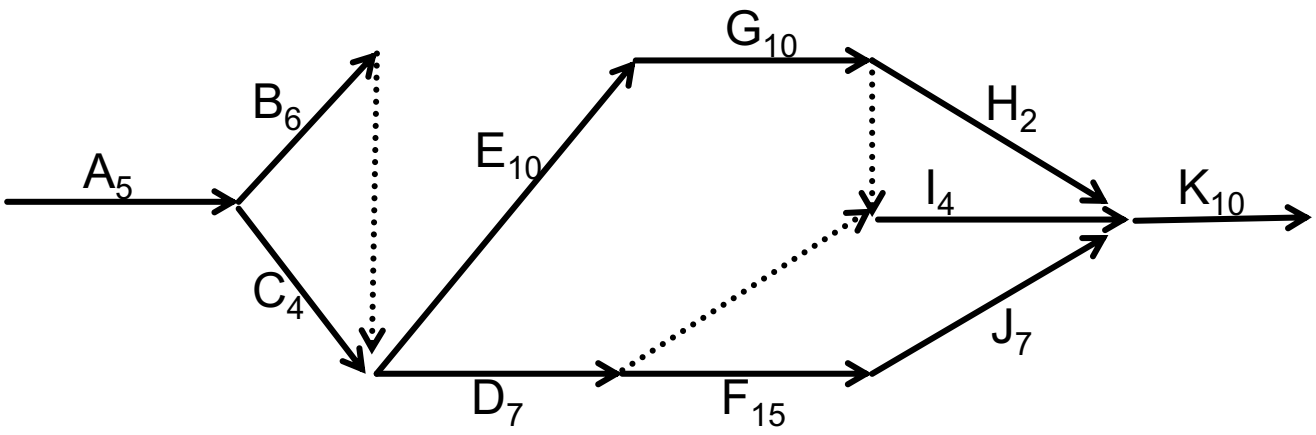
Solutions to Problem Sheet 8

1. Consider the Activities on Arrows diagram below:

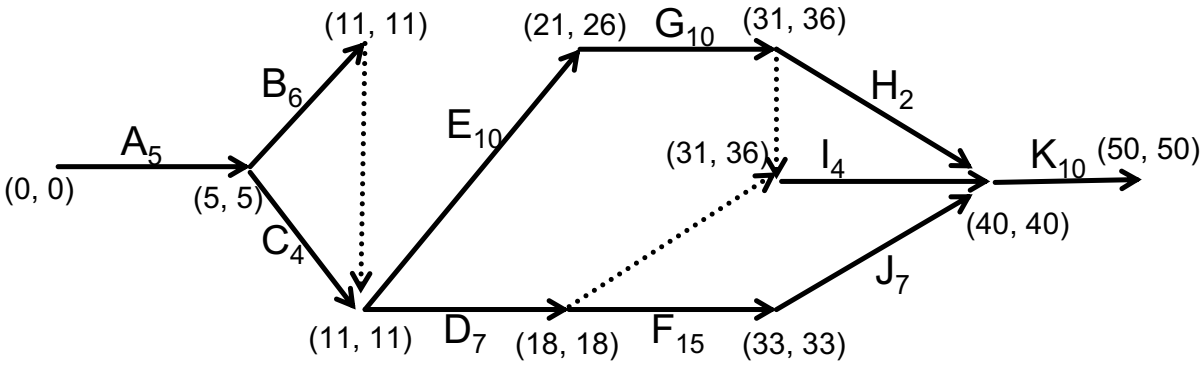


(a) Do a forward and backward pass to find the critical path.

(b) Draw the corresponding Activities on Nodes diagram.

