

Mark Scheme (Post-Standardisation) Summer 2009

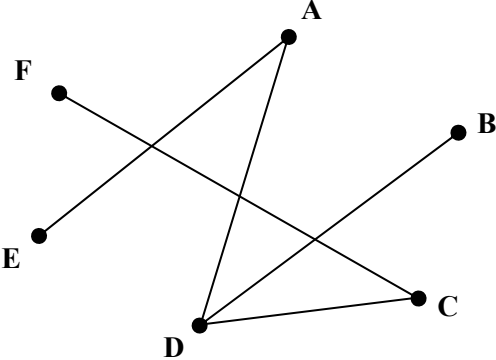
GCE

GCE Decision Mathematics D1 (6689/01)

General Marking Guidance

- All candidates must receive the same treatment. Examiners must mark the first candidate in exactly the same way as they mark the last.
- Mark schemes should be applied positively. Candidates must be rewarded for what they have shown they can do rather than penalised for omissions.
- Examiners should mark according to the mark scheme not according to their perception of where the grade boundaries may lie.
- There is no ceiling on achievement. All marks on the mark scheme should be used appropriately.
- All the marks on the mark scheme are designed to be awarded. Examiners should always award full marks if deserved, i.e. if the answer matches the mark scheme. Examiners should also be prepared to award zero marks if the candidate's response is not worthy of credit according to the mark scheme.
- Where some judgement is required, mark schemes will provide the principles by which marks will be awarded and exemplification may be limited.
- When examiners are in doubt regarding the application of the mark scheme to a candidate's response, the team leader must be consulted.
- Crossed out work should be marked UNLESS the candidate has replaced it with an alternative response.

June 2009
6689 Core Mathematics D1
Mark Scheme

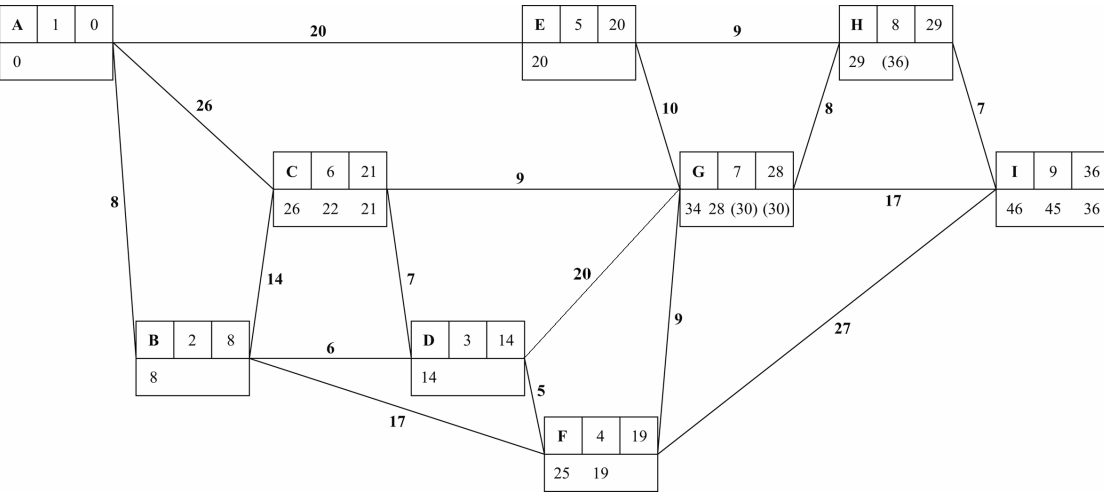
Question Number	Scheme	Marks																		
Q1	<p>(a) AD, AE, DB; DC, CF</p> <p>(b)</p>  <p>Weight 595 (km)</p> <p>(c) Notes: (a) 1M1: Using Prim – first 2 arcs probably but condone starting from another vertex. 1A1: first three arcs correct 2A1: all correct. (b) 1B1: CAO (c) 1B1: CAO condone lack of km.</p> <p><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</p> <table border="0" data-bbox="220 1697 1050 1953"> <tr> <td>[AD AE DB DC CF]</td> <td>{1 4 5 2 3 6}</td> <td>ADEBCF</td> </tr> <tr> <td>BD AD AE CD CF</td> <td>{3 1 5 2 4 6}</td> <td>BDAECF</td> </tr> <tr> <td>CD AD AE BD CF</td> <td>{3 5 1 2 4 6}</td> <td>CDAEBF</td> </tr> <tr> <td>DA AE DB CD CF</td> <td>{2 4 5 1 3 6}</td> <td>DAEBCF</td> </tr> <tr> <td>EA AD DB DC CF</td> <td>{2 4 5 3 1 6}</td> <td>EADBCF</td> </tr> <tr> <td>FC CD AD AE BD</td> <td>{4 6 2 3 5 1}</td> <td>FCDAEB</td> </tr> </table>	[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	<p>M1 A1; A1 (3)</p> <p>B1 (1)</p> <p>B1 (1)</p> <p>Total 5</p>
[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	<p>(a) $\frac{230}{60} = 3.8\dot{3}$ so 4 needed</p> <p>(b) Bin 1: 32 17 9 Bin 2: 45 12 Bin 3: 23 28 Bin 4: 38 16 Bin 5: 10</p> <p>(c) e.g. Bin 1: 32 28 Bin 2: 38 12 10 Bin 3: 45 9 Bin 4: 23 17 16</p> <p>Notes:</p> <p>(a) 1M1: Their 230 divided by 60, some evidence of correct method 3.8 enough. 1A1: cso 4.</p> <p>(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</p> <p>(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.</p> <p>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.</p>	<p>M1 A1 (2)</p> <p>M1 A1 A1 A1 (4)</p> <p>M1 A1 A1 (3)</p> <p>Total 9</p>

