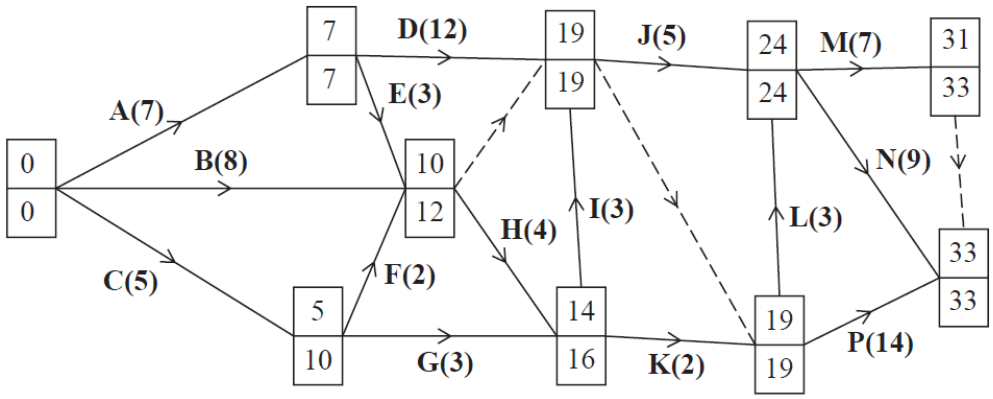
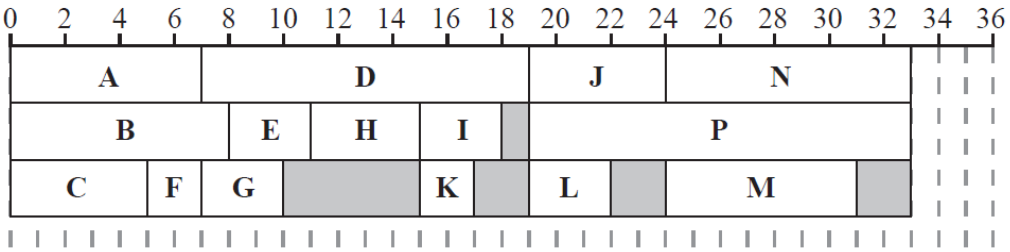
Question Number	Scheme	Marks
5.(a)		M1 A1 M1 A1 **(4)**
(b)	Lower bound is $\frac{87}{33} = 2.6363... = 3$	M1 A1 **(2)**
(c)	e.g. 	M1 A1 A1 A1 **(4)**
(d)	G is not a critical activity (it has a total float of 16 – 5 – 3 = 8 days) and so there is no benefit from reducing the duration of G by one day Activities D and P are both critical activities	M1
	However, D appears in both critical paths therefore reducing P would not reduce the minimum completion time (as there is still a critical path A – D – J – N of length 33) and so activity D should be shortened by one day	A1 **(2)**
		12 marks

Notes for Question 5

a1M1: All top boxes complete, values generally increasing in the direction of the arrows ('left to right'), condone one rogue
a1A1: CAO (top boxes)
a2M1: All bottom boxes complete, values generally decreasing in the opposite direction of the arrows ('right to left'), condone one rogue. Condone missing 0 and/or their 33 (at the end event) for the M mark only
a2A1: CAO (bottom boxes)
b1M1: Attempt to find lower bound: (a value in the interval [73 – 101] / their finish time) **or** (sum of the activities / their finish time) **or** (as a minimum) an awrt 2.6
b1A1: CSO – requires both a **correct** calculation **or** awrt 2.6 seen and 3. An answer of 3 with no working scores no marks
c1M1: Not a cascade chart. 4 workers used at most, at least 10 activities placed
c1A1: 3 workers. All 15 activities present (just once). Condone **two** errors. An activity can give rise to at most three errors; one on duration, one on time interval and only one on IPA
c2A1: 3 workers. All 15 activities present (just once). Condone **one** error. An activity can give rise to at most three errors; one on duration, one on time interval and only one on IPA

c3A1: CAO

Activity	Duration	Time interval	IPA
A	7	0 – 7	-
B	8	0 – 12	-
C	5	0 – 10	-
D	12	7 – 19	A
E	3	7 – 12	A
F	2	5 – 12	C
G	3	5 – 16	C
H	4	10 – 16	B, E, F
I	3	14 – 19	G, H
J	5	19 – 24	B, D, E, F, I
K	2	14 – 19	G, H
L	3	19 – 24	B, D, E, F, I, K
M	7	24 – 33	J, L
N	9	24 – 33	J, L
P	14	19 – 33	B, D, E, F, I, K

d1M1: D and P stated as being critical **or** activity G is not critical
d1A1: Correct answer of D with fully correct reason (G not critical, D and P are both critical but D appears in both/all critical paths or P appears in only one critical path)