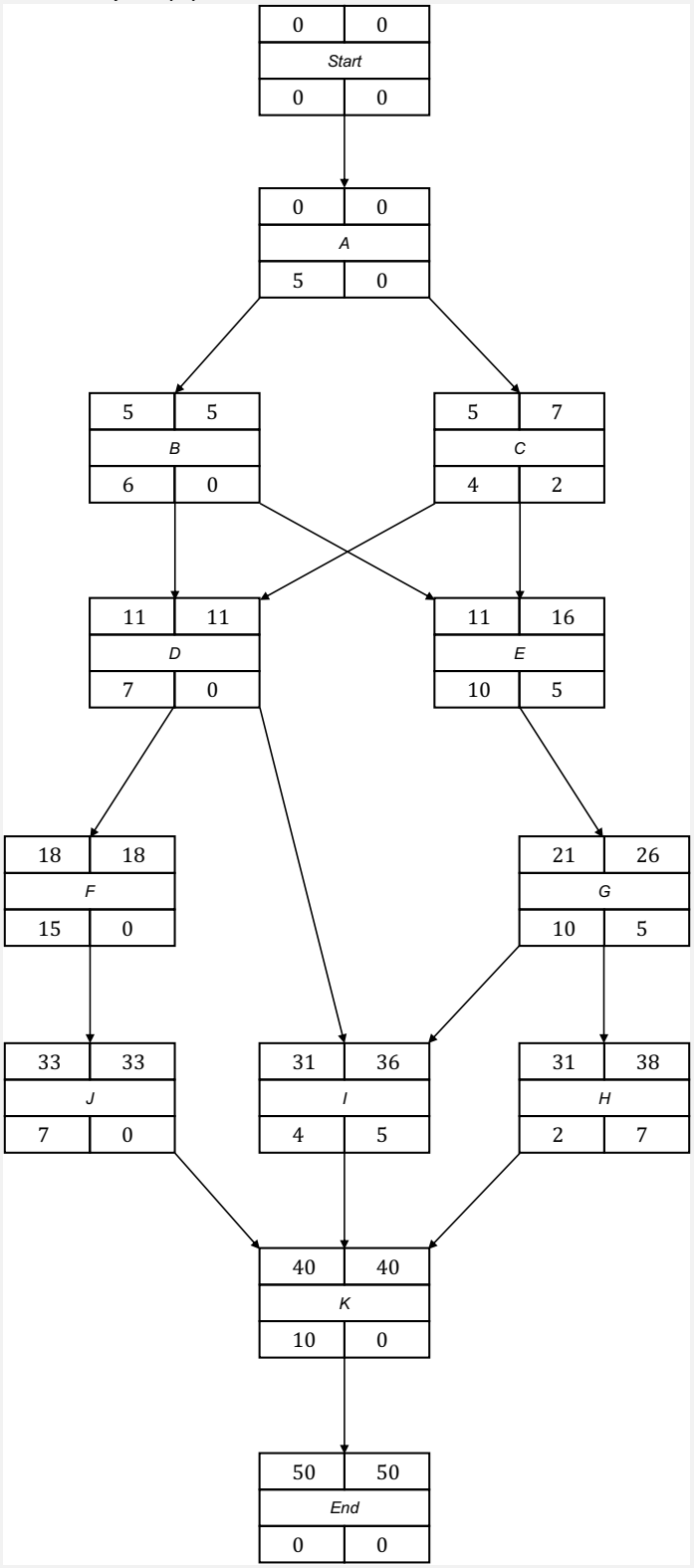
(c) Give the float for each activity.

Solution 1 *(a) After a forward and backward pass we get:*



And so the critical path is A-B-D-F-J-K.

Solution 1 (continuing from p. 1) *(b) The corresponding Activities on Nodes diagram is:*



(c) Activities on the critical path, A, B, D, F, J, and K, have float of 0. Activity C has float of 2, activities E, G and I have floats of 5, and activity H has float of 7.

