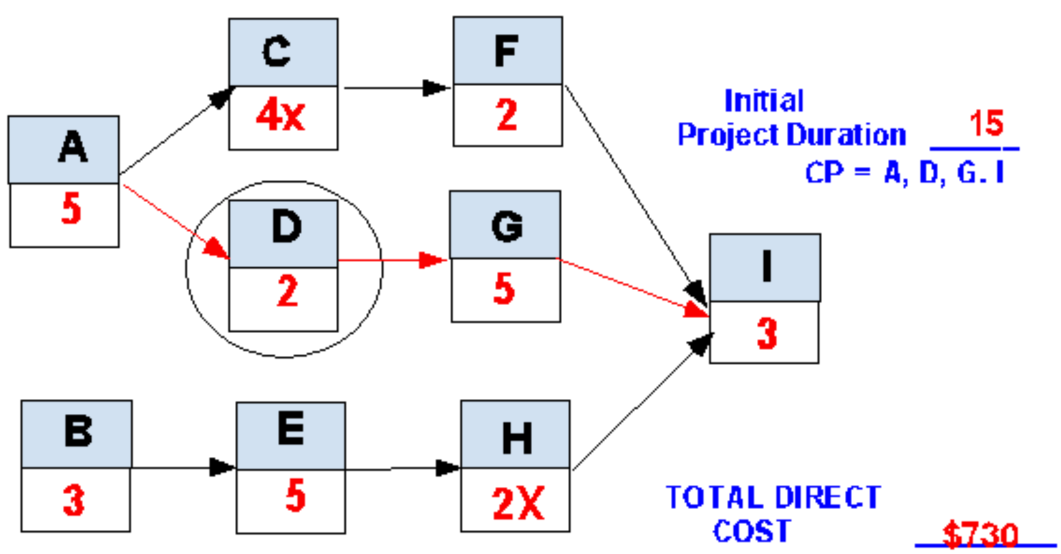
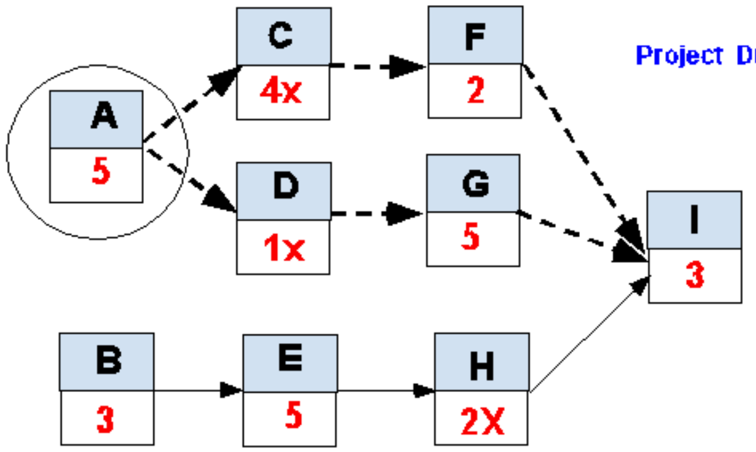
1. Given the data and information that follow, compute the total direct cost for each project duration. If the indirect costs for each project duration are $90 (15 time units), $70 (14), $50 (13), $40 (12), and $30 (11), compute the total project cost for each duration. What is the optimum cost-time schedule for the project? What is this cost?

ACT.	NORMAL TIME	NORMAL COST	MAXIMUM CRASH TIME	CASH COST (per week)
A	5	50	1	20
B	3	60	2	60
C	4	70	0	0
D	2	50	1	10
E	5	100	3	60
F	2	90	1	100
G	5	50	1	30
H	2x	60	0	40
I	3	200	1	200
		$730		





