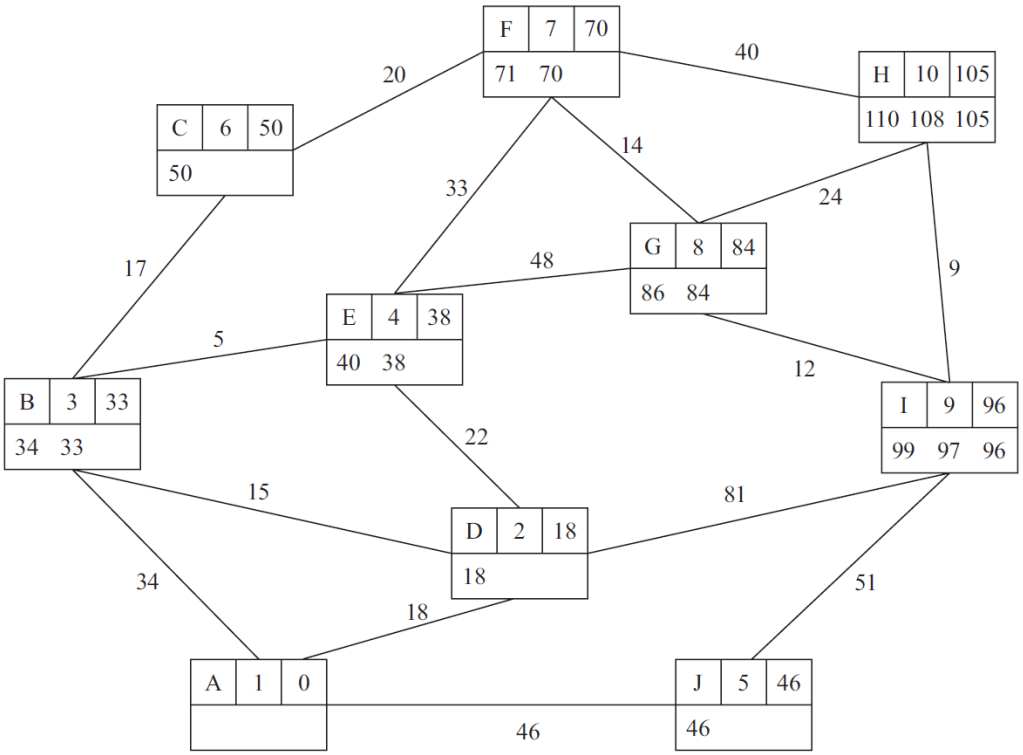
Question Number	Scheme	Marks
3. (a)	Semi-Eulerian as there are (exactly) two odd nodes	B1 **(1)**
(b) (i)		M1 A1 A1 A1ft
	Shortest time from A to H is 105 (minutes)	A1ft
(b) (ii)	Quickest route is ADBCFGIH	A1 **(6)**
(c)	New route is ADBEFGIH (106)	M1
	Increase is 106 – 105 = 1 (minute)	A1ft **(2)**
		9 Marks

	Notes for Question 3
aB1	CAO with correct reason – two odd nodes oe Accept A and H odd.
	In (b) 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 I the working values must be 99 97 96 in that order (so 99 96 97 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**
bi1M1	A larger value replaced by a smaller value at least twice in the working values at either B, E, F, G, H, I
bi1A1	All values at A, D, B, E and J correct and the working values in the correct order
bi2A1	All values at C, F and G correct and the working values in the correct order

bi3A1ft	All values at I and H correct on the follow through and the working values in the correct order. To follow through I check that the working values at I follow from the candidate's final values for the nodes that are directly attached to I (which are D, J and G (and H)). For example, **if** correct then the order of labelling of nodes D, J and G are 2, 5 and 8 respectively so the working values at I should come from D, J and G in that order. The first working value at I should be their 18 (the Final value at D) + 81 (the weight of the arc DI), the second working value at I should be their 46 (the Final value at J) + 51 (the weight of the arc JI) and the third working value should be their 84 (the Final value at G) + 12 (the weight of the arc GI) . Repeat the process for H (which will have working values from F, G and I with the order of these nodes determined by the candidate's order of labelling at F, G and I)
bi4A1ft	Follow through their final value at H **only** – if answer is 105 but the Final Value at H is not 105 then A0. Condone shortest time written on line below, swapped with quickest route
bii1A1	CAO Condone quickest route written on line above
c1M1	Identifies the correct new shortest route or part of this route to include BEF ie ADBEFGIH (106) or ADBEF (71) or BEF (38). Must not be using any route other than ADBEFGIH and must be implying an increase. Numbers need not be seen for this mark but can imply the correct route. (No increase implies M0)
c1A1ft	Increase of 1 ft (minute) with number for comparison (eg 106, 71 or 38) We do not need to see a calculation as their 105, 70 and 37 are implied from (b). If ft an increase must result.