2. Consider the following project:

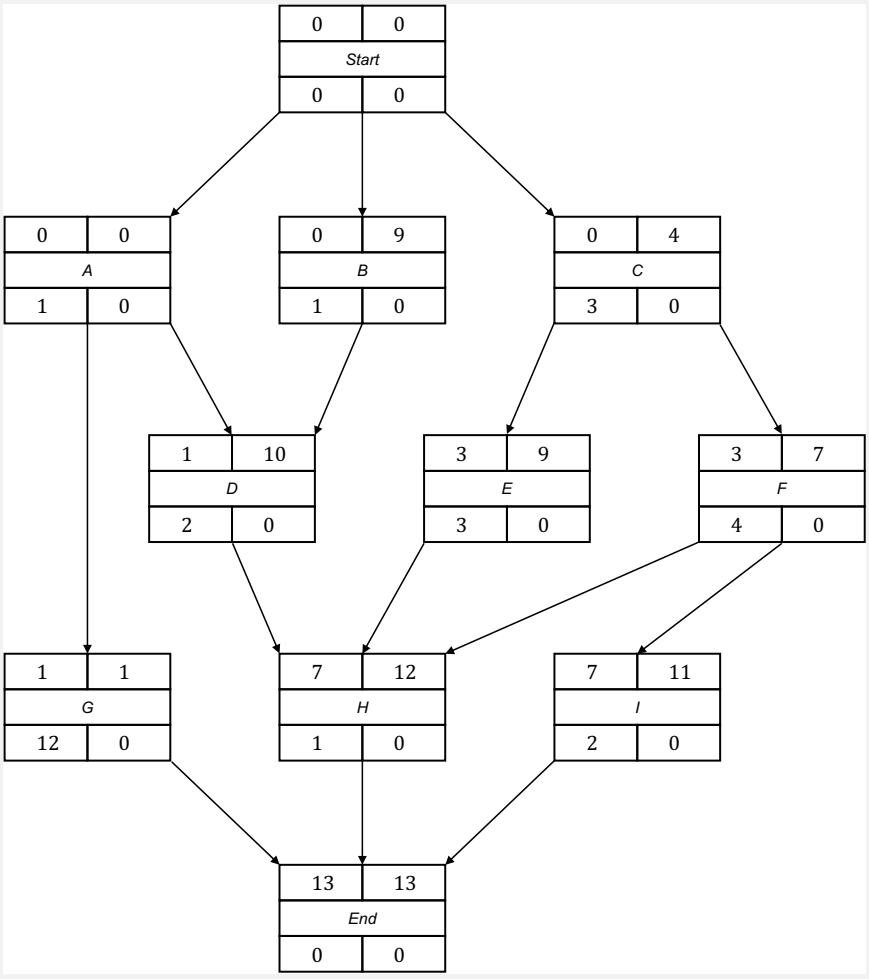
Activity	Duration	Prerequisites
A	1	-
B	1	-
C	3	-
D	2	A, B
E	3	C
F	4	C
G	12	A
H	1	D, E, F
I	2	F

(a) Draw the Activities on Nodes diagram and find the critical path.

(b) Draw the Activities on Arrows diagram and find the critical path.