Question Number	Scheme	Marks
Q3	<p>(a) $H - 2 = M - 5 = R - 4$ change status to give $C = 3$ (E unmatched) $H = 2$ $M = 5$ $R = 4$ $S = 1$</p> <p>(b) e.g. C is the only person who can do 3 and the only person who can do 6</p> <p>(c) e.g. $E - 5 = M - 2 = H - 1 = S - 3 = C - 6$ change status to give $C = 6$ $E = 5$ $H = 1$ $M = 2$ $R = 4$ $S = 3$</p> <p>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</p>	<p>M1 A1 A1 (3) B1 (1) M1 A1 A1 (3) Total 7</p>

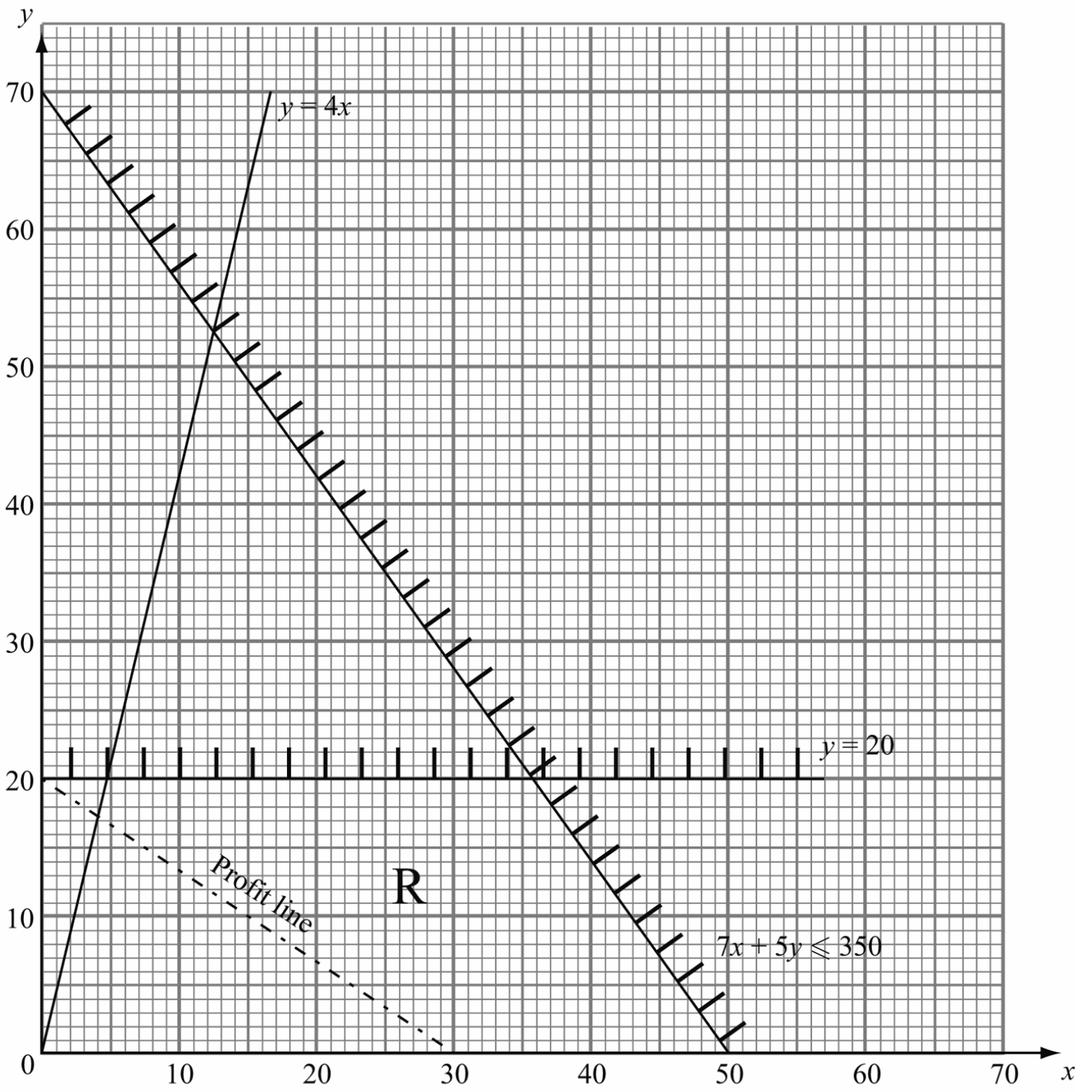
Question Number	Scheme	Marks																																																																		
Q4	<table border="1" data-bbox="400 277 1157 562"> <tr><td>M</td><td>J</td><td>E</td><td>K</td><td>H</td><td>B</td><td>L</td><td>P</td><td>N</td><td>D</td><td>B</td></tr> <tr><td>B</td><td>M</td><td>J</td><td>E</td><td>K</td><td>H</td><td>L</td><td>P</td><td>N</td><td>D</td><td>H</td></tr> <tr><td>B</td><td>E</td><td>D</td><td>H</td><td>M</td><td>J</td><td>K</td><td>L</td><td>P</td><td>N</td><td>D L</td></tr> <tr><td>B</td><td>D</td><td>E</td><td>H</td><td>J</td><td>K</td><td>L</td><td>M</td><td>P</td><td>N</td><td>(E) K P</td></tr> <tr><td>B</td><td>D</td><td>E</td><td>H</td><td>J</td><td>K</td><td>L</td><td>M</td><td>N</td><td>P</td><td>(J) N</td></tr> <tr><td>B</td><td>D</td><td>E</td><td>H</td><td>J</td><td>K</td><td>L</td><td>M</td><td>N</td><td>P</td><td>(M)</td></tr> </table> <p data-bbox="667 