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Mark Scheme (Results)
January 2009

GCE

GCE Mathematics (6689/01)

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January 2009
6689 Decision D1
Mark Scheme

Question Number	Scheme	Marks
1 (a)	e.g.	

M	L	J	H	K	T	R	I
J	H	I	K	M	L	T	R
H	J	I	K	M	L	R	T
H	I	J	K	L	M	R	T
H	I	J	K	L	M	R	T

M1
A1
A1ft
A1ft
A1cso
(5)

(b) Sort complete.

1^{st} choice $\left[\frac{1+8}{2}\right] \rightarrow 5$ Lauren reject right

2^{nd} choice $\left[\frac{1+4}{2}\right] \rightarrow 3$ John reject right

M1 A1

3^{rd} choice $\left[\frac{1+2}{2}\right] \rightarrow 2$ Imogen reject right

A1ft

4^{th} choice 1 Hannah reject

List now empty so Hugo not in list

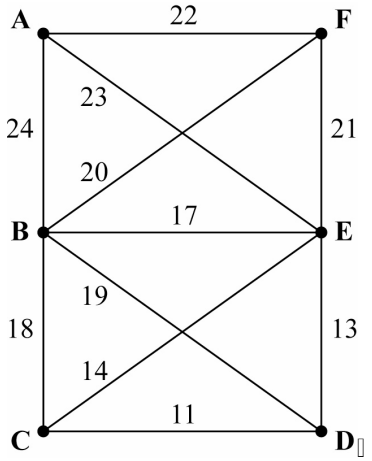
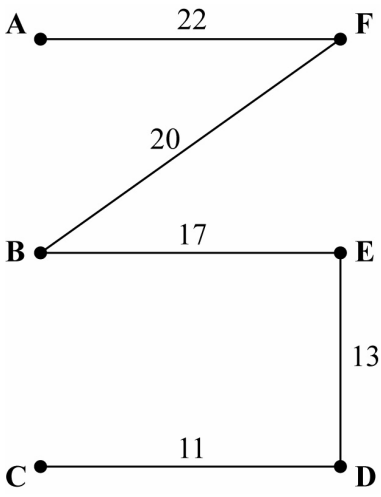
A1 (4)

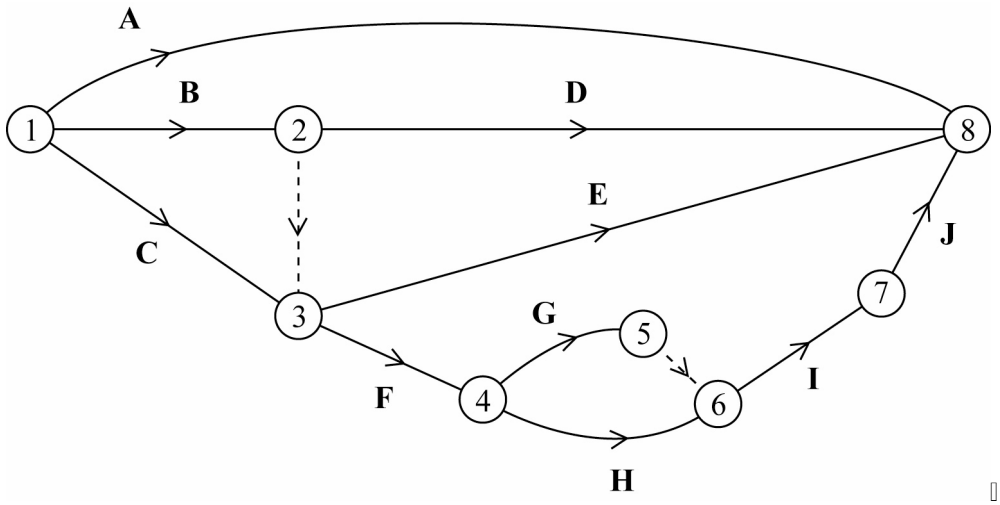
[9]

Notes:

(a) 1M1: quick sort, pivots, p, chosen and two sublists one <p one >p.
If choosing 1 pivot per iteration only M1 only.
1A1: first pass correct and next pivots chosen correctly/consistently.
2A1ft: second pass correct, next pivots correctly/consistently chosen.
3A1ft: third pass correct, next pivots correctly/consistently chosen.
4A1: all correct, cso.