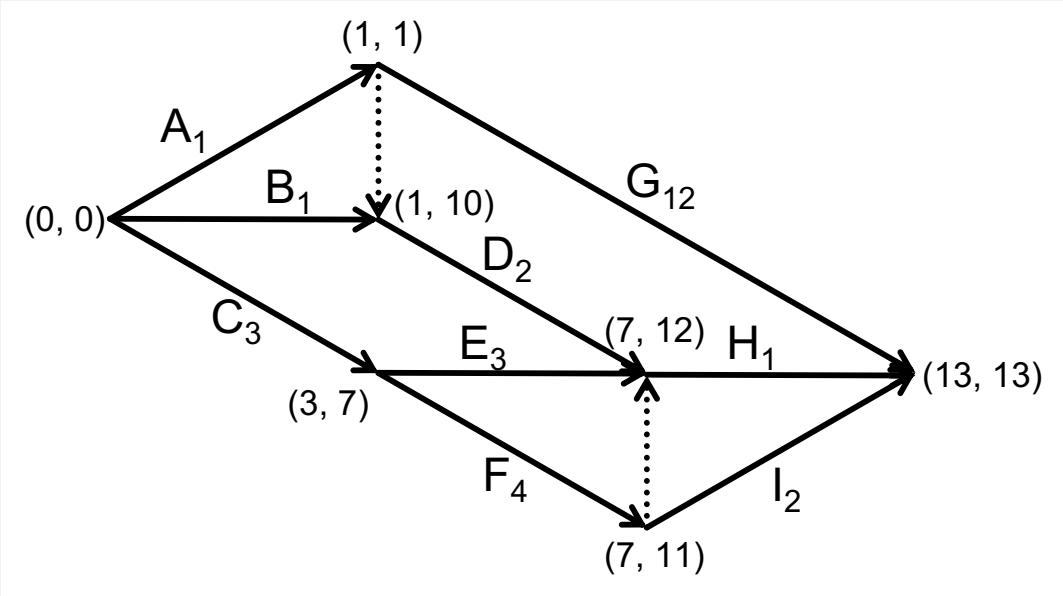
(c) Draw a Gantt chart for the project.

Solution 2 *(a) The Activities on Nodes diagram is:*



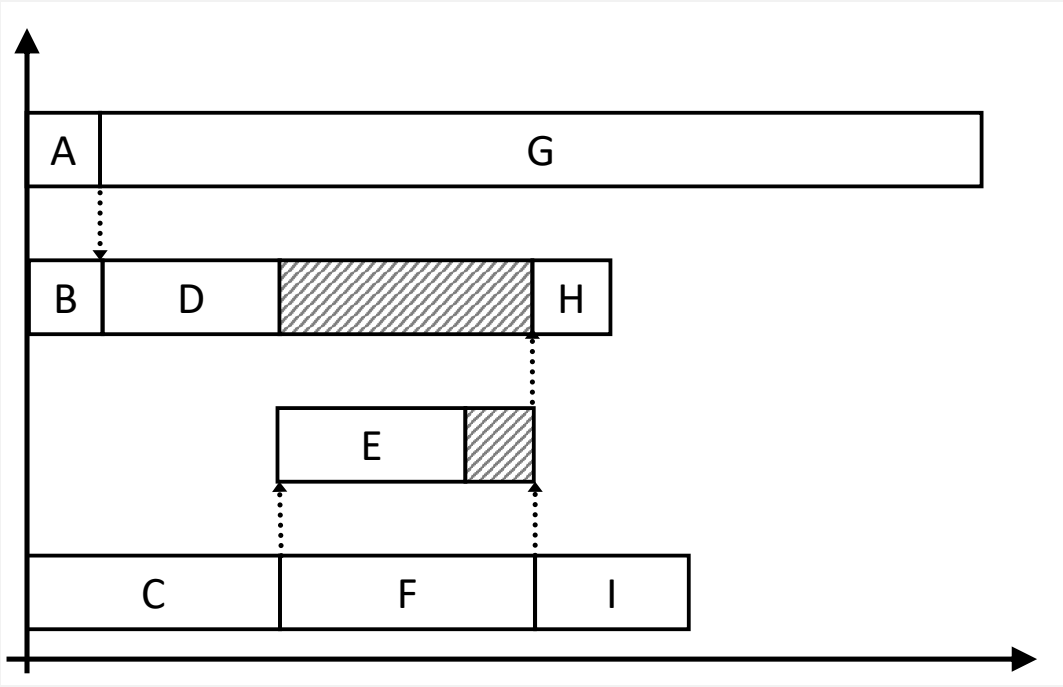
And so the critical path is A-G.

Solution 2 (continuing from p. 3) *(b) The Activities on Arrow diagram is:*



And so the critical path is A-G.