607 895 645" style="text-align: center;">Sort completed</p> <p data-bbox="225 696 671 779">$\left[\frac{1+10}{2} \right] = 6$ Katie reject left</p> <p data-bbox="225 831 735 913">$\left[\frac{7+10}{2} \right] = 9$ Natsuko reject right</p> <p data-bbox="225 965 687 1048">$\left[\frac{7+8}{2} \right] = 8$ Miri reject right</p> <p data-bbox="284 1061 660 1099">7 = Louis name found</p> <p data-bbox="220 1196 325 1234">Notes:</p> <p data-bbox="240 1240 1273 1279">(a) 1M1: quick sort, pivots, p, identified, two sublists one <p one >p.</p> <p data-bbox="288 1285 1070 1323">If choosing one pivot only per iteration, M1 only.</p> <p data-bbox="300 1330 1150 1368">1A1: first pass correct, next pivot(s) chosen consistently.</p> <p data-bbox="277 1375 1190 1413">2A1ft: second pass correct, next pivot(s) chosen consistently</p> <p data-bbox="277 1420 1158 1458">3A1ft: third pass correct, next pivot(s) chosen consistently</p> <p data-bbox="304 1464 1267 1541">4A1: cso List re-written or end statement made or each element been chosen as a pivot.</p> <p data-bbox="220 1547 1110 1585">(b) 1M1: binary search, choosing pivot rejecting half list.</p> <p data-bbox="304 1592 820 1630">If using unordered list then M0.</p> <p data-bbox="316 1637 655 1675">If choosing J M1 only</p> <p data-bbox="304 1682 1257 1720">1A1: first two passes correct, condone 'sticky' pivots here, bod.