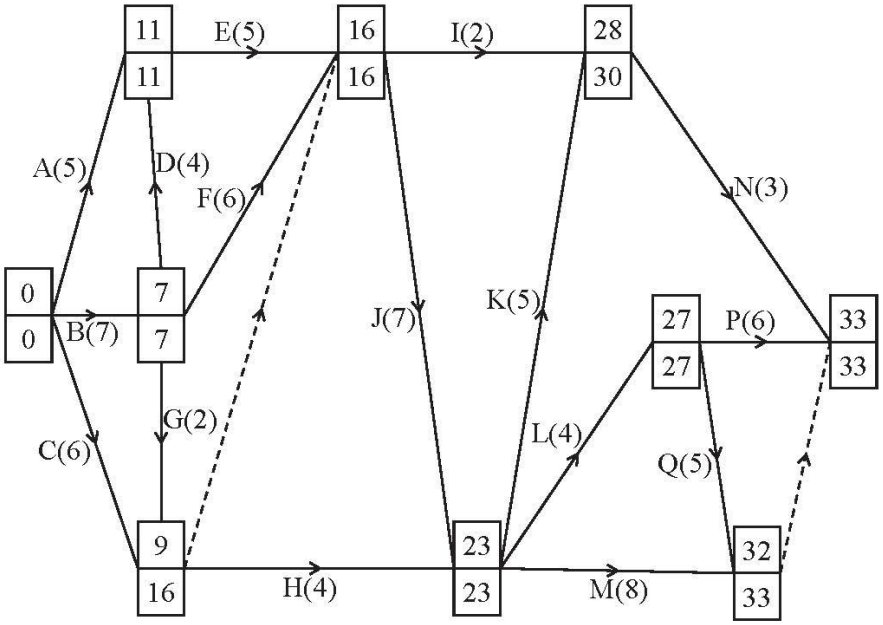
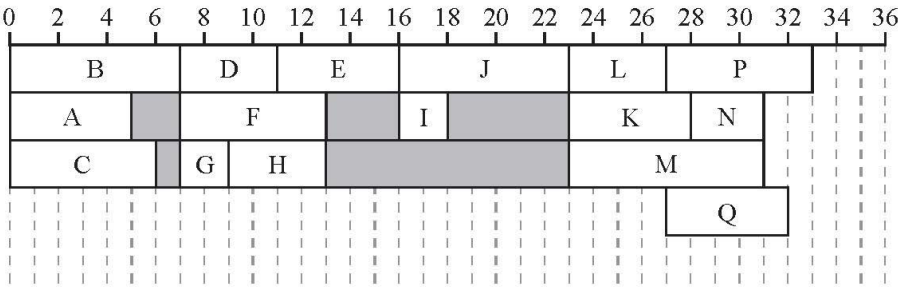
Question Number	Scheme	Marks
1. (a)		M1 A1 M1 A1 **(4)**
(b)	Activity H can be delayed by 23 – 9 – 4 = 10 (days)	B1ft **(1)**
(c)	Lower bound = $\frac{5+7+6+\ldots+6+5}{33}=\frac{79}{33}=2.393...=3$ workers	M1 A1 **(2)**
(d)	e.g. 	M1 A1 A1 **(3)**
		10 marks

Notes for Question 1

a1M1: All top boxes complete, values generally increasing in the direction of the arrows (so generally going from 'left to right' across the network), condone one 'rogue' value (if values do not increase in the direction of the arrows then if one value is ignored and the remaining values do increase in the direction of the arrows then this is considered to be a single rogue value). Note that all values in the top boxes could be incorrect but it can still score the M mark if the values are **increasing** in the way stated above
a1A1: CAO – **all** values correct in the top boxes
a2M1: All bottom boxes complete (but condone a blank box for the late event time at the end event node and/or no zero value for the late event time at the start event node for the **M** mark only). Values generally decreasing in the opposite direction of the arrows (so generally going from 'right to left' across the network), condone one 'rogue' (as described above in **a1M1**)
a2A1: CAO – **all** values correct in the bottom boxes

b1B1ft: Correct calculation seen for their H (provided total float is non-negative). Correct answer or the correct answer following through the event times for H with no working seen scores **B0** – must see all three numbers in their calculation (e.g. 23 – 9 – 4 = 10, or 9 + 4 = 13, 23 – 13 = 10, etc.)

c1M1: Attempt to find lower bound: (a value in the interval [71 – 87] / their finish time) **or** (sum of all the activities / their finish time) **or** (as a minimum) an awrt 2.4
c1A1: CSO – requires the correct answer of 3 **and** either a **correct** calculation **or** awrt 2.4. An answer of 3 with no working scores no marks in this part

d1M1: Not a cascade chart. 4 workers used at most, at least 10 activities placed
d1A1: 4 workers. All 16 activities present just once. Condone at most **two** errors. An activity can give rise to at most three errors; one on duration, one on time interval and only one on IPA
d2A1: CAO – no errors, all 16 activities present just once.

Activity	Duration	Time interval	IPA
A	5	0 – 11	-
B	7	0 – 7	-
C	6	0 – 16	-
D	4	7 – 11	B
E	5	11 – 16	A, D
F	6	7 – 16	B
G	2	7 – 16	B
H	4	9 – 23	C, G
I	2	16 – 30	C, E, F, G
J	7	16 – 23	C, E, F, G
K	5	23 – 30	H, J
L	4	23 – 27	H, J
M	8	23 – 33	H, J
N	3	28 – 33	I, K
P	6	27 – 33	L
Q	5	27 – 33	L