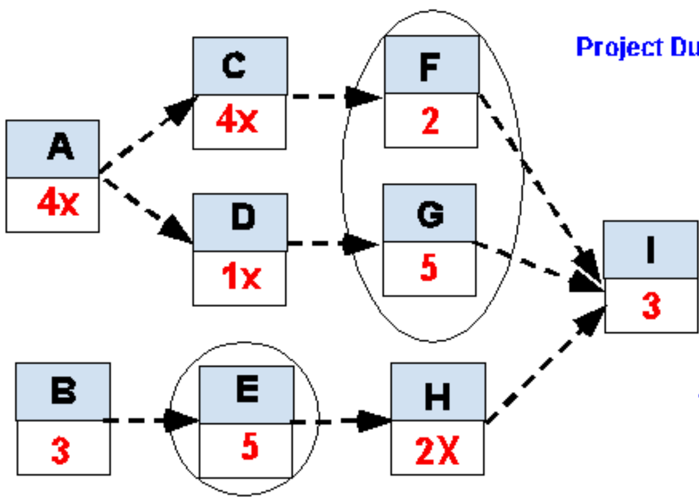
Project Duration 14

Activities changed

D

$10

Total Direct Co st $740



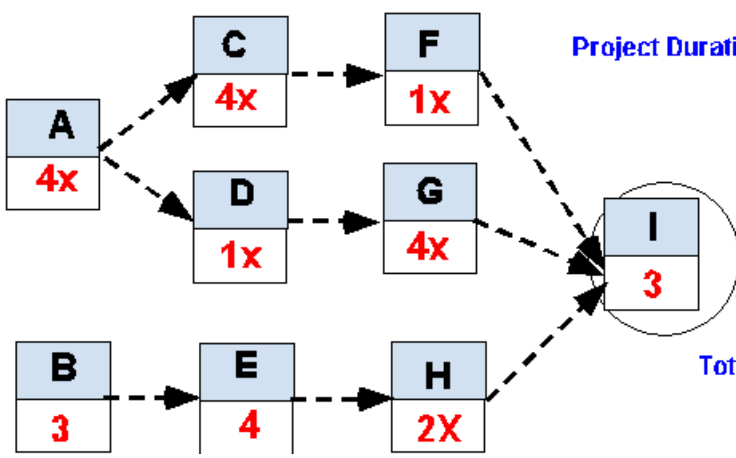
Project Duration 13

Activities changed

A

$20

Total Direct Cost $760



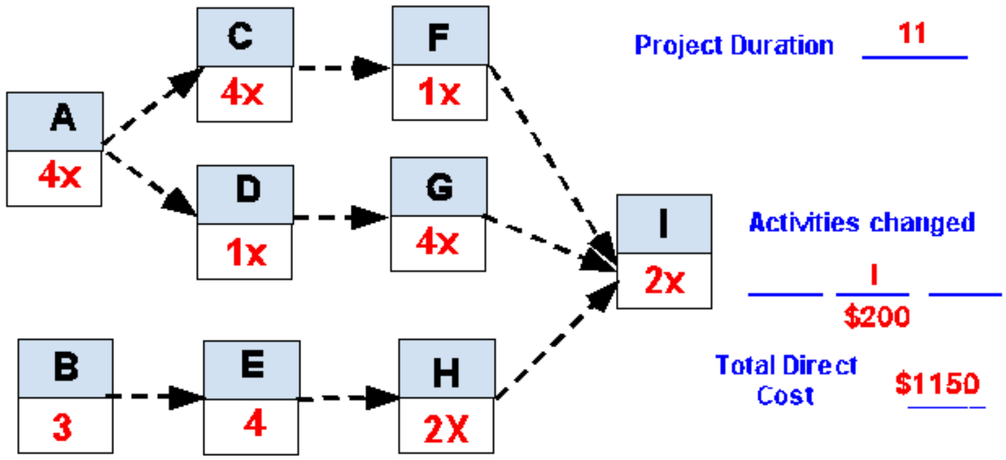
Project Duration 12

Activities changed

E F G

$60 $100 $30

Total Direct Cost $950

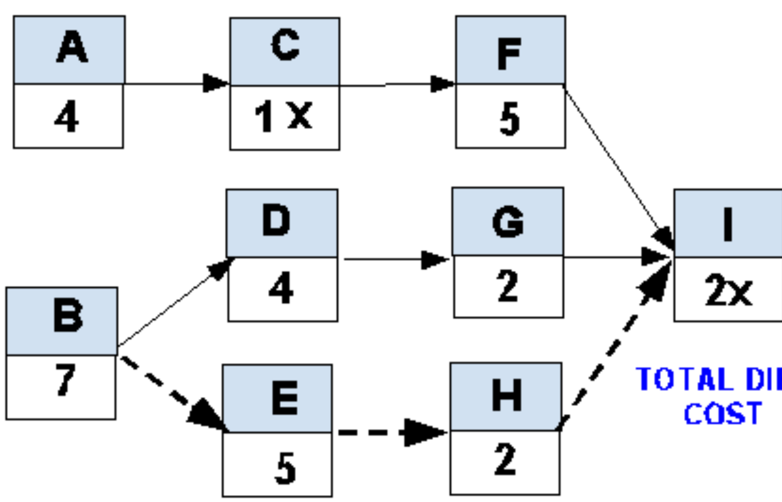


PROJECT DURATION	15	14	13	12	11
TOT. DIRECT COST	730	740	760	950	1150
TOT. INDIRECT COST	90	70	50	40	30
TOTAL COSTS	820	810	810	990	1180

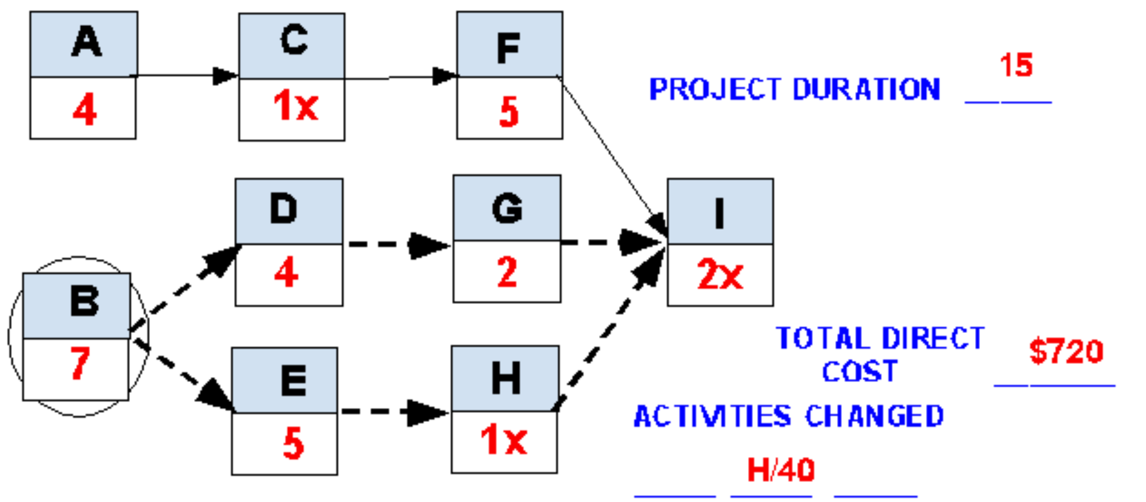
2. If the indirect costs for each duration are $1,200 for 16 weeks, $1,130 for 15 weeks, $1,000 for 14 weeks, $900 for 13 weeks, $860 for 12 weeks, $820 for 11 weeks and $790 for 10 weeks, compute the total costs for each duration. Plot these costs on a graph. What is the optimum cost-time schedule?

