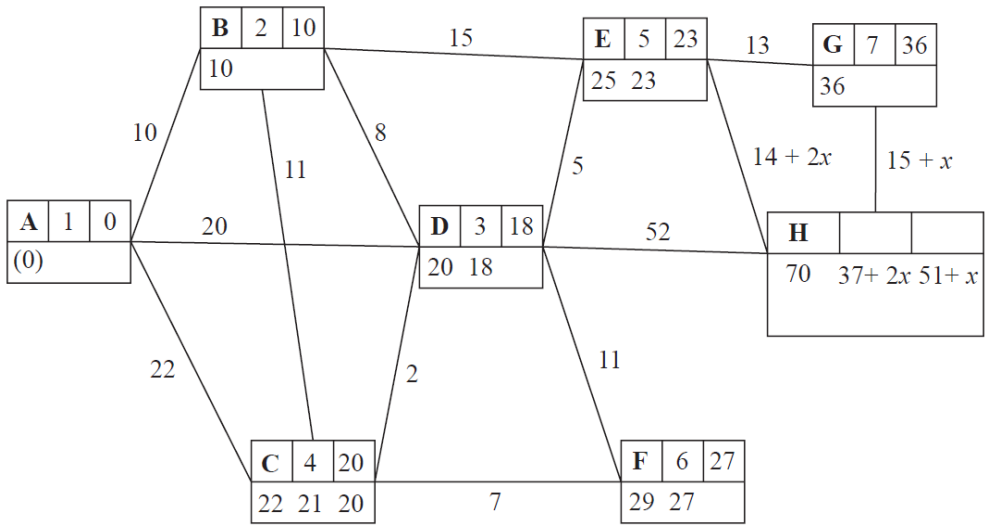
Question Number	Scheme	Marks
7.(a)		M1 A1 A1 A1ft
	Shortest path from A to H via DH: ABDH length: 70	A1
	Shortest path from A to H via EH: ABDEH length: $37 + 2x$	A1
	Shortest path from A to H via GH: ABDEGH length: $51 + x$	A1 **(7)**
(b)	A to H are the only two odd nodes in the network so repeat arcs in path ABDEH	M1
	$3x + 205 + 37 + 2x = 307$	M1
	$x = 13$	A1
	Time taken is 63 (minutes)	A1 **(4)**
		11 marks

Notes for Question 7

In (a) it is important that all values at each node are checked very carefully – the order of the working values must be correct for the corresponding A mark to be awarded e.g. at C the working values must be 22 21 20 in that order (22 20 21 is incorrect) It is also important that the order of labelling is checked carefully. The order of labelling must be a strictly increasing sequence – so 1, 2, 3, 3, 4, … will be penalised once (see notes below) but 1, 2, 3, 5, 6, … is fine. Errors in the final values and working values are penalised before errors in the order of labelling

a1M1: A larger value replaced by a smaller value in at least two of the working value boxes at any node except A, B, G or H (or once with at least two working values seen at H)
a1A1: All values in A, B, D and C correct and the working values in the correct order at D and C (including order of labelling)
a2A1: All values E and F correct and the working values in the correct order. Penalise order of labelling only once per question
a3A1ft: All values in G and H correct on the follow through and the working values in the correct order (the order at H must be correct but give bod). Penalise order of labelling only once per question. Ignore permanent label and final value at H only. Allow unsimplified expressions in x for the working values at H
a4A1: ABDH and 70
a5A1: ABDEH and $37 + 2x$
a6A1: ABDEGH and $51 + x$

If A0A0A0 for the final three marks in **(a)** then award A1A0A0 for all 3 routes stated correctly or all 3 correct values stated explicitly (so not just left in the working values at H)

b1M1: Indication of repeating arcs in a path from A to H. As a minimum: stating A and H as the odd nodes for the network (not just stating A and H) **or** stating a route from A to H with 5 nodes only **or** stating the need to repeat a path/route from A to H - this mark is for making their method clear
b2M1: $3x + 205 +$ (one of their paths involving x) $= 307$ – this mark is for making their working clear
b1A1: CAO ($x = 13$) – this mark is dependent on the second M mark only
b2A1: CAO (63) – this mark is dependent on the second M mark only

SC If M0M0 then **both** correct answers of $x = 13$ and 63 score M0M0A0A1 only (so treating the final mark as a B mark)