edexcel
advancing learning, changing lives

Mark Scheme (Results)
Summer 2008

GCE

GCE Mathematics (6689/01)

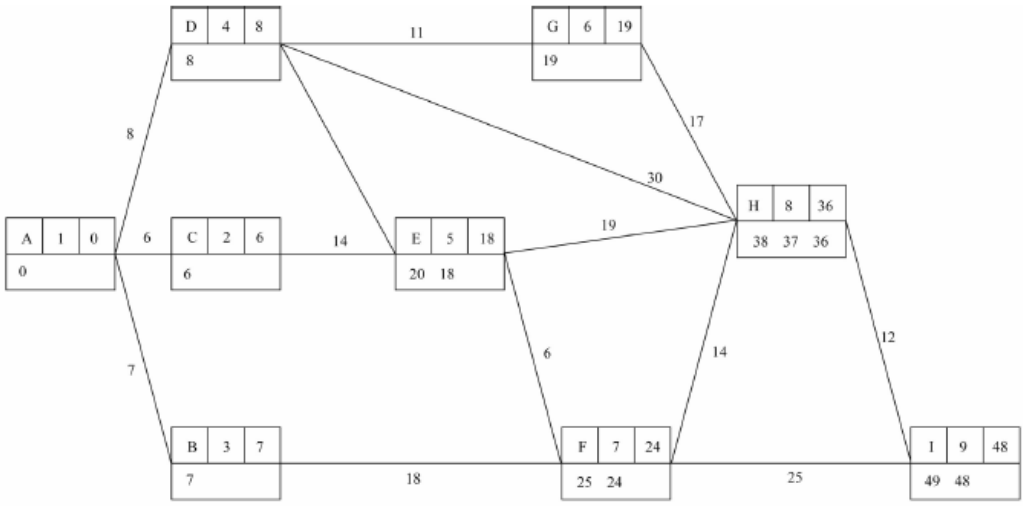
Edexcel Limited. Registered in England and Wales No. 4496750
Registered Office: One90 High Holborn, London WC1V 7BH

A PEARSON COMPANY

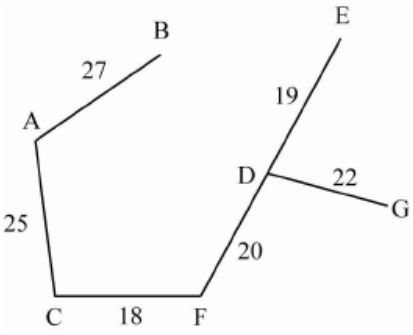
June 2008
6689 Decision Mathematics D1
Mark Scheme

Question Number	Scheme	Marks
Q1 (a)	$\frac{502}{100} = 5.02$ so 6 tapes.	M1 A1 (2)
(b)	Bin 1: 29, 52 Bin 2: 73 Bin 3: 87 Bin 4: 74 Bin 5: 47, 38 Bin 6: 61 Bin 7: 41	M1 A1 A1 (3)
(c)	Bin 1: 87 Bin 2: 74 Bin 3: 73 Bin 4: 61, 38 Bin 5: 52, 47 Bin 6: 41, 29	M1 A1 A1 (3)
	Notes: (a) 1M1: $(502 \pm 40) \div 100$ (maybe implicit) 1A1: cao 6 tapes (b) 1M1: Bin 1 correct and at least 8 values put in bins 1A1: Condone one error, (e.g. extra, omission, 'balanced'swap). 2A1: All correct (c) 1M1: Bin 1 correct and at least 8 values put in bins 1A1: Condone one error, (e.g. extra, omission, 'balanced'swap). 2A1: All correct	**Total 8**

Question Number	Scheme	Marks
Q2		
(a)	G – 5 = W – 3 change status G = 5 – W = 3	M1 A1 (2)
(b)	A – no match E = 2 G = 5 R = 4 W = 3	A1 (1)
(c)	e.g. R is the only person who can do 1 and the only person who can do 4	B 2, 1, 0 (2)
(d)	A – 2 = E – 3 = W – 4 = R – 1 change status A = 2 – E = 3 – W = 4 – R = 1 A = 2 E = 3 G = 5 R = 1 W = 4	M1 A1 A1 (3) **Total 8**
	Notes: (a) 1M1: Path from G to 3 1A1: CAO including change status (stated or shown), chosen path clear. (b) 2A1: CAO must ft from stated path (c) 1B1: Correct answer, may be imprecise or muddled (bod gets B1) but all nodes refered to must be correct. 2B1: Good, clear, correct answer. (d) 1M1: Path from A to 1 1A1: CAO including change status (stated or shown) but don't penalise twice. Chosen path clear. 1A1: CAO must ft from stated path **Misread** (remove last two A or B marks if earned.) A – 2 = E – 3 c.s. A=2 – E = 3 Matching A = 2, E = 3, R = 4 W = 5 Then G – 5 = W – 4 = R – 1 c.s. G = 5 – W = 4 – R =1 Matching A = 2, E = 3, G = 5, R = 1, W = 4	

