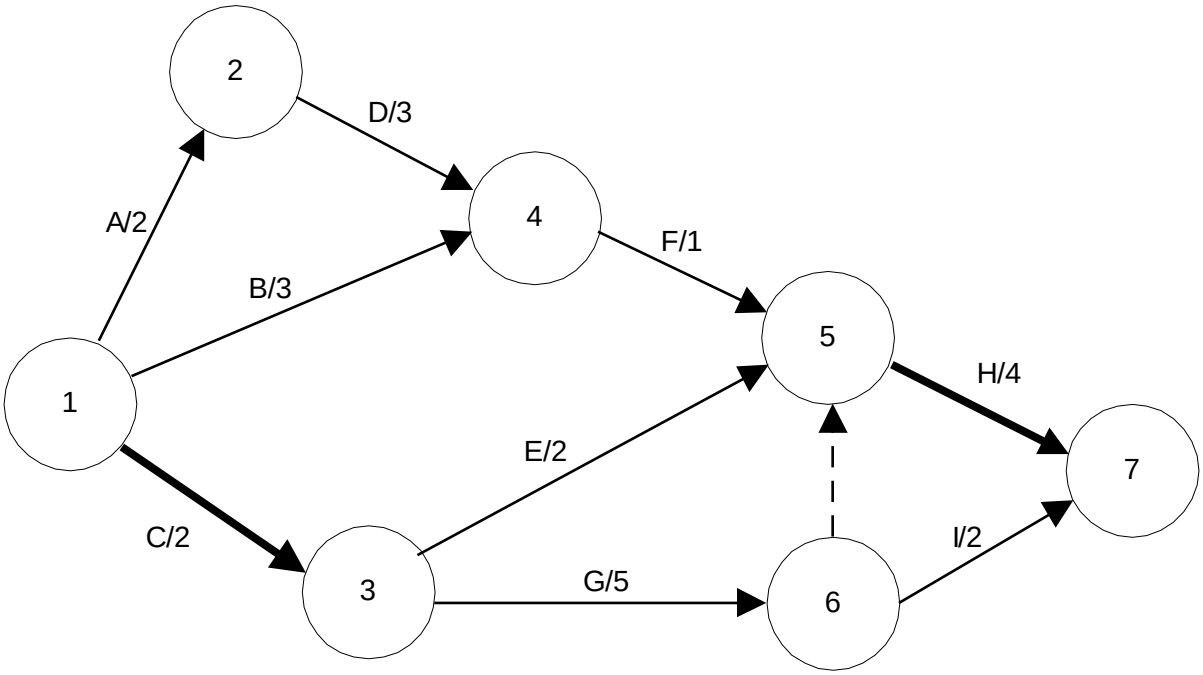
Critical Path Data Table Problem 8

Act.	Duration	Actual	Immediate	Earliest		Latest		Float	Critical
	Est.	Finish	Predecessor	ES	EF	LS	LF	or Slack	Path
A	3	3	*						
B	4	9	A						
C	8	13	A						
D	4	17	B,C						
E	2		D	17	19	17	19	0	X
F	2		E	19	21	19	21	0	X
G	5		F	21	26	21	26	0	X
H	4		F	21	25	22	26	1	
I	3		G,H	26	29	26	29	0	X

No, the project cannot be completed in 27 weeks. Current duration is 29 Weeks.

Focus on EFGI, the remaining items on the critical path, to recover the schedule starting with the nearest activity first. Note that removing more than one week from G makes H critical.

8) Based on the following network, calculate the ES, EF, LS, LF times and slack for each activity. In addition, identify the critical path and the amount of time needed to complete the project. All durations are in weeks. (Note labels on arrows. Numerator is the activity and the denominator is the activity duration.)

