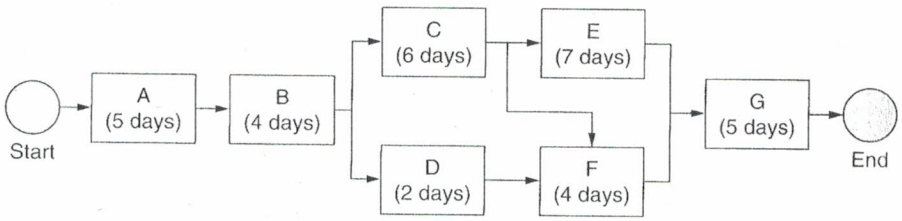
SAMPLE SOLVED PROBLEMS

1. Assume the following network diagram:



Time Required (Days)			Cost ($)		Extra Crashing Cost Per Saved Day ($)
Activity	Normal	Crash	Normal	Crash	
	Col A	Col B	Col C	Col D	Col D – Col C/(Col A – Col B)
A	5	2	10,000	12,000	666.67
B	4	2	15,000	22,500	3,750
C	6	1	4,500	8,000	700
D	2	1	6,000	12,000	6,000
E	7	3	34,000	40,000	1,500
F	4	2	14,000	20,000	3,000
G	5	2	5,000	30,000	8,333.34

Which of the activities would you crash and in what order?

Step 1: Find the critical path.

Using the precedence diagramming method, you can chart the different paths as follows:

Start – Task A – Task B – Task C – Task E – Task G – End	27 days
Start – Task A – Task B – Task D – Task F – Task G – End	20 days
Start – Task A – Task B – Task C – Task F – Task G – End	24 days

The critical path is "Start – Task A – Task B – Task C – Task E – Task G – End" with a duration of 27 days. So now you know that these are the tasks that you need to crash.

Step 2: Find the order in which to crash costs.

After you identify which critical-path tasks you need to crash, the order in which they should be crashed is determined by the crash cost. Tasks with lower crash costs should be crashed before those with higher crash costs.

Listed below are the tasks in ascending order of their crash cost.

Task	Crash Cost ($)
A	666.67
C	700
E	1,500
B	3,750
G	8333.34

Thus the crash order should be tasks A, C, E, B, G.

EXERCISE PROBLEMS

1. Consider activities A, B, and D that are on the critical path. Activities E and C are in the near-critical path.

Task	Normal Time (weeks)	Crash Time (weeks)	Normal Cost ($)	Crash Cost ($)
A	5	3	12,000	14,000
B	6	3	14,000	20,000
C	4	2	16,000	18,000
D	5	3	15,000	25,000
E	4	2	11,000	12,000

Which of the following lists the tasks in the correct crashing order?

A. Tasks C, B, D
B. Tasks B, D, A
C. Tasks A, B, D
D. Tasks C, E, A

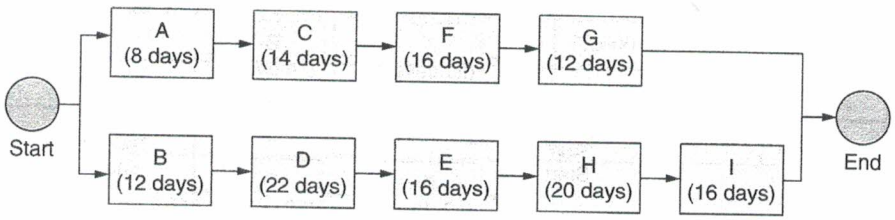
2. Activities A, B, C, D, E, and F are on the critical path.

Task	Normal Time (weeks)	Crash Time (weeks)	Normal Cost ($)	Crash Cost ($)
A	10	5	14,000	22,000
B	15	5	20,000	26,000
C	12	8	28,000	34,000
D	20	10	26,000	36,000
E	14	10	22,000	42,000
F	16	6	13,000	33,000

Which of the following lists the tasks in the correct crashing order ?