</p> <p data-bbox="284 1727 903 1765">2A1ft: third pass correct, pivots rejected.</p> <p data-bbox="316 1771 895 1809">3A1: cso, including success statement.</p> <p data-bbox="220 1816 1318 1877">Special case for (b) – If just one letter out of order, award maximum of M1A1A0A0</p>	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)	<p data-bbox="1362 277 1501 315">M1 1A1</p> <p data-bbox="1362 367 1458 405">2A1ft</p> <p data-bbox="1362 456 1458 495">3A1ft</p> <p data-bbox="1362 591 1522 629">4A1 (5)</p> <p data-bbox="1362 703 1417 741">M1</p> <p data-bbox="1362 837 1433 875">1A1</p> <p data-bbox="1362 972 1458 1010">2A1ft</p> <p data-bbox="1362 1061 1522 1099">3A1 (4)</p> <p data-bbox="1362 1128 1481 1167">Total 9</p>
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																																																										
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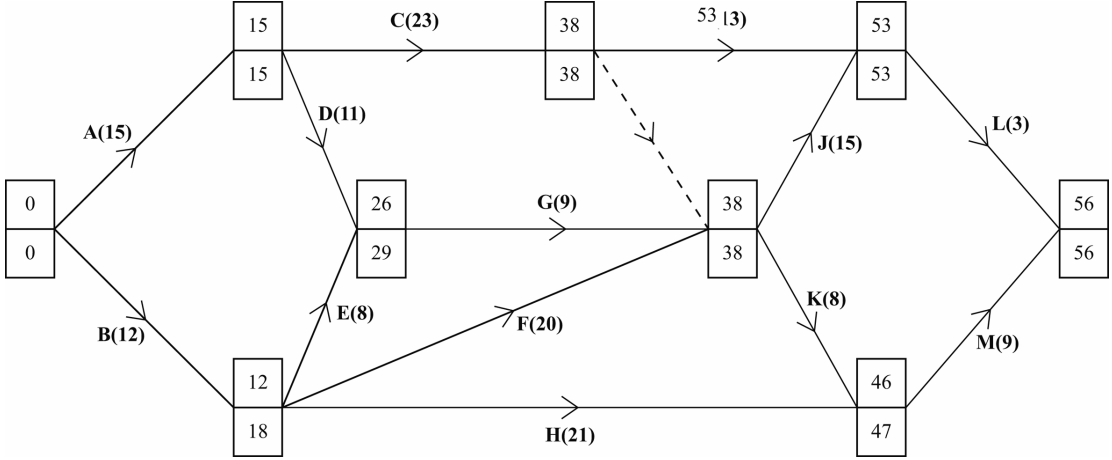
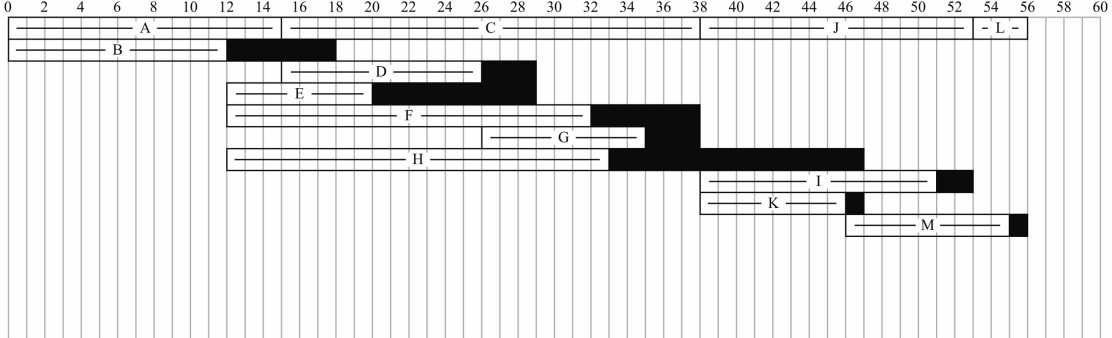
Question Number	Scheme	Marks
Q5 (a)	<p> $CD + EG = 45 + 38 = 83$ $CE + DG = 39 + 43 = 82 \leftarrow$ $CG + DE = 65 + 35 = 100$ Repeat CE and DG Length $625 + 82 = 707$ (m) </p> <p> DE (or 35) is the smallest So finish at C. New route $625 + 35 = 660$ (m) </p> <p> Notes: (a) 1M1: Three pairings of their 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) </p>	<p> M1 1A1 2A1 3A1 4A1ft 5A1ft (6) </p> <p> M1 A1ft A1ft=1B1 (3) </p> <p> Total 9 </p>