(b) 1M1: binary search, choosing pivot, rejecting half list. If using unsorted list, M0. Accept choice of K for M1 only.
1A1: first pass correct, condone 'sticky'pivot here, bod.
2A1ft: second pass correct, pivot rejected.
3A1: cso.

Question Number	Scheme	Marks
2 (a)		M1 A1 A1 (3)
(b)	CD, DE, reject CE, BE, reject BC, reject BD, BF, reject EF, AF 11 13 14 17 18 19 20 21 22	M1 A1 A1 (3)
		B1 B1
	Weight of tree 83 (m)	(2) **[8]**
	Notes: (a) 1M1: More than 10 arcs 1A1: all arcs correct 2A1: all values correct (b) 1M1: First three arcs correctly chosen 1A1: All used acrs selected correctly 2A1: All rejected arcs selected in correct order (c) 1B1: CAO for arcs – numbers not needed. NO ft. 2B1: CAO 83, condone units	

Question Number	Scheme	Marks
3 (a)		M1 A1 A1 A1 A1 (5)
(b)	1^{st} dummy – D depends on B only, but E and F depend on B and C 2^{nd} dummy – G and H both must be able to be described uniquely in terms of the events at each end.	B1 B1 (2) **[7]**
	Notes: (a) 1M1: one start and A to C and one of D, E or F drawn correctly 1A1: 1^{st} dummy (+arrow) and D, E and F drawn correctly 2A1: G, H, I and J drawn in correct place 3A1: second dummy (+arrow) drawn in a correct place 4A1: cso. all arrows and one finish. (b) 1B1: cao, but B, C, D, E and/or F referred to, generous 2B1: cao, but generous.	

Question Number	Scheme	Marks
4		
(a)	Alternating path B – 3 = A – 5 change status B = 3 – A = 5	M1 A1
	A = 5 B = 3 C = 2 D = 1 E = 6 F unmatched	A1 (3)
(b)	e.g. C is the only person able to do 2 and the only person able to do 4. Or D, E and F between them can only be allocated to 1 and 6.	B2, 1, 0 (2)
(c)	Alternating path F – 6 = E – 1 = D – 2 = C – 4 change status F = 6 – E = 1 – D = 2 – C = 4	M1 A1
	A = 5 B = 3 C = 4 D = 2 E = 1 F = 6	A1 (3)
		[8]

Notes:

(a) 1M1: Path from B to 5.
1A1: Correct path including change status
2A1: CAO my matching, may be drawn but if so 5 lines only and clear.

(b) 1B1: Close, a correct relevant, productive statement bod generous
2B1: A Good clear answer generous