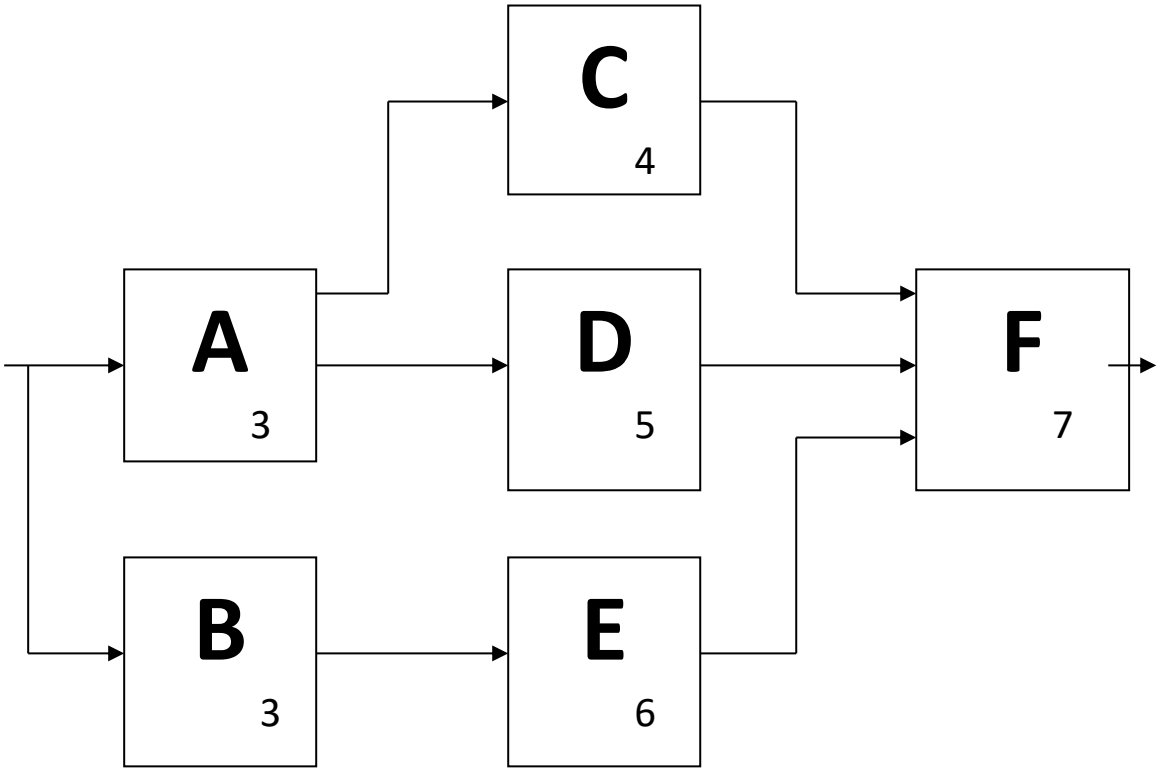


Critical Path Data Table Problem 8

Activity	Duration	Immediate	Earliest		Latest		Float	Critical
	Estimate	Predecessor	ES	EF	LS	LF	or Slack	Path
A	2	*	0	2	1	3	1	
B	3	*	0	3	3	6	3	
C	2	*	0	2	0	2	0	X
D	3	A	2	5	3	6	1	
E	2	C	2	4	5	7	3	
F	1	B,D	5	6	6	7	1	
G	5	C	2	7	2	7	0	X
H	4	E,F,G	7	11	7	11	0	X
I	2	G	7	9	9	11	2	

Project Duration = 11 Weeks **Critical Path: C-G-dummy-H**

9) Based on the following network, calculate the ES, EF, LS, LF times and slack for each activity. In addition, identify the critical path and the amount of time needed to complete the project. All durations are in weeks. (Note: Activity duration is in lower right corner of each box.)



Critical Path Data Table Problem 9

Activity	Duration Estimate	Immediate Predecessor	Earliest ES	Earliest EF	Latest LS	Latest LF	Float or Slack	Critical Path
A	3	*	0	3	1	4	1	
B	3	*	0	3	0	3	0	X
C	4	A	3	7	5	9	2	
D	5	A	3	8	4	9	1	
E	6	B	3	9	3	9	0	X
F	7	C,D,E	9	16	9	16	0	X

Project Duration = 16 Weeks **Critical Path: BEF**

5.3 Schedule Compression Practice Solutions

Case A: The table below reflects the initial schedule developed for a project and the activity Cost-Time Trade-Offs. Assume a linear relationship between estimated and crash time. Activity durations cannot be less than the crash time. (e.g. if crashing an activity costs $3,000 to reduce it by three weeks, reducing it one week costs $1,000). Remember it is necessary to select the correct cost-time trade-offs to get the least cost shortest duration.

Act.	Immediate	Duration (Wks)		Cost ($000)	
	Predecessor	Est.	Crash	Est.	Crash
A	*	4	3	4	8
B	*	6	4	6	12
C	A	6	4	6	10
D	A	9	6	9	15
E	B	12	8	12	20
F	B	3	2	3	5
G	D,E	15	10	30	50
H	C	6	4	12	20
I	F,G,H	9	6	18	30

1) What is the initial project's critical path prior to employing any time savings?
    - CP = **BEGI** (See Problem 1 practice solution, Topic 5.2 Critical Path page 219)
2) What is the initial project's estimated cost and project duration prior to crashing?
    - Project Cost = Sum of estimated activity cost column = **$100,000**
    - Project Duration = Sum of critical activity durations = (6+12+15+9) = **42 weeks**
3) What is the cost/week savings for each activity? Cost values are multiples of $1,000.