Question Number	Scheme	Marks
Q3 (a)		M1 A1 A1ft
	Route: ADGHI Length: 48 (km)	A1 A1ft (5)
(b)	Odd vertices are A and H Attempt to find shortest route from A to H = ADGH New length: 197 + 36 = 233 Route: e.g. ADGHGDACEDHIFHEFBA (18)	B1 M1 A1ft A1 (4)
	Notes: (a) 1M1: Smaller number replacing larger number in the working values at E or F or H or I. (generous – give bod) 1A1: All values in boxes A to E and G correct 2A1ft: All values in boxes F, H and I correct (ft). Penalise order of labelling just once. 3A1: CAO (not ft) 4A1ft: Follow through from their I value, condone lack of units here. (b) 1B1: A and H identified in some way – allow recovery from M mark. 1M1: Accept, if correct, path, or its length. Accept attempt if finding shortest. 1A1ft: 197 + their shortest A to H (36) 2A1: A correct route.	**Total 9**

Question Number	Scheme	Marks
Q4 (a)	e.g. • Prims starts with any vertex, Kruskal starts with the shortest arc. • It is not necessary to check for cycles when using Prim. • Prims adds nodes to the growing tree, Kruskal adds arcs. • The tree 'grows' in a connected fashion when using Prim. • Prim can be used when data in a matrix form. Other correct statements also get credit.	B 2, 1, 0 (2)
(b)(i)	e.g. AC, CF, FD, DE, DG, AB.	M1, A1, A1 (3)
(ii)	CF, DE, DF, not CD, not EF, DG, not FG, not EG, AC, not AD, AB. [18, 19, 20, not 21, not 21 , 22 , not 23, not 24, 25, not 26, 27]	M1, A1, A1 (3)
		Total 8
	Notes: (a) 1B1: Generous one correct difference. If bod give B1 2B1: Generous two distinct, correct differences. (b) 1M1: Prim's algorithm – first three arcs chosen correctly, in order, or first four nodes chosen correctly, in order. 1A1: First five arcs chosen correctly; all 7 nodes chosen correctly, in order. 2A1: All correct and arcs chosen in correct order. 2M1: Kruskal's algorithm – first 4 arcs selected chosen correctly. 1A1: All six non-rejected arcs chosen correctly. 2A1: All rejections correct and in correct order and at correct time.	



Question Number	Scheme	Marks
Q5		
(a)	$x = 9,\ y = 11$	B1,B1 (2)
(b)	AC DC DT ET	B2,1,0 (2)
(c)	36	B1 (1)
(d)	$C_1 = 49,\ C_2 = 48,\ C_3 = 39$	B1,B1,B1 (3)
(e)	e.g. SAECT	B1 (1)
(f)	maximum flow = minimum cut cut through DT, DC, AC and AE	M1 A1 (2)
		Total 11

Notes:

(a) 1B1: cao (permit B1 if 2 correct answers, but transposed)
2B1: cao

(b) 1B1: correct (condone one error – omission or extra)
2B1: all correct (no omissions or extras)

(c) 1B1: cao

(d) 1B1: cao
2B1: cao
3B1: cao

(e) 1B1: A correct route (flow value of 1 given)

(f) 1M1: Must have attempted (e) and made an attempt at a cut.
1A1: cut correct – may be drawn. Refer to max flow-min cut theorem three words out of four.