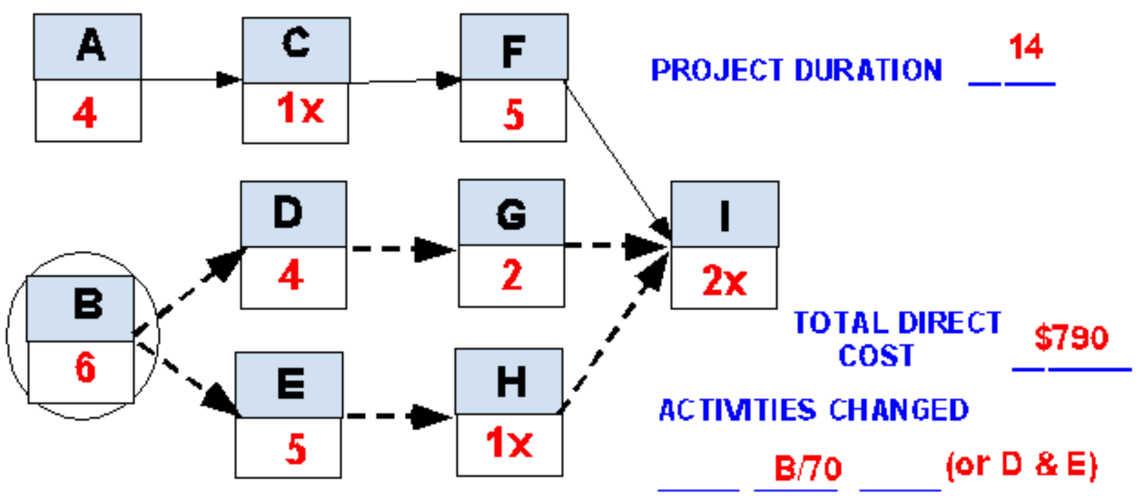
ACT.	NORMAL TIME	NORMAL COST	MAXIMUM CRASH TIME	CRASH COST (SLOPE)
A	4	30	1	10
B	7	60	2	70
C	1	80	0	0
D	4	40	2	20
E	5	110	3	50
F	5	90	3	200
G	2	60	1	30
H	2	70	1	40
I	2	140	0	0
		$ 6 80		

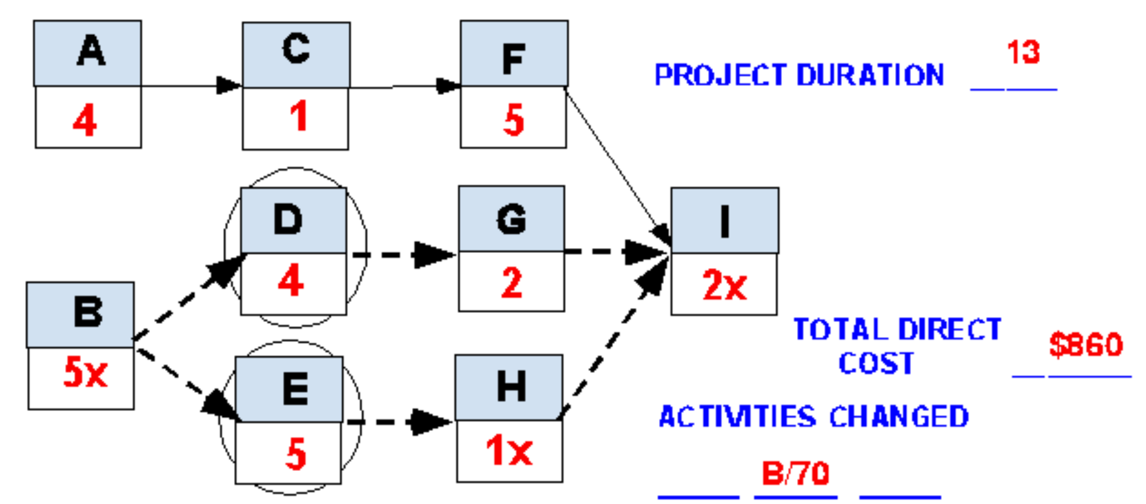
PROJECT DURATION 16



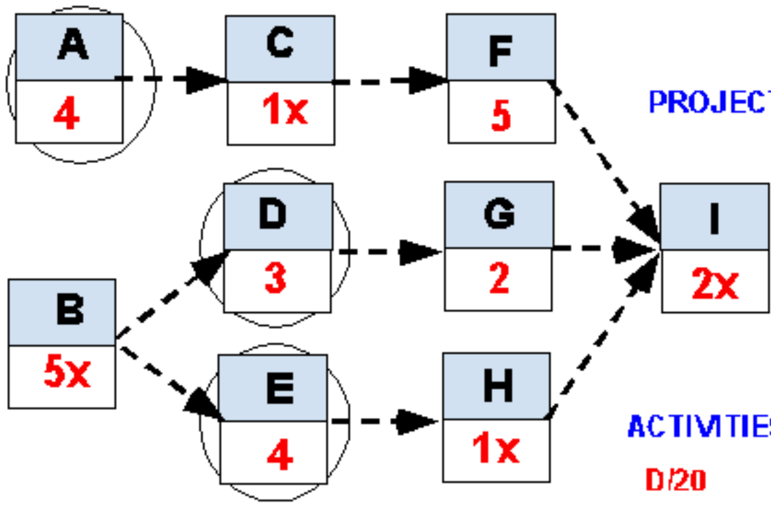
TOTAL DIRECT COST $ 680







For duration 14, B is chosen over D & E because it is the earliest task. If problems occur, you can crash D or E.