Act.	Duration (Wks)		Cost ($000)		Calculations		
	Est.	Crash	Est.	Crash	Cost Diff	Time Diff	Cost/Wk
A	4	3	4	8	4	1	4
B	6	4	6	12	6	2	3
C	6	4	6	10	4	2	2
D	9	6	9	15	6	3	2
E	12	8	12	20	8	4	2
F	3	2	3	5	2	1	2
G	15	10	30	50	20	5	4
H	6	4	12	20	8	2	4
I	9	6	18	30	12	3	4

4) What is the least cost solution for reducing the schedule by three weeks and the resulting total estimated cost at completion (EAC)?
    - Activity E has the least cost/week value on the critical path.
    - Reduce Activity E by three weeks. Cost = 3 x $2,000 = **$6,000**
    - Total Estimated Cost at Completion = EAC = $100,000 + $6,000 = **$106,000**
5) What is the least cost solution for reducing the schedule by six weeks and the resulting total estimated cost at completion?
    - Reduce Activity E by weeks. This is the maximum Activity E can be reduced.
    - Reducing Activity B by 1 week creates a second critical path that requires reductions in Activities B and D at a combined cost of $5000/week. Since Activity G is common to both paths, reduce it to get the sixth week at the lowest cost.
    - Reduce Activity E by 4 weeks. Cost = 4 x $2,000 = **$8,000**
    - Reduce Activity B by 1 week. Cost = 1 x $3,000 = **$3,000**
    - Reduce Activity G by 1 week. Cost = 1 x $4,000 = **$4,000**
    - Reduce schedule by 6 weeks = $8,000 + $3,000 + $4,000 = **$15,000**
    - EAC = $100,000 + $15,000 = **$115,000**
6) What is the total project cost for crashing all activities?
    - Sum of Activity Crash Cost Column = **$170,000**
7) What is the shortest duration to complete the project?
    - Crash everything on critical path and check that other activities stay noncritical within their crash allowance times.
    - Shortest duration = 4 + 8 + 10 + 6 = **28 weeks**
8) What is the least cost to complete the project within the shortest duration?
    - Reduce Activity B by 2 weeks = 2 x $3,000 = **$6,000**
    - Reduce Activity E by 4 weeks = 4 x $2,000 = **$8,000**
    - Reduce Activity G by 5 weeks = 5 x $4,000 = **$20,000**
    - Reduce Activity I by 3 weeks = 3 x $4,000 = **$12,000**
    - Second critical path created requires 1 week reduction in Activity D = **$2,000**
    - Least Cost = $100,000 + $6,000 + $8,000 + $20,000 + $12,000 + $2,000= **$148,000**
9) What is the critical path for the least cost shortest duration project?
    - Two critical Paths: **BEGI and ADGI**

Case B: The table below reflects the current schedule network 27 weeks into the project. Activities A, B, and C are complete, D has completed 11 weeks of the 12-week duration task, and no other activities have started. This case reflects the actual time and cost for completed activities and the cost-time trade-offs for the remaining activities. Assume a linear relationship between estimated and crash times. (e.g. if crashing an activity costs $3,000 to reduce it by three weeks, reducing it one week costs $1,000).

Act.	Immediate	Duration (Wks)			Cost ($000)		
	Predecessor	Est.	Actual	Crash	Est.	Actual	Crash
A	*	15	16	*	30	32	*
B	A	9	11	*	9	12	*
C	A	6	10	*	6	10	*
D	A	12	*	8	24	*	32
E	B	3	*	2	6	*	7
F	B	12	*	9	12	*	18
G	B	9	*	6	18	*	24
H	C,D	6	*	4	12	*	18
I	E,F,G,H	3	*	2	3	*	7

10) What is the original project's estimated cost, critical path, and duration prior to starting? (See practice Problem 2 solution, Topic 5.2 Critical Path on page 220)

- Estimated original cost = Sum the activity cost estimates = **$120,000**
- Critical Path = **ABFI**
- Project Duration = CP duration= ABFI = 15 + 9 + 12 + 3 = **39 weeks**

11) What is the project's current critical path and project duration given the actual data prior to crashing?