Question Number	Scheme	Marks
Q6 (a)		

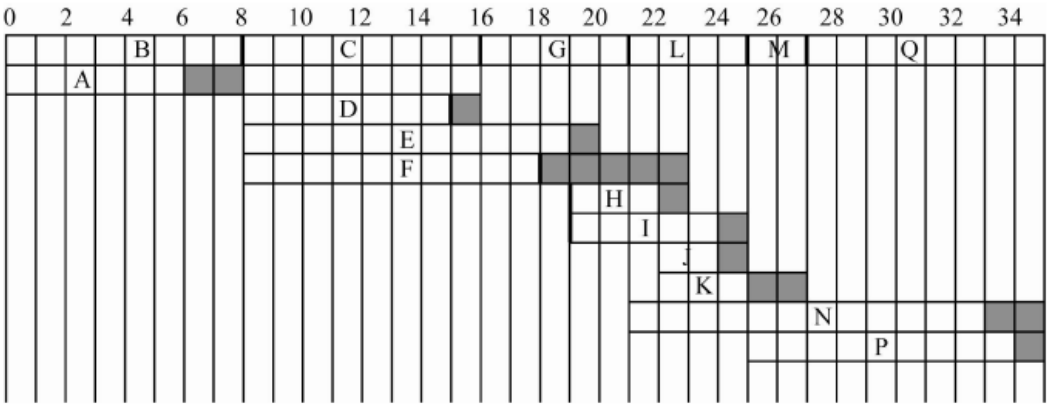
b.v	x	y	z	R	s	t	value
r	4	$\frac{7}{3}$	$\frac{5}{2}$	1	0	0	64
s	1	3	0	0	1	0	16
t	4	2	2	0	0	1	60
P	-5	$-\frac{7}{2}$	-4	0	0	0	0

b.v	x	y	z	R	s	t	value	Row ops	
r	0	$\frac{1}{3}$	$\frac{1}{2}$	1	0	-1	4	$R_1 - 4R_3$	M1 A1
s	0	$\frac{5}{2}$	$-\frac{1}{2}$	0	1	$-\frac{1}{4}$	1	$R_2 - R_3$	M1 A1ft A1
x	1	$\frac{1}{2}$	$\frac{1}{2}$	0	0	$\frac{1}{4}$	15	$R_3 \div 4$	
P	0	-1	$-\frac{3}{2}$	0	0	$\frac{5}{4}$	75	$R_4 + 5R_3$	

b.v	x	y	z	R	s	t	value	Row ops	
z	0	$\frac{2}{3}$	1	2	0	-2	8	$R_1 \div \frac{1}{2}$	M1 A1ft
s	0	$\frac{17}{6}$	0	1	1	$-\frac{5}{4}$	5	$R_2 + \frac{1}{2}R_1$	M1 A1
x	1	$\frac{1}{6}$	0	-1	0	$\frac{5}{4}$	11	$R_3 - \frac{1}{2}R_1$	(9)
P	0	0	0	3	0	$-\frac{7}{4}$	87	$R_4 + \frac{3}{2}R_1$	

(b) There is still a negative number in the profit row. B1 (1)

Total 10

Question Number	Scheme	Marks
Q7 (a)	v = 16 w = 25 x = 23 y = 20 z = 8	B3,2,1,0 (3)
(b)	B C G L M Q	B1 (1)
(c)	Float on H = 23ft – 19 – 3 = 1 Float on J = 25 – 22 – 2 = 1	B1 B1 (2)
(d)		M1 A1 A1 A1 (4)
(e)	E has one day of float, so project can still be completed on time.	B2,1,0 (2)
(f)	e.g • At time 23 ½ activities L, I, J and N must be taking place • At time 13 ½ or 14 ½ activities C, D, E and F must be taking place So 4 workers needed.	B2,1,0 (2)
		Total 14

Question Number	Scheme	Marks
Q8	Maximise (P=) $0.2\,a + 0.15\,b$ or $20\,a + 15\,b$ **o.e.**	B1 B1 (2)
	Subject to $a + b \leq 800$ $a \geq 2b$ $50 \leq b \leq 100$ $a \geq 0$	B1 B2,1,0 B1 B1 (5)
		Total 7
	Notes: 1B1: 'Maximise' 2B1: ratio of coefficients correct 3B1: cao 4B1: ratio of coefficients of a and b correct. 5B1: inequality correct way round i.e. $a \geq b$ 6B1: cao accept < – accept two separate inequalities here 7B1: cao • Penalise < and > only once with last B mark earned • Be generous on letters a, b, A, B, x, y etc and mixed, but remove last B mark earned if inconsistent or 3 letters in the ones marked.	