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Mark Scheme (Results)
Summer 2009

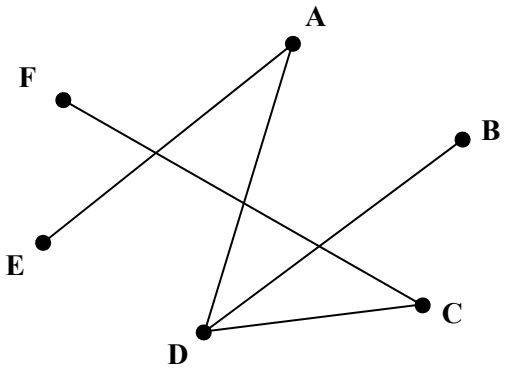
GCE

GCE Mathematics (6689/01)

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June 2009
6689 Decision Mathematics D1
Mark Scheme

Question Number	Scheme	Marks
Q1 (a)	AD, AE, DB; DC, CF	M1 A1; A1 (3)
(b)		B1 (1)
(c)	Weight 595 (km)	B1 (1)
		[5]

Notes:

(a) 1M1: Using Prim – first 2 arcs probably but condone starting from another vertex.
1A1: first three arcs correct
2A1: all correct.

(b) 1B1: CAO

(c) 1B1: CAO condone lack of km.

<u>Apply the misread rule, if not listing arcs or not starting at A.</u>
So for M1 (only)
Accept numbers across the top (condoning absence of 6)
Accept full vertex listing
Accept full arc listing starting from vertex other than A

[AD AE DB DC CF]	{1 4 5 2 3 6}	ADEBCF
BD AD AE CD CF	{3 1 5 2 4 6}	BDAECF
CD AD AE BD CF	{3 5 1 2 4 6}	CDAEBF
DA AE DB CD CF	{2 4 5 1 3 6}	DAEBCF
EA AD DB DC CF	{2 4 5 3 1 6}	EADBCF
FC CD AD AE BD	{4 6 2 3 5 1}	FCDAEB

Question Number	Scheme	Marks
Q2 (a)	$\frac{230}{60} = 3.8\dot{3}$ so 4 needed	M1 A1 (2)
(b)	Bin 1: 32 17 9 Bin 2: 45 12 Bin 3: 23 28 Bin 4: 38 16 Bin 5: 10	M1 A1 A1 A1 (4)
(c)	e.g. Bin 1: 32 28 Bin 2: 38 12 10 Bin 3: 45 9 Bin 4: 23 17 16	M1 A1 A1 (3)
		[9]

Notes:

(a) 1M1: Their 230 divided by 60, some evidence of correct method 3.8 enough.
1A1: cso 4.

(b) 1M1: Use of first fit. Probably 32, 45 and 17 correctly placed.
1A1: 32, 45, 17, 23, 38 and 28 placed correctly
2A1: 32, 45, 17, 23, 38, 28, 16, 9 placed correctly.
3A1: cao

(c) 1M1: Use of full bin – at least one full bin found and 5 numbers placed.
1A1: 2 full bins found
Eg [32+28 and 38+12+10] [23+28+9 and 16+12+32]
[32+28 and 23+16+12+9] [38+12+10 and 23+28+9]
2A1: A 4 bin solution found.

Special case for (b) misread using first fit decreasing.
Give M1A1 (max)
Bin 1: 45 12
Bin 2: 38 17
Bin 3: 32 28
Bin 4: 23 16 10 9
M1 for placing 45, 38, 32, 28 and 23 correctly
A1 for cao.

Question Number	Scheme	Marks
Q3 (a)	H – 2 = M – 5 = R – 4 change status to give	M1 A1
(b)	C = 3 (E unmatched) H = 2 M = 5 R = 4 S = 1	A1 (3)
(c)	e.g. C is the only person who can do 3 and the only person who can do 6	B1 (1)
	e.g. E – 5 = M – 2 = H – 1 = S – 3 = C – 6 change status to give	M1 A1
	C = 6 E = 5 H = 1 M = 2 R = 4 S = 3	A1 (3)
		[7]
	Notes: (a) 1M1: Path from H to 4 1A1: correct path and change status 2A1: CAO must follow from correct path. (b) 1B1: CAO or e.g reference to E 5 M 2 H 1 S (c) 1M1: Path from E to 6 1A1: CAO do not penalise lack of change status a second time. 2A1: CAO must follow from a correct path	

Question Number	Scheme	Marks
Q4		

M	J	E	K	H	**B**	L	P	N	D	**B**
B	M	J	E	K	**H**	L	P	N	D	**H**
B	E	**D**	***H***	M	J	K	**L**	P	N	**D L**
B	***D***	**E**	***H***	J	**K**	***L***	M	**P**	N	**(E) K P**
B	***D***	***E***	***H***	**J**	***K***	***L***	M	**N**	***P***	**(J) N**
B	***D***	***E***	***H***	***J***	***K***	***L***	**M**	***N***	***P***	**(M)**