A. Tasks B, D, C, A, F, E
B. Tasks B, C, D, A, E, F
C. Tasks B, A, D, A, F, E
D. Tasks E, F, A, C, D, B

3. Consider the following network diagram:



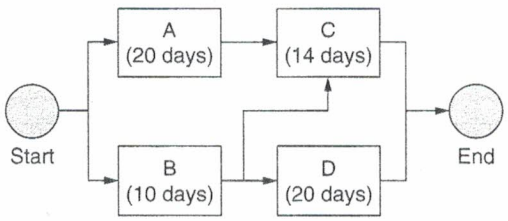
Some of these tasks can be crashed, but crashing involves extra costs, as shown in the following table:

Activity	Time Required (Days)		Cost ($)		Extra Crashing Cost Per Saved Day ($)
	Normal	Crash	Normal	Crash	
A	8	6	14,000	22,000	4,000
B	12	6	20,000	26,000	1,000
C	14	10	30,000	32,000	500
D	22	14	26,000	36,000	1,250
E	16	12	22,000	42,000	5,000
F	16	6	13,000	33,000	2,000
G	12	8	22,000	28,000	1,500
H	20	15	8,000	12,000	800
I	16	12	16,000	26,000	2,500

Which of the following lists the tasks that can be crashed in the correct order?

A. Tasks B, D, E, H, I
B. Tasks H, B, D, I, E
C. Tasks B, A, D
D. Tasks A, C, F, G

4. Consider the following network diagram:



Some of these tasks can be crashed, but crashing involves extra costs, as shown in the following table:

Activity	Time Required (Days)		Cost ($)		Extra Crashing Cost Per Saved Day ($)
	Normal	Crash	Normal	Crash	
A	20	15	8,000	12,000	800
B	10	5	20,000	22,000	400
C	14	10	30,000	32,000	500
D	20	16	26,000	30,000	1,000

Which of the following lists the tasks that can be crashed in the correct order?

A. Tasks B, C, A, D
B. Tasks B, D, C
C. Tasks A, C
D. Tasks C, A

5. A certain project has a float of –6 months. Given the following information, which activities would you crash and in what order?

Activity	Normal Time (months)	Crash Time (months)	Time Saved (months)	Normal Cost ($)	Crash Cost ($)	Extra Cost for Crashing ($)	Extra Crashing Cost Per Saved Month ($)
A	8	6	2	14,000	22,000	8,000	4,000
B	12	6	6	20,000	26,000	6,000	1,000
C	14	10	4	30,000	32,000	2,000	500
D	22	14	8	26,000	36,000	10,000	1,250
E	16	12	4	22,000	42,000	20,000	5,000

A. Task B
B. Tasks A, C
C. Tasks A, E
D. Tasks D, E

6. A certain project has a float of −5 months. Given the following information, which activities would you crash and in what order?

Activity	Normal Time (months)	Crash Time (months)	Time Saved (months)	Normal Cost ($)	Crash Cost ($)	Extra Cost for Crashing ($)	Extra Cost Per Saved Month ($)
A	8	6	2	16,000	22,000	6,000	3,000
B	12	9	3	20,000	26,000	6,000	2,000
C	14	12	2	30,000	38,000	8,000	4,000
D	23	20	3	30,000	33,000	3,000	1,000
E	16	11	5	22,000	39,000	17,000	3,400

A. Tasks A and B
B. Task E
C. Tasks A and D
D. Tasks C and D

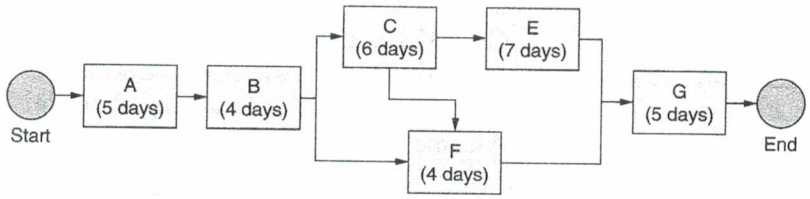
7. Activities A, B, and E are on the critical path. Activities D and C are on the near-critical path.

