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Mark Scheme (Results)
January 2007

GCE

GCE Mathematics

Decision Mathematics D1 (6689)

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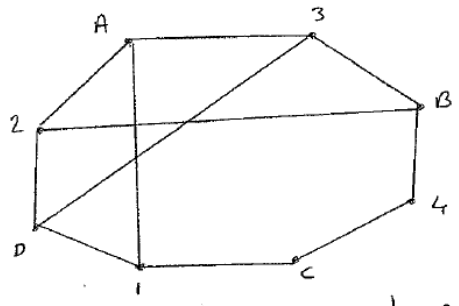
6689 Decision D1
Mark Scheme

Question Number	Scheme	Marks
1)	$\left[\frac{1+10}{2}\right] = 6$ Nicky – reject top of list. $\left[\frac{7+10}{2}\right] = 9$ Trevor – reject bottom of list $\left[\frac{7+8}{2}\right] = 8$ Steve – reject bottom of list $[7] = 7$ Preeby – reject Nigel not in list.	M1 A1 A1 A1 [4]

Question Number	Scheme	Marks
2) (a)	$G-3 = J-4 = L-5$ change status: $G = 3-J = 4-L = 5$ Improved matching: $E=2$, $G=3$, $J=4$, $L=5$	M1 A1 B1 (3)
(b)	e.g. George and Yiwen may both only be assigned to 3	B1 (1)
(c)	$Y-3 = G-2 = E-4 = J-1$ change status: $Y = 3-G = 2-E = 4-J = 1$ complete matching: $E=4$, $G=2$, $J=1$, $L=5$, $Y=3$	M1 A1 A1 (3) [7]

3) (a) A bipartite graph — B1 (1)

(b) A, 3, B, 4, C, 1, D, 2, A — B2, 1, 0 (2)

(c) 

Redrawing — m1

A1

Identifying that it is not planar — A1√ (3)

[6]

4) (a)

b.v.	x	y	z	r	s	Value	Row ops
z	$\frac{1}{2}$	0	1	$\frac{1}{4}$	0	20	$(R_1 \div 4)$
s	0	4	0	$-\frac{1}{2}$	1	120	$R_2 - 2R_1$
P	8	-8	0	5	0	400	$R_3 + 20R_1$

m1 A1

m1 A1√

A1√ (5)

(b) $P + 8x - 8y + 5r = 400$ — B1√ (1)

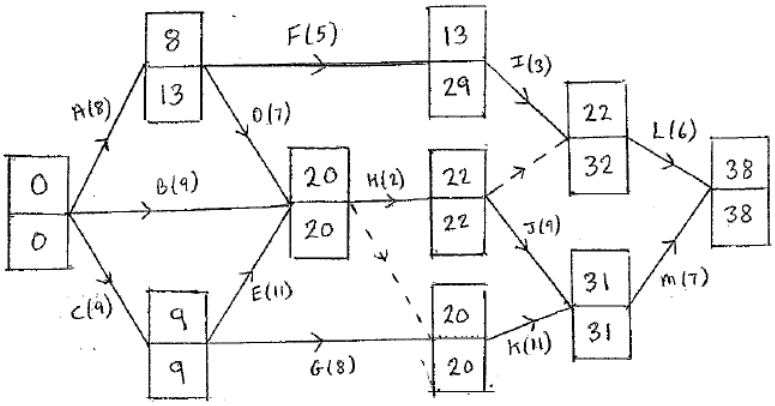
(c) Not optimal since there is a negative number in the profit row — B1√ (1)

[7]

5 (a)	e.g. Each edge contributes 2 to the sum of degrees, hence this sum must be even. Therefore there must be an even (or zero) number of vertices of odd degree Hence there cannot be an odd number of vertices of odd degree	B2,1,0 (2)
(b)	$CD + FH = 200 + 220 = 420$ * $CF + DH = 180 + 380 = 560$ $CH + DF = 400 + 160 = 560$ repeat CA, AD and FH	M1 A1 A1 A1 (4)
(c)	length = $4180 + 420\surd = 4600$ m	B1$\surd$ (1) 7

6) (a) J depends on H alone, but L depends on H and I — B1 (1)

(b)



m1 A1 m1 A1 (4)

(c) Total float on D = 20 − 7 − 8 = 5
Total float on E = 20 − 11 − 9 = 0
Total float on F = 29 − 5 − 8 = 16

m1 A1√ A1 (3)

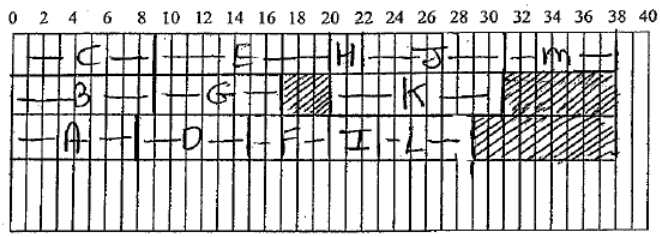
(d) C – E < H – J > m, K

m1 A1 (2)

(e) $\frac{95}{38} = 2.5$ so 3 workers

m1 A1√ (2)

(f) e.g.