- Current Critical Path = **ABFI**
- Project Duration = 16 + 11 + 12 + 3 = **42 weeks**

12) How much behind schedule is the current project?

- **3 weeks**

13) What is the cost/week savings for each remaining activity?

Activity	Duration (Wks)		Cost ($000)		Calculations		
	Est.	Crash	Est.	Crash	Cost Diff	Time Diff	Cost/Time
D	12	8	24	32	8	4	2
E	3	2	6	7	1	1	1
F	12	9	12	18	6	3	2
G	9	6	18	24	6	3	2
H	6	4	12	18	6	2	3
I	3	2	3	7	4	1	4

14) What is the least cost solution for recovering the original schedule and the resulting total estimated cost at completion (EAC)?

- Activity F has the least cost/week value on the critical path.
- Reduce Activity F by three weeks. Cost = 3 x $2,000 = **$6,000**
- EAC = **Act. Cost (ABC) + Est. Cost (DEFGHI) + Cost of reducing F by 3 weeks**
- EAC = 54,000 + 75,000 + 6,000 = **$135,000**

15) What is the total project cost for crashing the remaining activities?

- EAC = **Actual Cost (ABC) + Crash Cost (DEFGHI)**
- EAC = 54,000 + 106,000 = **$160,000**

16) What is the shortest duration to complete the project?

- Crash everything on critical path and check that other activities stay noncritical within their crash allowance times.
- Duration = Actual completed Times for A and B + Crash Times for F and I
- Duration = (16 + 11) + (9 + 2) = **38 weeks**

17) What is the least cost to complete the project within the shortest duration?

- Reduce Activity F by 3 weeks = 3 x $2,000 = **$6,000**
- Reduce Activity I by 1 weeks = 1 x $4,000 = **$4,000**
- Least cost for to get shortest schedule = 6000 + 4000 = **10,000**
- EAC = **Actual Cost (ABC) + Estimated Cost (DEFGHI) + Least cost reduction**
- EAC = 54,000 + 75,000 + 10,000 = **$139,000**

18) What is the critical path for the least cost shortest duration project?

- Two Critical Paths: **ABFI and ABGI**

5.4 Earned Value Practice Solutions

Case F: The following data tables represent the budgeted, actual, and earned value of work completed for each task in each week, respectively, covering three weeks into a 5-week project.

Budgeted Cost

Task	Week					Total Budgeted Cost
	1	2	3	4	5	
A	20	20	20	20		80
B		40	20	20		100
C		20	20			40
D	10	10	20	20	20	80

Actual Cost

Task	Week		
	1	2	3
A	20	20	20
B		30	30
C		0	20
D	5	5	10

Earned Value Work Completed

Task	Week		
	1	2	3
A	20	20	20
B		30	30
C		0	20
D	10	10	20

Using the data from these tables answer the following questions:

1) What is the cumulative planned cost at the end of Week 3?
    - Add all values for all tasks in Weeks 1 thru 3 of the Budgeted Cost Table
    - Cum PV = (20+20+20) + (40+20) + (20+20) + (10+10+20) = **200**
2) What is the cumulative actual cost at the end of Week 3?
    - Add all values for all tasks in Weeks 1 thru 3 of the Actual Cost Table
    - Cum AC = (20+20+20) + (30+30) + 20 + (5+5+10) = **160**
3) What is the cumulative earned value at the end of Week 3?
    - Add all values for all tasks in Weeks 1 thru 3 of the Earned Value Table
    - Cum EV = (20+20+20) + (30+30) + 20 + (10+10+20) = **180**
4) What is the cost performance index at the end of Week 3?
    - Divide the Cum EV by the Cum AC. Greater than 1 is good.
    - CPI = 180/160 = **1.125 Under Budget**

5) What is the schedule performance index at the end of Week 3?
   - Divide the Cum EV by the Cum PV. Less than 1 is bad.
   - SPI = 180/200 = **0.9** **Behind Schedule**
6) What is the cost variance at the end of Week 3?
   - Week 3 Variance = Earned Value – Actual Cost = 180 – 160 = **20**
7) What is the Forecasted Estimate at Completion (EAC) assuming 100% efficiency for balance of project and the resulting total variance?
   - EAC = 160 + [(300 – 180) / 1.0] = 160 + [120/1.0] = 160 + 120 = **280**
   - Total Variance = 300 – 280 = **20** (Note: At 100% efficiency for balance of the project, the project cost variance does not change after week 3.)
8) What is the Forecasted EAC assuming the same efficiency achieved for Weeks 1-3 for balance of project and the resulting total cost variance?
   - EAC = 160 + [(300-180) / 1.125] = 160 + [120 / 1.125] = 160 + 107 = **267**
   - Project Variance = 300 – 267 = **33**

9.) What is the cost status (over or under budget) and the schedule status (ahead or behind schedule)?