Task	Normal Time (weeks)	Crash Time (weeks)	Normal Cost ($)	Crash Cost ($)
Task A	8	6	16,000	22,000
Task B	12	9	20,000	26,000
Task C	14	12	30,000	38,000
Task D	23	20	30,000	33,000
Task E	16	11	22,000	39,000

Which of the following lists the tasks that can be crashed in the correct crashing order?

A. Tasks B, A, E
B. Tasks A, B, E
C. Tasks A, B, C, D
D. Tasks A, B, C, D, E

8. Assume the following network diagram:



	Time Required (Days)		Cost ($)		Extra Crashing Cost Per Saved Day ($)
Activity	Normal	Crash	Normal	Crash	
	Col A	Col B	Col C	Col D	Col D – Col C/(Col A – Col B)
A	5	2	10,000	10,600	200
B	4	2	15,000	15,650	325
C	6	1	8,000	8,500	100
E	7	3	40,000	41,000	250
F	4	2	20,000	20,750	375
G	5	2	5,000	5,900	300

Which of the following lists the tasks that can be crashed in the correct crashing order?

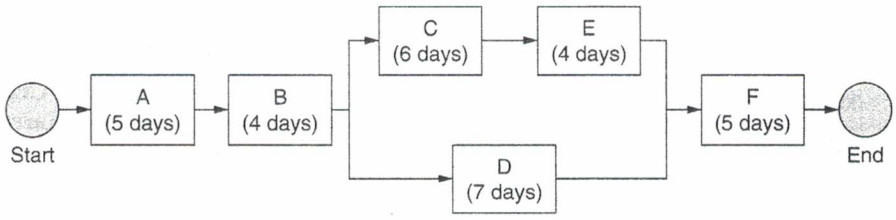
A. Tasks A, B, C
B. Tasks A, B, C, E
C. Tasks A, B, C, E, G
D. Tasks C, A, E, G, B

9. A certain project has a float of –5 months. Given the following information, which activities would you crash and in what order?

Activity	Normal Time (months)	Crash Time (months)	Time Saved (months)	Normal Cost ($)	Crash Cost ($)	Extra Cost for Crashing ($)	Extra Cost Per Saved Month ($)
A	5	2	3	10,000	10,600	600	200
B	4	2	2	15,000	15,650	650	325
C	6	1	5	8,000	12,000	4,000	800
D	5	2	3	5,000	5,900	900	300
E	4	2	2	20,000	20,750	750	375

A. Tasks A, B
B. Task C
C. Tasks A, E
D. Tasks D, E

10. Assume the following network diagram:



	Time Required (Days)		Cost ($)		Extra Crashing Cost Per Saved Day ($)
Activity	**Normal**	**Crash**	**Normal**	**Crash**	
	Col A	**Col B**	**Col C**	**Col D**	**Col D – Col C/(Col A – Col B)**
A	5	2	25,000	28,000	1000
B	4	2	30,000	36,000	3000
C	6	1	45,000	52,000	1400
D	7	3	40,000	52,000	3000
E	4	2	60,000	72,000	6000
F	5	2	21,000	25,500	1500

Which of the following lists the tasks that can be crashed in the correct crashing order?

A. Tasks A, B, C, E, F
B. Tasks A, C, F, B
C. Tasks A, C, F
D. Tasks A, C, F, B, E

Exercise Answers

1. **C**

   In this case, the extra crashing cost per saved week has not been given. So you need to compute that amount.

   Because only tasks A, B, and D are in the critical path, you need to compute the crashing cost for only those activities.

   To compute the extra crashing cost per saved week, first compute the number of saved weeks = normal time – crash time.

   Second, find the difference between the crash cost and normal cost.

   Third, divide the difference in cost by the difference in weeks, as shown in the table below.