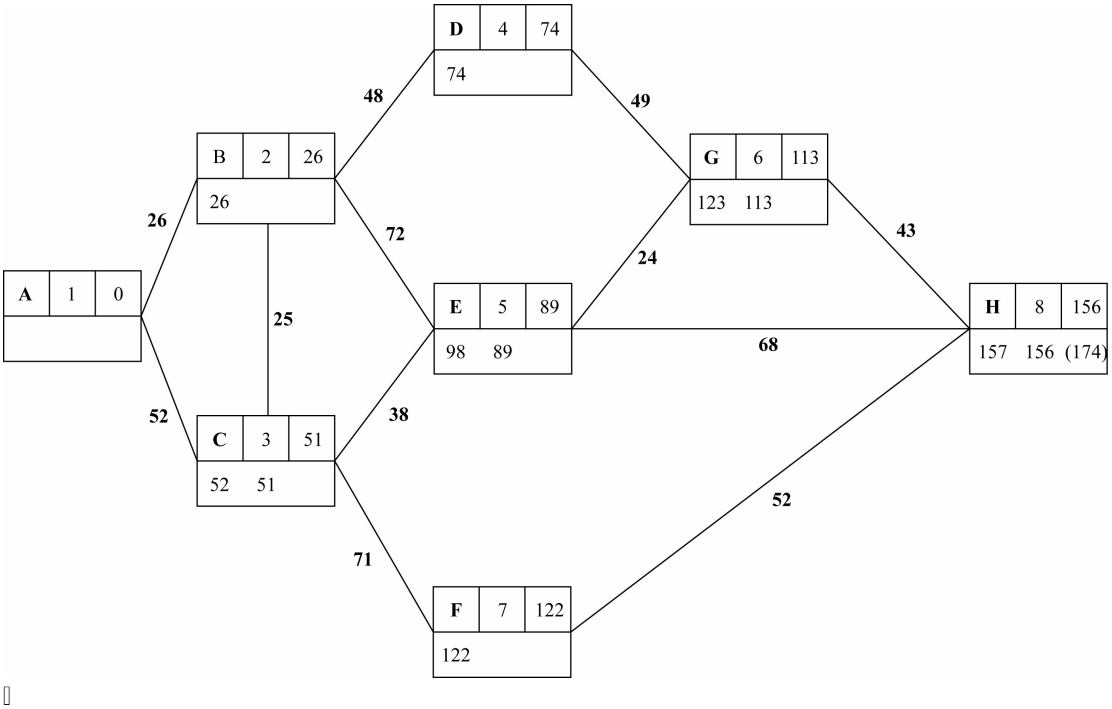
(c) 1M1: Path from F to 4. No ft.
1A1: Correct path penalise lack of change status once only
2A1: CAO may be drawn but if so 6 lines only and clear