- **Under Budget** and **Behind Schedule** (See questions 4 and 5 above)

Case G: The following data tables represent the budgeted, actual, and earned value of work completed for each task in each week respectively covering four weeks into a 7-week project.

Budgeted Cost

Task	Week							Total Budgeted Cost
	1	2	3	4	5	6	7	
A	10	10	10					30
B		10	20	20	20	20		90
C			10	10	10	10	10	50
D					10	10	10	30

Actual Cost

Task	Week			
	1	2	3	4
A	10	10	10	10
B		20	30	20
C			20	20
D				

Earned Value of Work Completed

Task	Week			
	1	2	3	4
A	10	5	5	10
B		20	20	20
C			15	15
D				

Using the data from the preceding tables answer the following questions:

10) What is the cumulative planned cost at the end of Week 4?

- Add all values for all tasks in weeks 1 thru 4 of the Budgeted Cost Table
- Cum PV = (10+10+10) + (10+20+20) + (10+10) = **100**
-

11.) What is the cumulative actual cost at the end of Week 4?

- Add all values for all tasks in Weeks 1 thru 4 of the Actual Cost Table
- Cum AC = (10+10+10+10) + (20+30+20) + (20+20)= **150**

12.) What is the cumulative earned value at the end of Week 4?

- Add all values for all tasks in Weeks 1 thru 4 of the Earned Value table
- Cum EV = (10+5+5+10)+(20+20+20)+(15+15) = **120**

13.) What is the cost performance index at the end of Week 4?

- Divide the Cum Earned Value by the Cum Actual Cost. Less than 1 is bad.
- CPI = 120/150 = **0.80** **Over Budget**

14.) What is the schedule performance index at the end of Week 4?

- Divide the Cum Earned Value by the Cum Planned Value. Greater than 1 is good.
- SPI = 120/100 = 1.20 **Ahead of Schedule**

15.) What is the cost variance at the end of Week 4?

- Week 4 Variance = Earned Value – Actual Cost = 120 – 150 = (**30)**

16.) What is the Forecasted Estimate at Completion (EAC) assuming 100% efficiency for balance of project and the resulting total variance?

- EAC = 150 + [(200 – 120) / 1.0] = 150 + [80/1.0] = 150 + 80 = **230**
- Project Variance = 200 – 230 = (30) (Note: At 100% efficiency the variance does not change after Week 4.)

17.) What is the Forecasted Estimate at Completion (EAC) assuming the same efficiency achieved for Weeks 1-4 for balance of project and the resulting total cost variance?

- EAC = 150 + [(200-120) / 0.80] = 150 + [80 / 0.80] = 150 + 100 = **250**
- Project Variance = 200 – 250 = **(50)**

18) What is the cost status (over or under budget) and the schedule status (ahead or behind schedule)?

- **Over Budget and Ahead of Schedule** (See preceding questions 13 and 14)

Case H: Project X has a total budget of $4,000. According to the schedule, $2,000 of work is to be complete by week ten. By week ten, the project cost is $1,600 and the budgeted value of the work completed is $1,400.

19.) From the project description, determine the following:

Project Budget = **$4,000**

Earned Value (EV) = **$1,400**

Planned Value (PV) = **$2,000**

Actual Cost (AC) = **$1,600**

20.) Calculate the Performance Indices:

CPI = EV/AC = 1400/1600 = **0.875**

SPI = EV/PV = 1400/2000 = **0.70**

CV = EV – AC = 1400 – 1600 = **-$200**

SV = EV – PV = 1400 – 2000 = **-$600**

21.) Determine project status: (under or over budget, and ahead or behind schedule)

Budget status = **Over Budget by $200**

Schedule Status = **Behind Schedule by 30%**

22 Thru 24.) Compute EAC and variance for assigned efficiency value for balance of project

EAC and Cost Variance Table			
Prob.	**Efficiency Value**	**Estimate @ Completion**	**Cost Variance @ End of Project**
22.)	87.5%	1600+ [(4000-1400)/0.875] = **$4571**	4000-4571= **-$571**
23.)	100.0%	1600 + [4000-1400] = **$4200**	4000-4200= **-$200**
24.)	92.0%	1600 + [(4000-1400)/0.92]= **$4426**	4000-4426= **-$426**