	Time Required (Weeks)		Cost ($)		
Activity	**Normal**	**Crash**	**Normal**	**Crash**	**Extra Crashing Cost Per Saved Week ($)**
	Col A	**Col B**	**Col C**	**Col D**	**Col D – Col C/(Col A – Col B)**
A	5	3	12,000	14,000	= 14,000 – 12,000/(5 – 3) = $1,000 per week
B	6	3	14,000	20,000	= 20,000 – 14,000/(6 – 3) = $2,000 per week
D	5	3	15,000	25,000	= 25,000 – 15,000/(5 – 3) = $5,000 per week

   The order in which the tasks should be crashed is **A, B, D.**

2. **A**

   Because all the activities are in the critical path, you need to compute the crashing cost for all of them, as shown in the following table:

	Time Required (Weeks)		Cost ($)		Extra Crashing Cost Per Saved Week ($)
Activity	Normal	Crash	Normal	Crash	
	Col A	Col B	Col C	Col D	Col D – Col C/(Col A – Col B)
Task A	10	5	14,000	22,000	= 22,000 – 14,000/(10 – 5) = $1,600 per week
Task B	15	5	20,000	26,000	= 26,000 – 20,000/(15 – 5) = $600 per week
Task C	12	8	28,000	34,000	= 34,000 – 28,000/(12 – 8) = $1,500 per week
Task D	20	10	26,000	36,000	= 36,000 – 26,000/(20 – 10) = $1,000 per week
Task E	14	10	22,000	42,000	= 42,000 – 22,000/(14 – 10) = $5,000 per week
Task F	16	6	13,000	33,000	= 33,000 – 13,000/(16 – 6) = $2,000 per week

The order in which the tasks should be crashed is **B, D, C, A, F, E**

3. **B**
   First, find the critical path: B, D, E, H, I.

   Because you are given the extra crashing cost per saved day for these tasks, all you need to do is arrange the tasks on the critical path in ascending order of their crashing cost.

   The correct order is **H, B, D, I, E.**

4. **D**
   First, find the critical path: A, C.

   Because you are given the extra crashing cost per saved day for these tasks, all you need to do is arrange the tasks on the critical path in ascending order of their crashing cost.

   The correct order is **C, A.**

5. **A**
   The different combinations to save 6 months are as follows:

Tasks	Cost ($)
Task B	1,000
Tasks A and C	4,500
Tasks A and E	9,000

The task that has the least cost is **Task B,** so that should be the task to crash.

6. **B**

Tasks	Cost ($)
Task E	3,400
Tasks A and B	5,000
Tasks A and D	4,000
Tasks C and B	6,000
Tasks D and C	5,000

The task that has the least cost is **Task E,** so that should be the task to crash.

7. **A**

Because tasks A, B, and E are on the critical path, you need to compute the extra crashing cost per saved week for each of them.

	Time Required (Weeks)		Cost ($)		Extra Crashing Cost Per Saved Week ($)
Activity	Normal	Crash	Normal	Crash	
	Col A	Col B	Col C	Col D	Col D – Col C/(Col A – Col B)
Task A	8	6	16,000	22,000	= 22,000 – 16,000/(8 – 6) = $3,000 per week
Task B	12	9	20,000	26,000	= 26,000 – 20,000/(12 – 9) = $2,000 per week
Task E	16	11	22,000	39,000	= 39,000 – 22,000/(16 – 11) = $3,400 per week

The crashing order should be **B, A, E.**

8. **D**
In the network diagram, the critical path is "Start – A – B – C – E – G – End." Because you are given the extra crashing cost per saved day, all you need to do is arrange the tasks on the critical path in ascending order of their crashing cost savings: **C, A, E, G, B.**

9. **A**
The following tasks or task combinations can each save 5 months of time.

Tasks	Cost ($)
Task C	800
Tasks A and B	525
Tasks A and E	575
Tasks D and B	625
Tasks D and E	675

The combination that has the least cost is **Tasks A and B.** Therefore, they are the ones that should be crashed.

10. **D**
The critical path is A, B, C, E, and F. The crash order should be in ascending order of the crash cost per week, that is **A, C, F, B, E.**