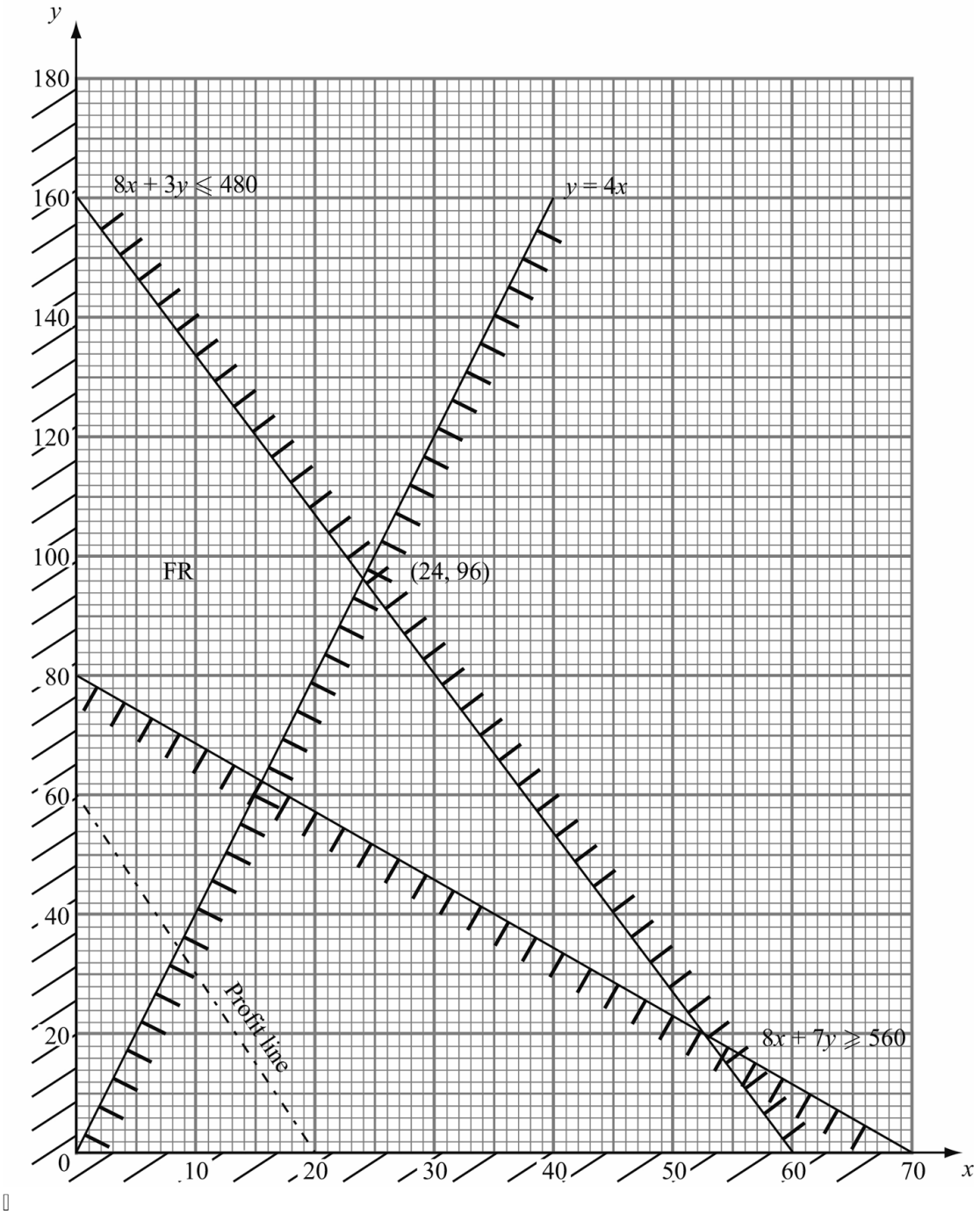
Question Number	Scheme	Marks
5		
(a)	Odd vertices C, D, E, G	B1
	CD + EG = 17 + 19 = 36 ←	M1 A1
	CE + DG = 12 + 25 = 37	
	CG + DE = 28 + 13 = 41	A1
	Length = 543 + 36 = 579 (km)	A1ft (5)
(b)	CE (12) is the shortest	M1
	So repeat CE (12)	A1ft
	Start and finish at D and G	A1ft (3)
		[8]