M1 1A1

2A1ft

3A1ft

Sort completed

4A1 (5)

$\left[\frac{1+10}{2}\right]=6$ Katie reject left

M1

$\left[\frac{7+10}{2}\right]=9$ Natsuko reject right

1A1

$\left[\frac{7+8}{2}\right]=8$ Miri reject right

2A1ft

7 = Louis name found

3A1 (4)

[9]

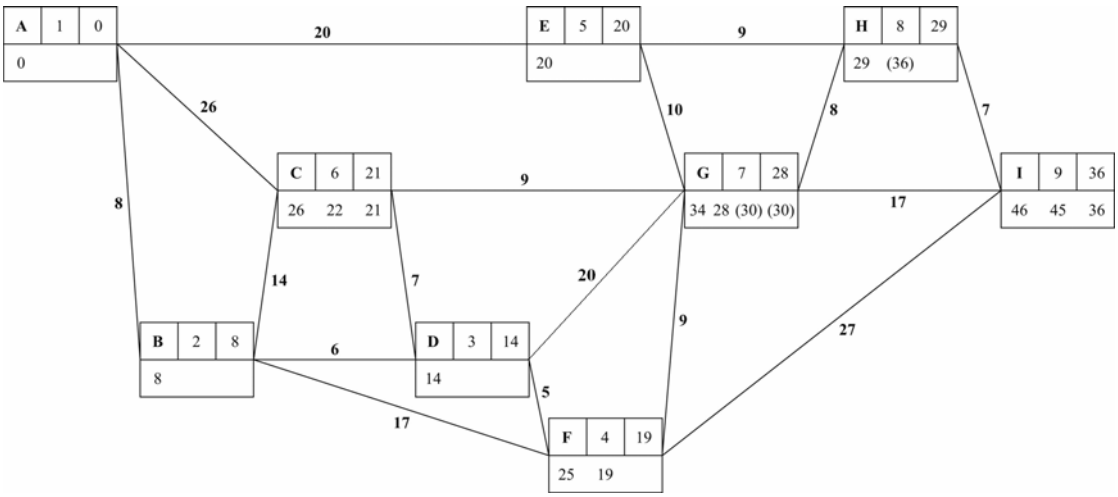
Notes:

(a) 1M1: quick sort, pivots, p, identified, two sublists one <p one >p.
If choosing one pivot only per iteration, M1 only.
1A1: first pass correct, next pivot(s) chosen consistently.
2A1ft: second pass correct, next pivot(s) chosen consistently
3A1ft: third pass correct, next pivot(s) chosen consistently
4A1: cso List re-written or end statement made or each element been chosen as a pivot.

(b) 1M1: binary search, choosing pivot rejecting half list.
If using unordered list then M0.
If choosing J M1 ony
1A1: first two passes correct, condone 'sticky'pivots here, bod.
2A1ft: third pass correct, pivots rejected.
3A1: cso, including success statement.

Special case for (b) – If just one letter out of order, award maximum of M1A1A0A0

Question Number	Scheme	Marks
Q5 (a)	CD + EG = 45 + 38 = 83 CE + DG = 39 + 43 = 82 ← CG + DE = 65 + 35 = 100 Repeat CE and DG Length 625 + 82 = 707 (m)	M1 1A1 2A1 3A1 4A1ft 5A1ft (6)
	DE (or 35) is the **smallest** So finish at C. New route 625 + 35 = 660 (m)	M1 A1ft A1ft=1B1 (3) **[9]**
	Notes: (a) 1M1: Three pairings of their four odd nodes 1A1: one row correct 2A1: two rows correct 3A1: three rows correct 4A1ft: ft their least, but must be the correct shortest route arcs on network. (condone DG) 5A1ft: 625 + their least = a number. Condone lack of m (b) 1M1: Identifies their shortest from a choice of at least 2 rows. 1A1ft: ft from their least or indicates C. 2A1ft = 1Bft: correct for their least. (Indept of M mark)	

Question Number	Scheme	Marks
Q6 (a)		M1 1A1 2A1ft 3A1ft 4A1ft
	Route: A E H I	5A1
(b)	Shortest distance from A to G is 28 km	B1ft
		[7]

Notes:

(a) 1M1: Small replacing big in the working values at C or F or G or I

1A1: Everything correct in boxes at A, B, D and F

2A1ft: ft boxes at E and C handled correctly but penalise order of labelling only once

3A1ft: ft boxes at G and H handled correctly but penalise order of labelling only once