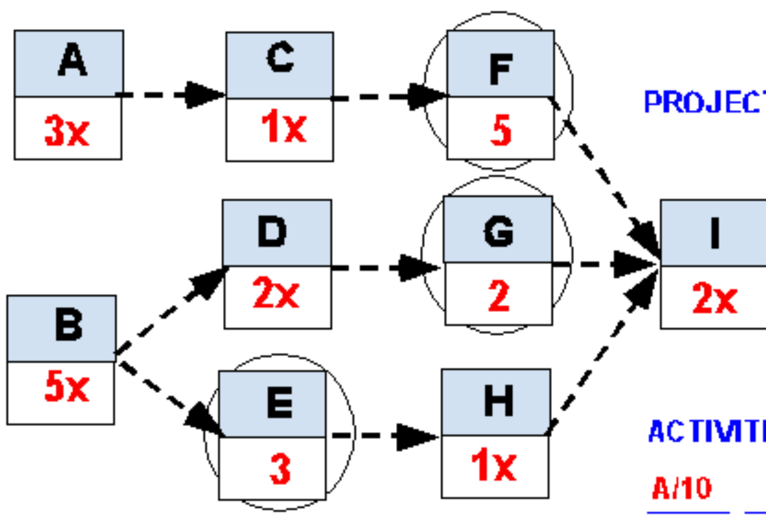


PROJECT DURATION 12

TOTAL DIRECT COST $930

ACTIVITIES CHANGED

D/20 E/50

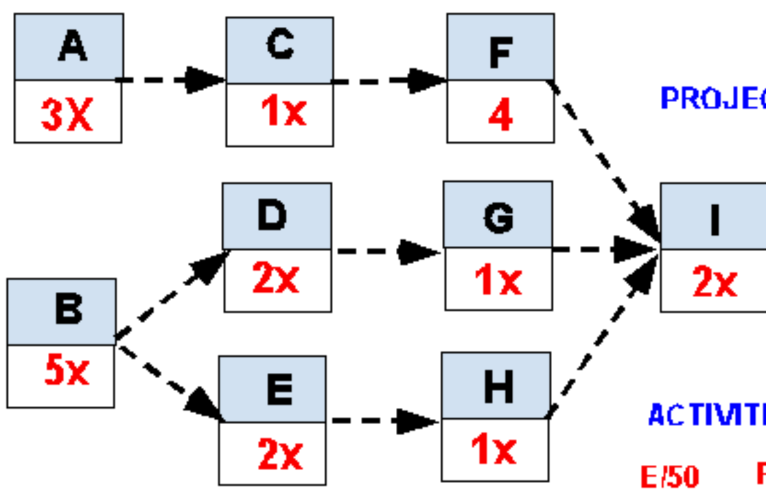


PROJECT DURATION 11

TOTAL DIRECT COST $1010

ACTIVITIES CHANGED

A/10 D/20 E/50



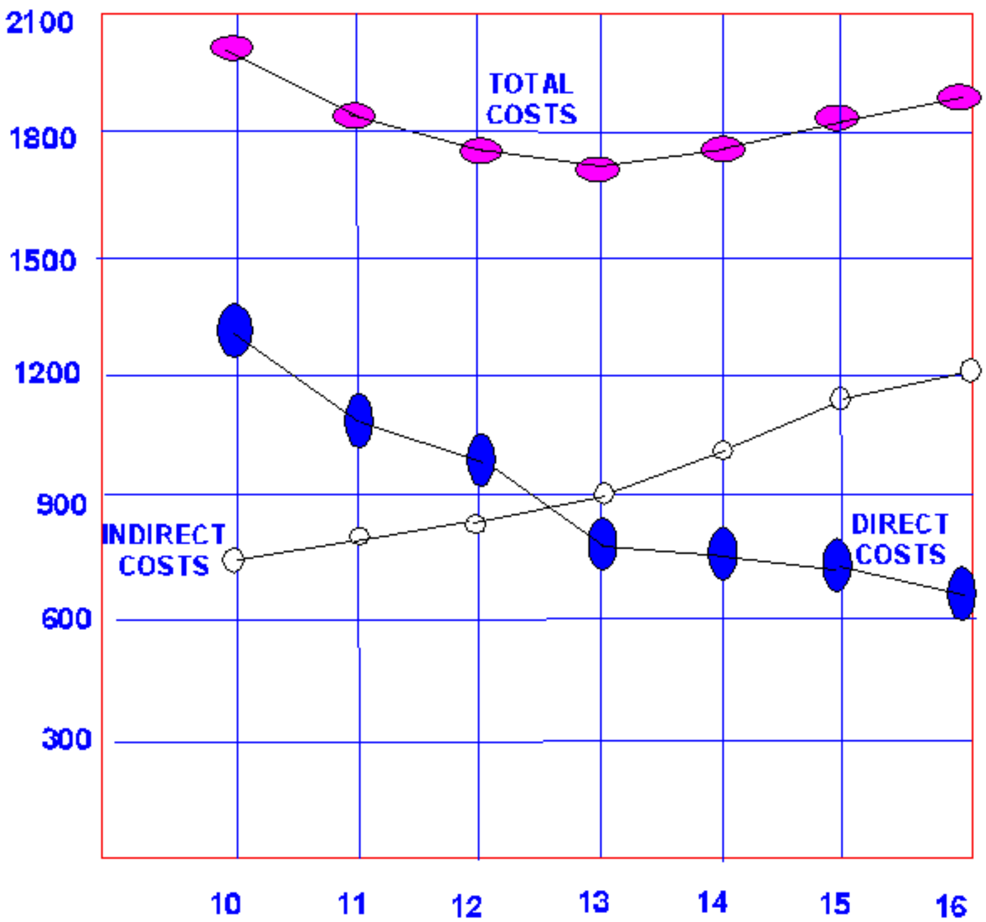
PROJECT DURATION 10

TOTAL DIRECT COST $1290

ACTIVITIES CHANGED

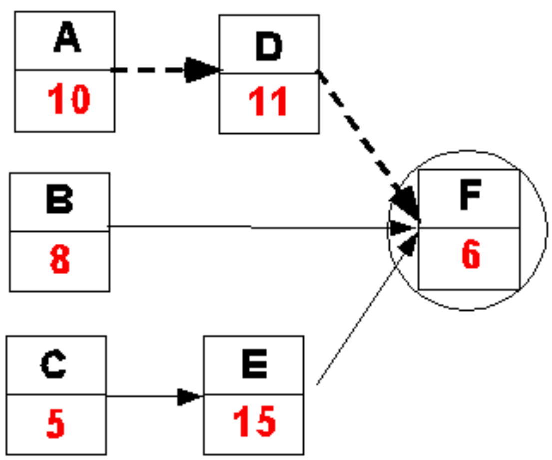
E/50 F/200 G/30

PROJECT DURATION	DIRECT COSTS	INDIRECT COSTS	TOTAL COSTS
10	1290	790	2080
11	1010	820	1830
12	930	860	1790
13	860	900	1760
14	790	1000	1790
15	720	1130	1850
16	680	1200	1880