19

m1 A1 A1 A1 (4)

16

A < F, D
C < E, G
B, D, E > H
B, D, E, G > K
J, K > m
H, I > L

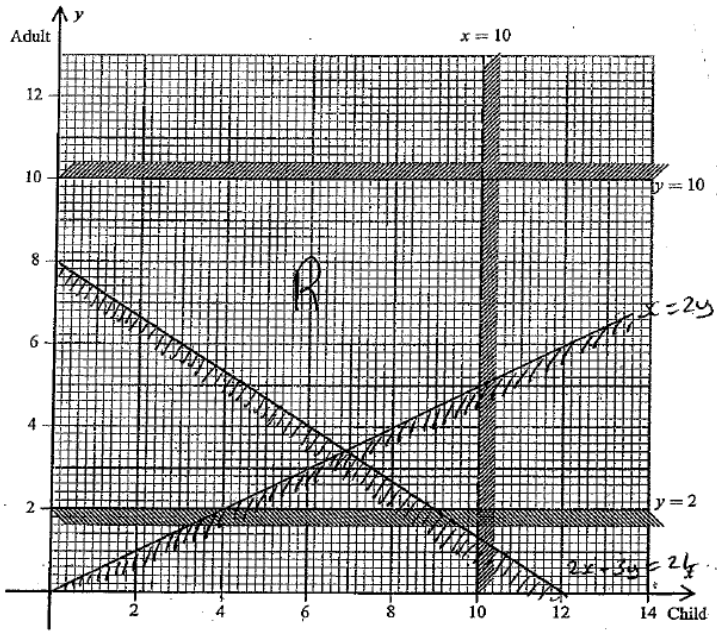
7) (a) To show a strict inequality — B1 (1)

(b) There must be fewer than 10 children — B1
There must be between 2 and 10 adults, inclusive. — B2,1,0 (3)

(c) $2x + 3y \geqslant 24$ — B1
$x \leqslant 2y$ — B1 (2)

(d)

Diagram 1

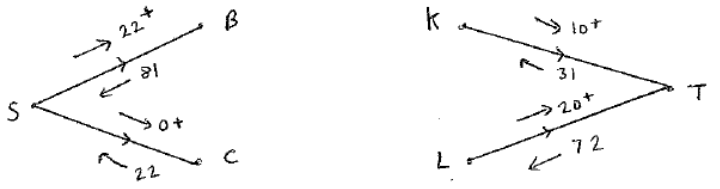


B1✓ (2x+3y=24)
B1✓ (x=2y)
B1✓ (shading)
B1 (R)
(4)

(e) minimum 0 children 8 Adults - 8 passengers — m1 A1
maximum 9 children 10 Adults - 19 passengers — B1 B1
(4)

14

8) (a)



M1 A1
A1
(3)

(b) 103

B1 (1)

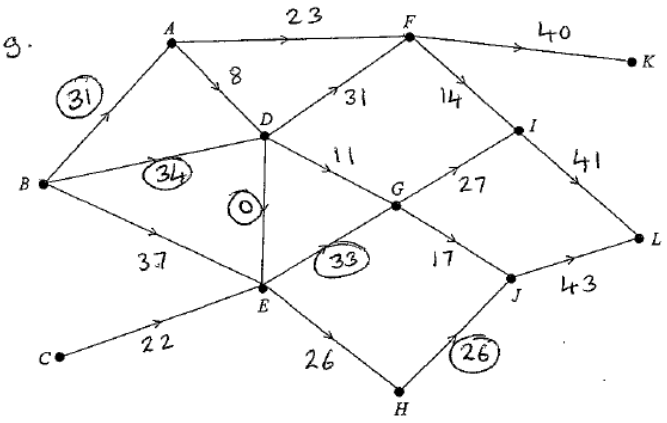
(c) e.g. S B E G I L T - 3
S B E D F K T - 5
S B E H J G D F K T - 4
S B E G D F I L T - 9

M1
A 4,3,2,1,0

(5)

Diagram 3

(d) e.g.



M1 A1
A1
(3)

Flow value 124 (given)

(e) Max flow = min cut
cut through AB, BD, DE, EG, HJ

M1 A1 (2)

14