4A1ft: ft boxes at I handled correctly but penalise order of labelling only once

5A1: route cao A E H I

(b) 1B1ft: ft their final label at G condone lack of km

Question Number	Scheme	Marks
Q7 (a)	$7x+5y \le 350$	M1 A1 (2)
(b)	$y \le 20$ e.g. make at most 20 small baskets $y \le 4x$ e.g. the number of small (y) baskets is at most 4 times the number of large baskets (x). {E.g if $y = 40$, x =10, 11, 12 etc. or if $x = 10$, $y = 40, 39, 38$}	B1 B1 (2)
(c)	(see graph next page) Draw three lines correctly Label R	B3,2,1,0 B1 (4)
(d)	(P=) $2x + 3y$	B1 (1)
(e)	Profit line or point testing. $x = 35.7$ $y = 20$ precise point found. Need integers so optimal point in R is (35, 20); Profit (£)130	M1 A1 B1 B1;B1 (5) **[14]**

Notes:

(a) 1M1: Coefficients correct (condone swapped x and y coefficients) need 350 and any inequality
1A1: cso.

(b) 1B1: cao
2B1: cao, test their statement, need both = and < aspects.

(c) 1B1: One line drawn correctly
2B1: Two lines drawn correctly
3B1: Three lines drawn correctly. Check (10, 40) (0, 0) and axes
4B1: R correct, but allow if one line is slightly out (1 small square).

(d) 1B1: cao accept an expression.

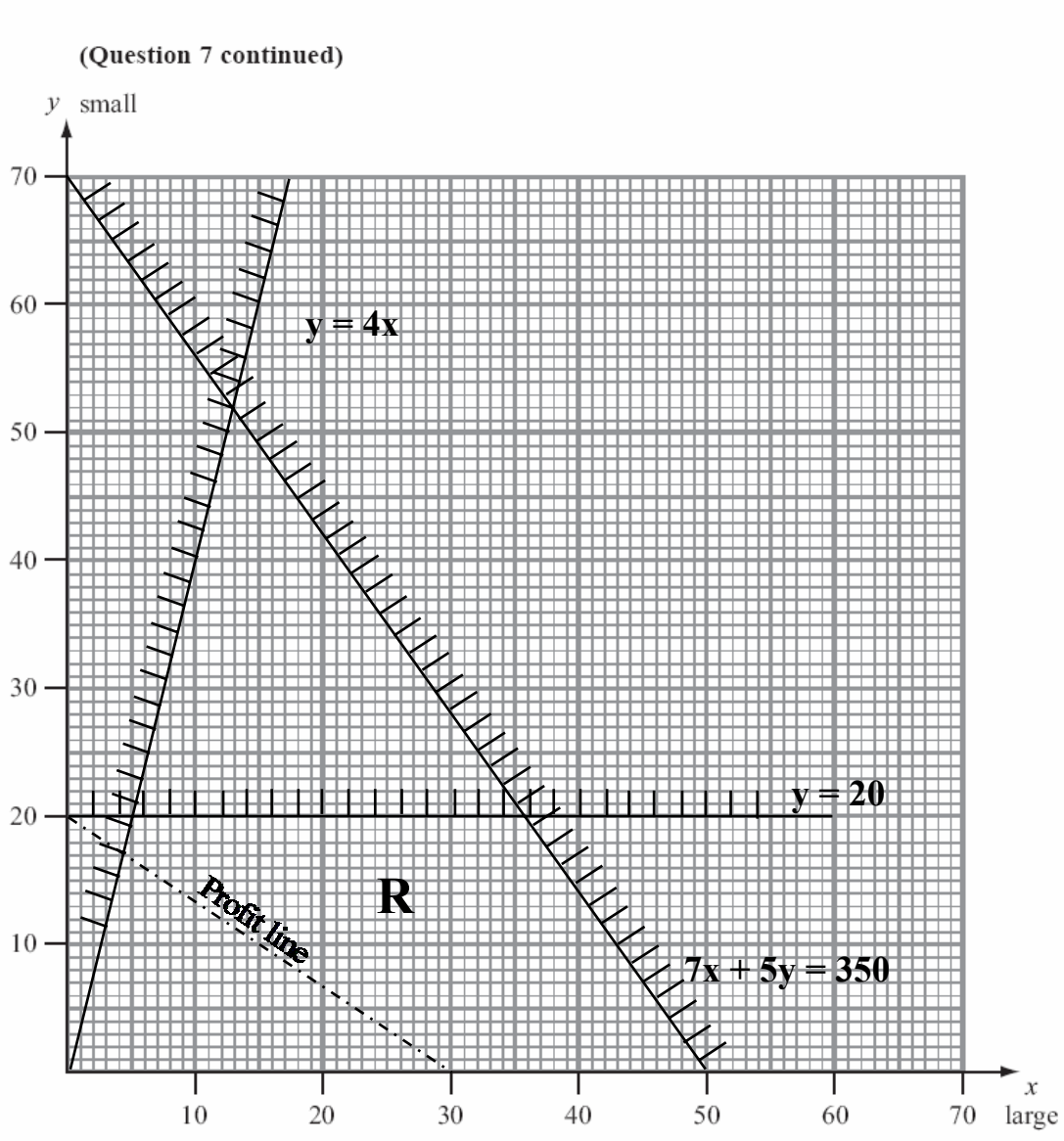
(e) 1M1: Attempt at profit line or attempt to test at least two vertices in their feasible region.
1A1: Correct profit line or correct testing of at least three vertices.