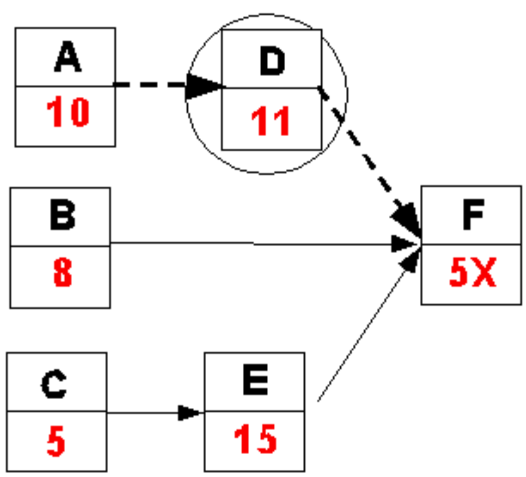
3. **If the indirect costs for each duration are \$300 for 27 weeks, \$240 for 26 weeks, \$180 for 25 weeks, \$120 for 24 weeks, \$60 for 23 weeks, and \$50 for 22 weeks, compute the direct, indirect and total costs for each duration. What is the optimum cost-time schedule? The customer offers you \$10 dollars for every week you shorten the project from your original network. Would you take it? If so for how many weeks?**

ACT.	NORMAL TIME	NORMAL COST	MAXIMUM CRASH TIME	CASH COST (per week)
A	10	40	2	80
B	8	10	3	30
C	5	80	1	40
D	11	50	2	50
E	15	100	4	100
F	6	20	1	30
		300		