(c) The Gantt chart is:



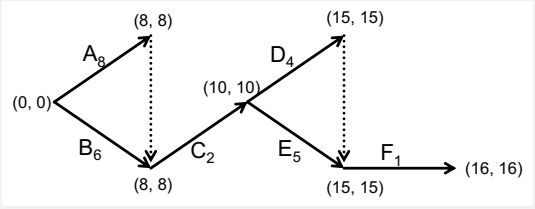
(take care to ensure that prerequisite relationships are indicated.)

3. Consider the project below:

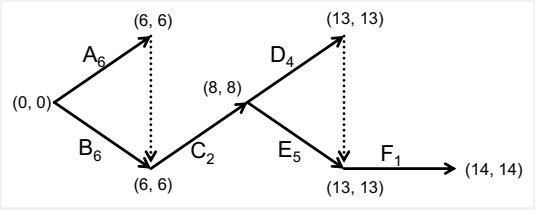
Task	Prerequisites	Duration	Crash Time	Crash Cost
A	-	8	5	£30
B	-	6	2	£200
C	A, B	2	1	£15
D	C	4	2	£60
E	C	5	1	£100
F	D, E	1	-	-

By drawing activities on arrows diagrams, find the least cost method of reducing the overall project duration to 11 time units.

Solution 3 *First note that the unit cost reduction for A is £10, for B is £50, for C is £15, for D is £30, and for E is £25. Activity F cannot be crashed.*
Step 1: *Draw the initial activity on arrows diagram and find the critical path:*

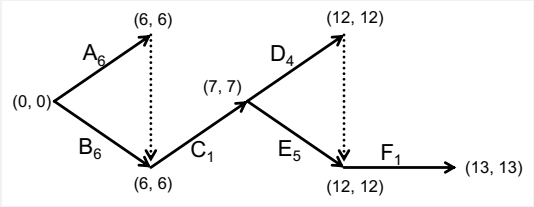


which gives a critical path of A-C-E-F, and so can reduce any of these. The cheapest activity that is possible to crash out of these is A. We can reduce A by 2 before the critical path changes, at a cost of £20.
Step 2: *Redraw the activity on arrows diargam:*



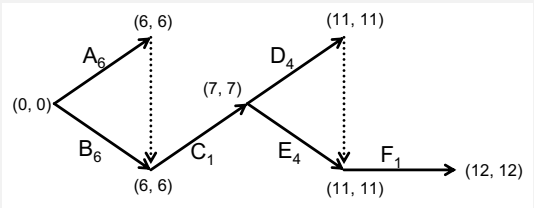
which gives a two critical paths A-C-E-F and B-C-E-F. We have a choice between reducing both A and B together (costing a total of £60), reducing C or E. Reducing C is the cheapest. We can reduce C by a maximum of 1, at a cost of £15.

Solution 3 (continuing from p. 5) Step 3: *Redraw the activity on arrows diargam:*

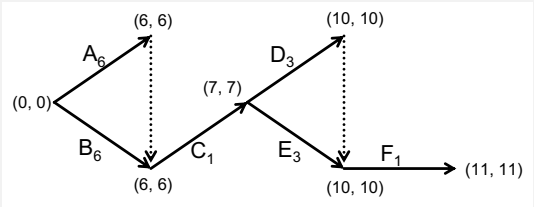


which gives a two critical paths A-C-E-F and B-C-E-F. We have a choice between reducing both A and B together (costing a total of £60), or reducing E. Reducing E is the cheapest. We can reduce E by 1 before the critical path changes, at a cost of £25.

Step 4: *Redraw the activity on arrows diargam:*



which gives a four critical paths A-C-E-F, A-C-D-F, B-C-D-F and B-C-E-F. We have a choice between reducing both A and B together (costing a total of £60), or reducing D and E together (costing a total of £55). So reduce both D and E together by 1 each, to reach the target time:



Therefore the least cost reductions to achieve an overall target time of 11 is to reduce A by 2, C by 1, D by 1, and E by 2. This costs a total of £115.