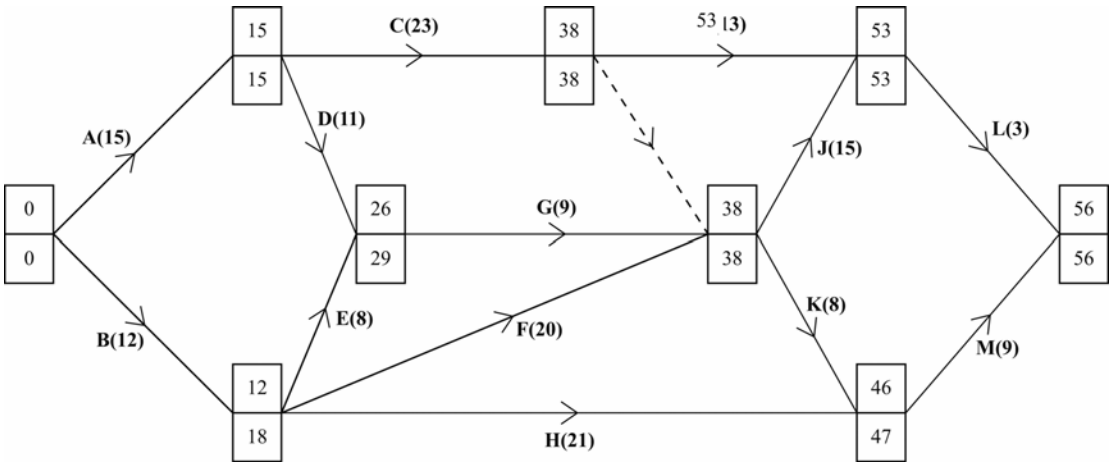
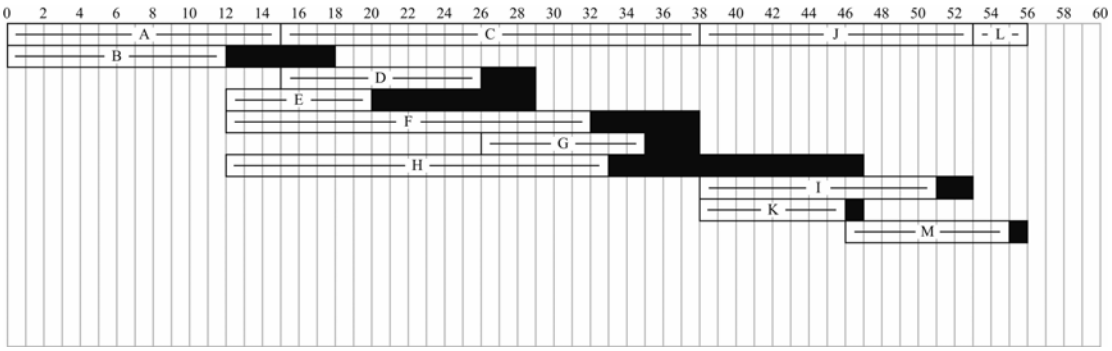
Point testing: (0,0) P= 0; (5,20) P = 70; (50,0) P = 100

$\left(35\frac{5}{7}, 20\right) = \left(\frac{250}{7}, 20\right)$ P = $131\frac{3}{7} = \frac{920}{7}$

also (35, 20) P = 130. Accept (36,20) P = 132 for M but not A.

Objective line: Accept gradient of 1/m for M mark or line close to correct gradient.
1B1: cao – accept x co-ordinates which round to 35.7
2B1: cao
3B1: cao

Question Number	Scheme	Marks
(c)		

Question Number	Scheme	Marks
Q8 (a)		M1 A1 M1 A1 (4)
(b)	A C J L	B1 (1)
(c)	Total float for M = 56(ft) – 46 – 9 = 1 Total float for H = 47 – 12 – 21 = 14	M1 A1ft B1 (3)
(d)		M1 A1 M1,A1 (4)
(e)	1pm day 16: C 1pm day 31: C F G H	B1ft B2ft,1ft,0 (3) **[15]**