PROJECT DURATION 27

TOTAL DIRECT COST $300

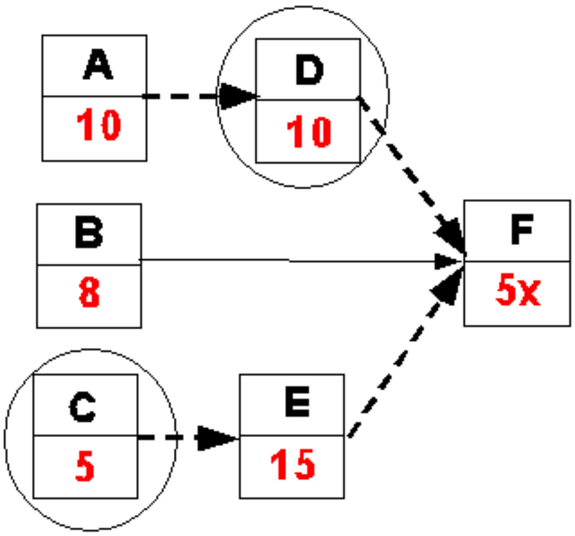


PROJECT DURATION 26

TOTAL DIRECT COST $330

ACTIVITIES CHANGED

F/30

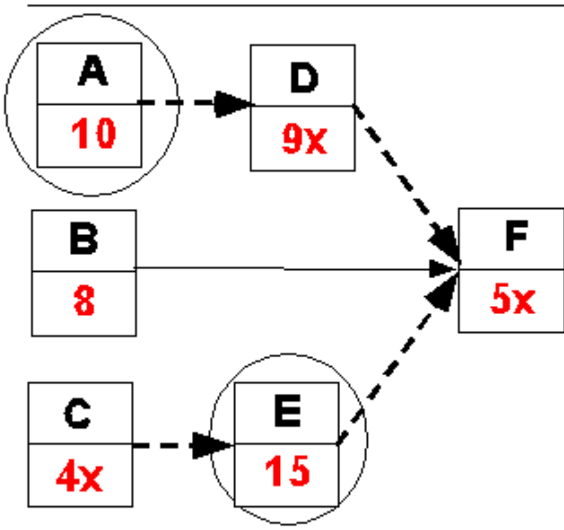


PROJECT DURATION 25

TOTAL DIRECT COST $380

ACTIVITIES CHANGED

D/50

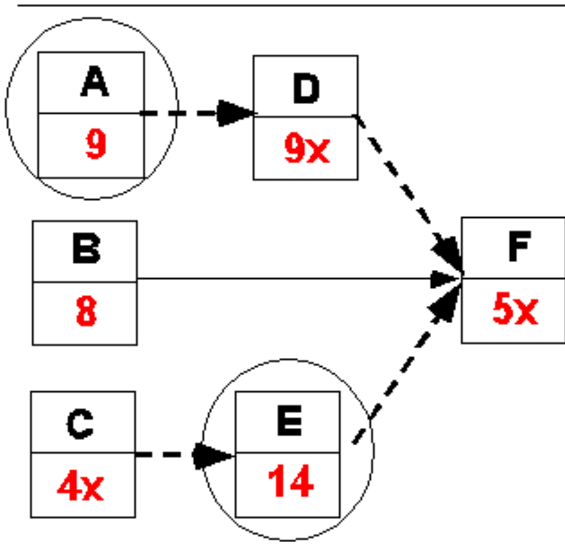


PROJECT DURATION 24

TOTAL DIRECT COST $470

ACTIVITIES CHANGED

C/40 D/50



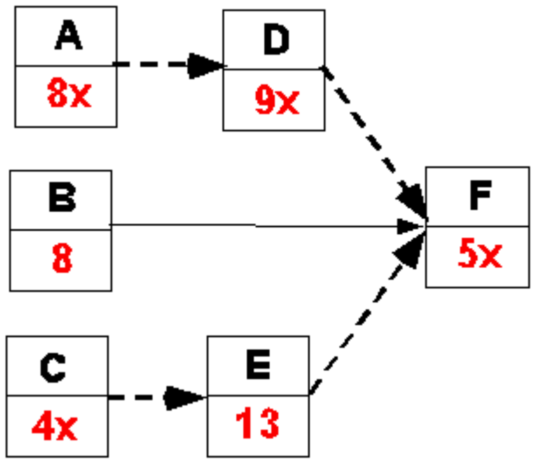
PROJECT DURATION 23

TOTAL DIRECT COST $650

ACTIVITIES CHANGED

A/80 E/100

5c



PROJECT DURATION 22

TOTAL DIRECT COST $830

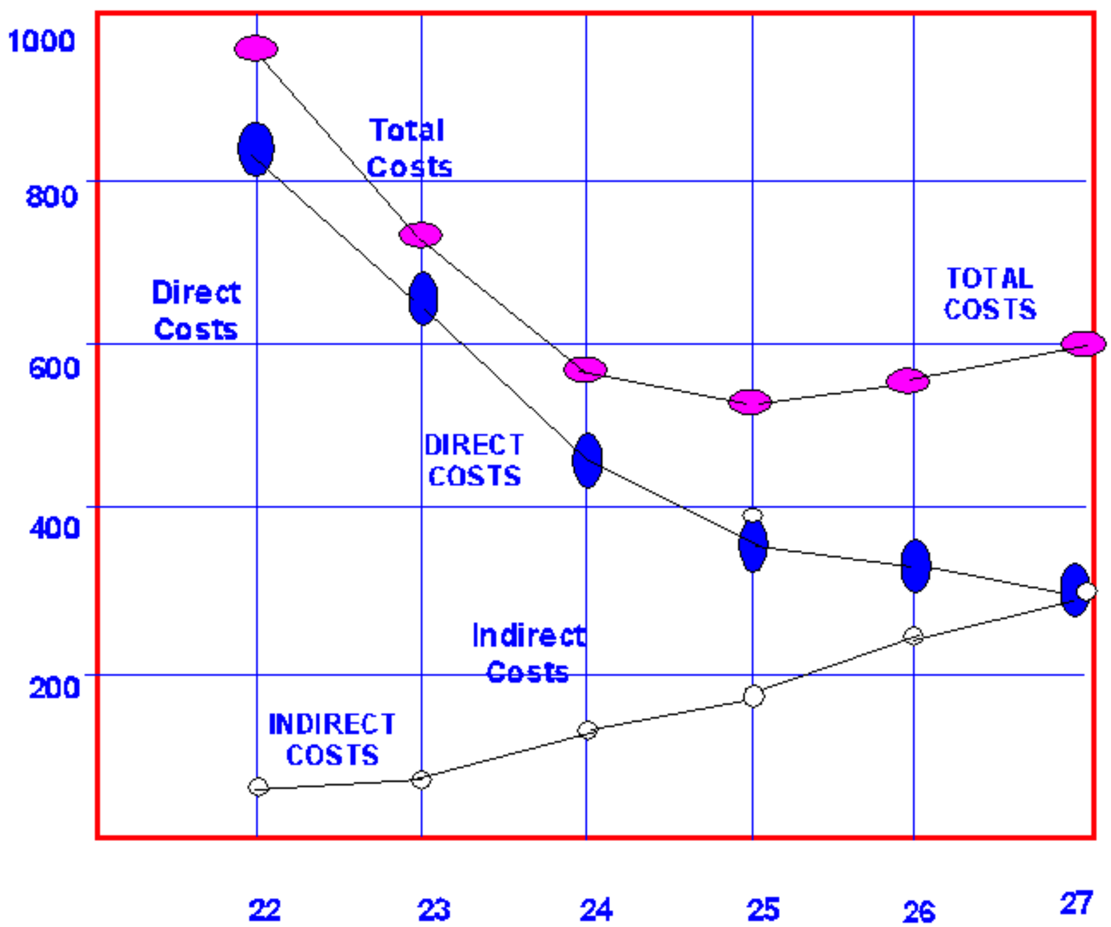
ACTIVITIES CHANGED

A/80 E/100

PROJECT DURATION	22	23	24	25	26	27
TOT. DIRECT COST	830	650	470	380	330	300
TOT. INDIRECT COST	50	60	120	180	240	300
TOTAL COSTS	880	710	590	560	570	600
Incentive	-50	-40	-30	-20	-10	0
Costs with incentive	830	670	560	540	560	600

Take incentive down to 25 weeks, which is the low cost and optimum--with or without the incentive. However, you are increasing the chances of being late by creating two critical paths.