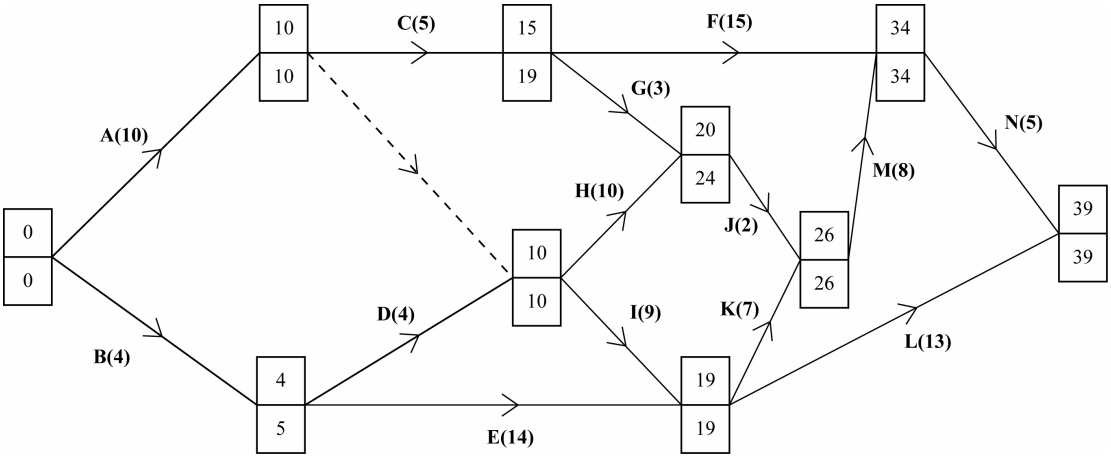
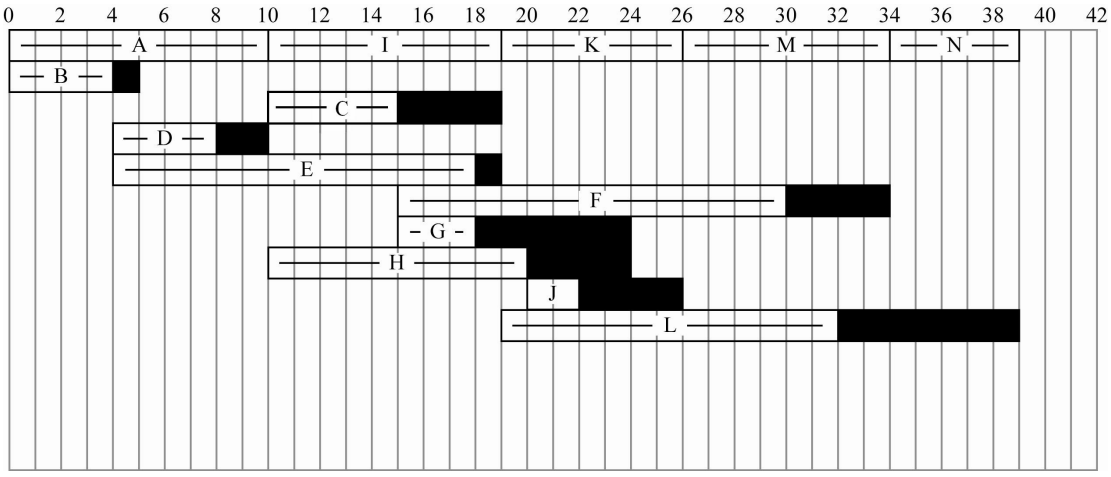
Notes:

(a) 1B1: cao (may be implicit)
1M1: Three pairings of their four odd nodes
1A1: one row correct
2A1: all correct
3A1ft: 543 + their least = a number. Condone lack of km

(b) 1M1ft: Identifies their shortest from a choice of at least 2 rows.
1A1ft: indicates their intent to repeat shortest.
2A1ft: correct for their least.

Question Number	Scheme	Marks
Q6 (a)		M1 A1 A1ft
	Shortest route: A B C E G H Length: 156 (km)	A1 A1ft (5)
(b)	New route: A B E G H Length: 165 (km)	B1 B1 (2)
		[7]
	Notes: (a) 1M1: Dijkstra's algorithm, small replacing larger in at least one of the sets of working values at C, E, G or H 1A1: Values correct at vertices A to E. 2A1ft: Values correct at vertices F to H, penalise order only once. 3A1: cao 4A1ft: 156ft (b) 1B1: cao ABEGH 2B1: 165 Special Case Accept 166 if ABDGH listed as the path.	

Question Number	Scheme	Marks
7 (a)		B1 B1 B1 (lines) B1 (shading) B1 (R found) B1 (labels) (6)
(b)	Point testing or Profit line method Minimum point (0, 80); Value of 80 Maximum point (24, 96); Value of 168	M1 A1 B1 A1 B1 A1 (6) **[12]**

Question Number	Scheme	Marks
8 (a)		M1 A1 M1 A1 (4)
(b)	A, I, K, M, N; Length 39	B2,1,0; B1 (3)
(c)	Float on F is 34 – 15 – 15 = 4 Float on G is 24 – 15 – 3 = 6	M1 A1 B1 (3)
(d)		M1 A1 M1 A1 (4)
(e)	e.g. At time 14 ½ there are 4 tasks I, E, H and C must be happening.	B2,1,0 (2) **[16]**