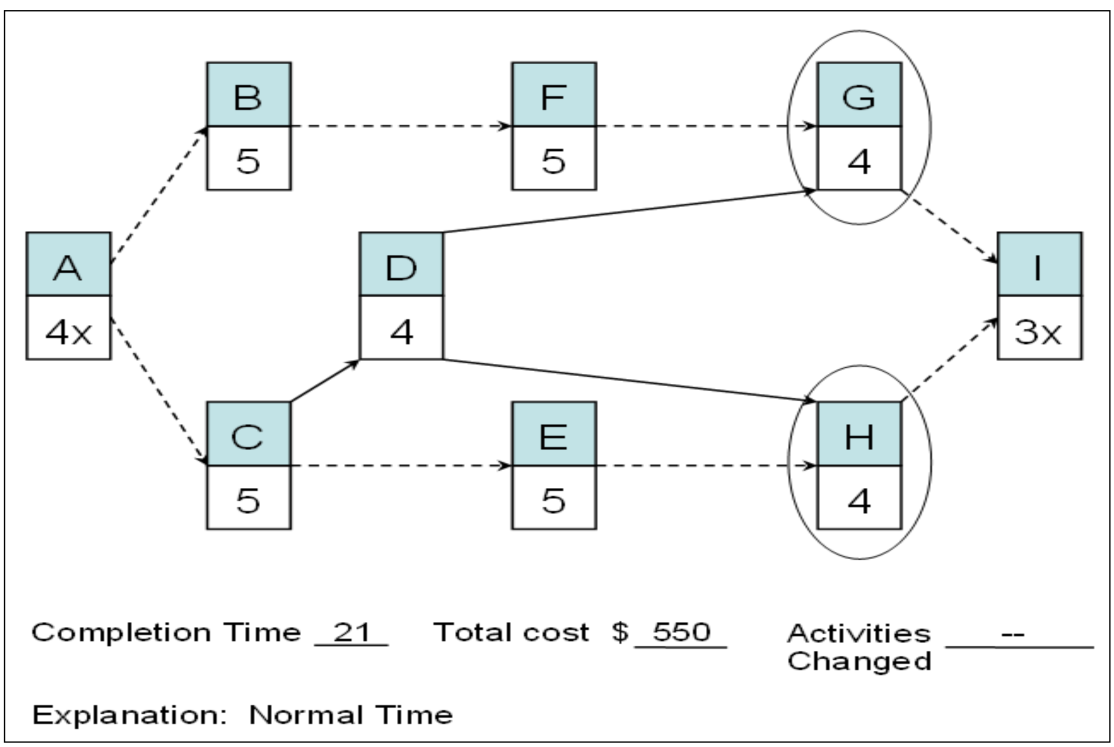
PROJECT DURATION	DIRECT COSTS	INDIRECT COSTS	TOTAL COSTS	WiTH INCENTIVE
22	830	50	980	930
23	650	60	710	670
24	470	120	590	560
25	380	180	560	540
26	330	240	570	560
27	300	300	600	600

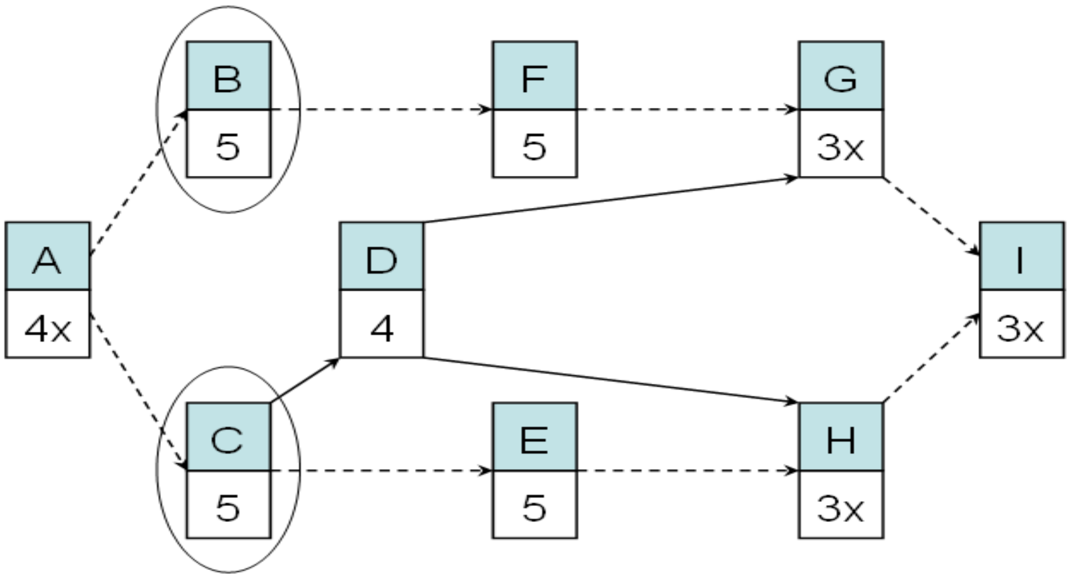


4. Use the information contained below to compress one time unit per move using the least cost method. Reduce the schedule until you reach the crash point of the network. For each move identify what activity(s) was crashed, the adjusted total cost, and explain your choice if you have to choose between activities that cost the same.
Note: Crash point of the network is the point in which the duration cannot be reduced any further.

Activity		Maximum	Direct Costs			
			Normal		Crash	
ID	Slope	Crash Time	Time	Cost	Time	Cost
A	-	0	4	$50	0	-
B	$40	3	5	70	2	$190
C	40	1	5	80	4	120
D	40	2	4	40	2	120
E	40	2	5	60	3	140
F	40	1	5	50	4	90
G	30	1	4	70	3	100
H	30	1	4	80	3	110
I	-	0	3	50	0	-
		Total direct normal costs—		$550		

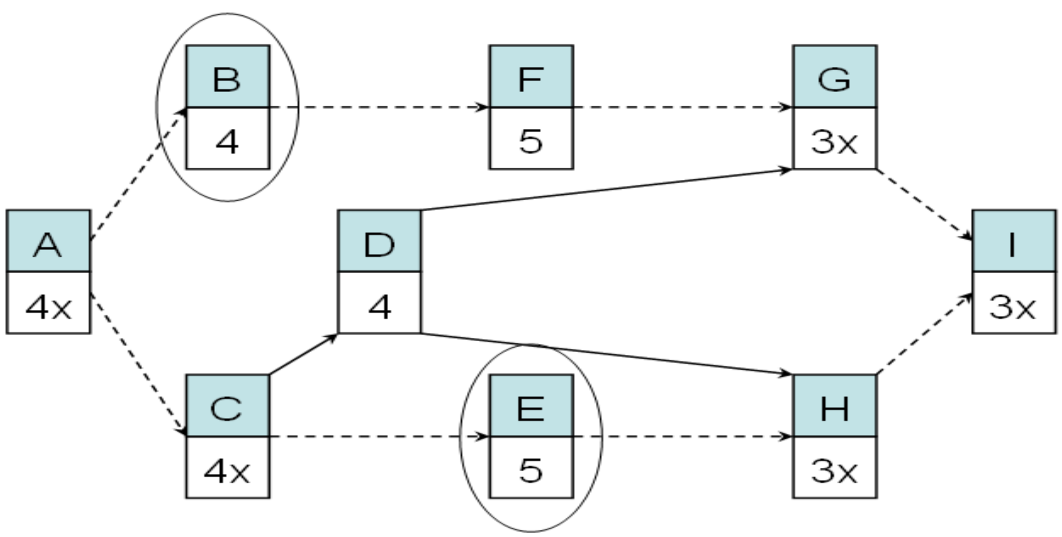
Caution: There is an error in the text – the "crash" cost for Activity C should be 120, not 40. This should not be a problem for most students since the slope is correctly listed as $40, but we encourage you to point this out before assigning this exercise.





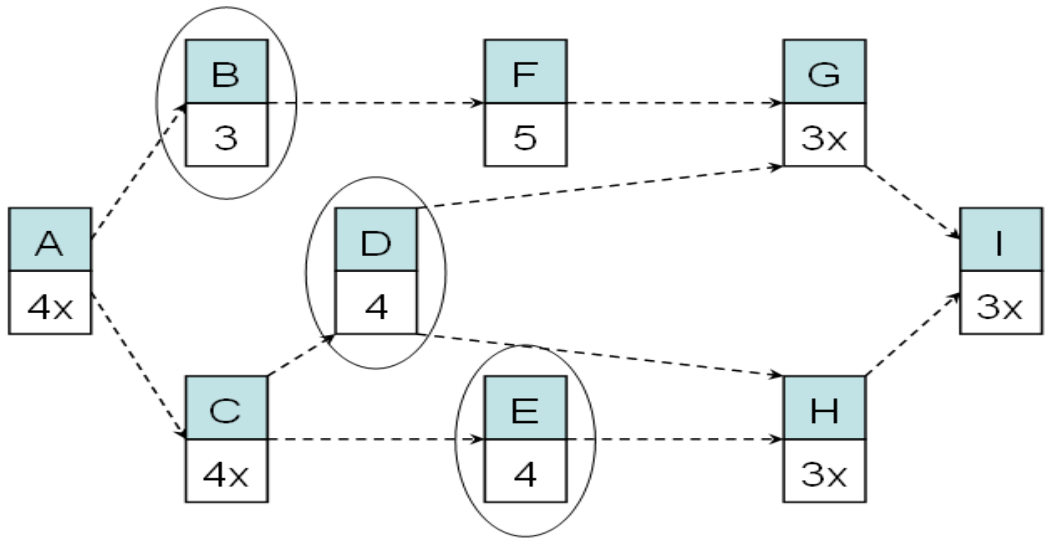
Completion Time _20_ Total cost $ _610_ Activities Changed _G and H_

Explanation: The cheapest solution for crashing both ABFGI and ACEHI critical paths.



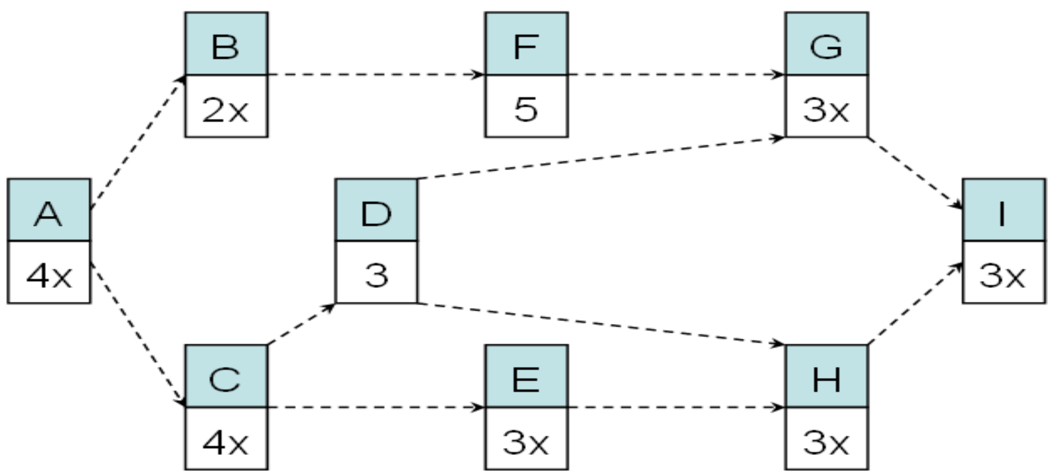
Completion Time _19_ Total cost $ _690_ Activities Changed _C and B_

Explanation: Choose C instead of E to avoid creating ACDGI and ACDHI critical paths. Either B or F would be the cheapest solution for the other critical path. Choose B because it occurs earlier and if things get delayed, F could still be crashed.



Completion Time 18 Total cost $ 770 Activities Changed B and E

Explanation: See above explanation for B. E is the only alternative for the ACEHI critical path.



Completion Time 17 Total cost $ 890 Activities Changed E, D, B

Explanation: E is the only alternative for the ACEHI critical path and D is the only available option for both the ACDGI and ACDHI paths. B is chosen instead of F because if B is delayed, F could still be crashed.

Crash Point!