Question Number	Scheme	Marks
<p>Q6</p> <p>(a)</p>	 <p>Route: A E H I</p> <p>(b) Shortest distance from A to G is 28 km</p> <p>Notes:</p> <p>(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</p> <p>(b) 1B1ft: ft their final label at G condone lack of km</p>	<p>M1</p> <p>1A1</p> <p>2A1ft</p> <p>3A1ft</p> <p>4A1ft</p> <p>5A1</p> <p>B1ft</p> <p>Total 7</p>

Question Number	Scheme	Marks
Q7	<p>(a) $7x + 5y \leq 350$</p> <p>(b) $y \leq 20$ e.g. make at most 20 small baskets $y \leq 4x$ 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 $x = 10$, $y = 40, 39, 38$}</p> <p>(c) (see graph next page) Draw three lines correctly Label R</p> <p>(d) (P=) $2x + 3y$</p> <p>(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</p> <p>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</p>	<p>M1 A1 (2)</p> <p>B1 B1 (2)</p> <p>B3,2,1,0 B1 (4)</p> <p>B1 (1)</p> <p>M1 A1 B1 B1;B1 (5)</p> <p>Total 14</p>

7(c)



Question Number	Scheme	Marks
<p>Q8</p> <p>(a)</p>  <p>(b)</p> <p>A C J L</p> <p>(c)</p> <p>Total float for M = $56(\text{ft}) - 46 - 9 = 1$ Total float for H = $47 - 12 - 21 = 14$</p> <p>(d)</p>  <p>(e)</p> <p>1pm day 16: C 1pm day 31: C F G H</p>	<p>M1 A1</p> <p>M1 A1</p> <p>(4)</p> <p>B1 (1)</p> <p>M1 A1ft</p> <p>B1 (3)</p> <p>M1 A1</p> <p>M1,A1</p> <p>(4)</p> <p>B1ft</p> <p>B2ft,1ft,0</p> <p>(3)</p> <p>Total 15</p>	

Q4a 6689(01) D1 June 2009

Full credit for both of these:

Choosing middle left

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

Choosing first

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

Q8 6689(01) D1 June 2009

Q8 Notes:

- (a) 1M1: Top boxes completed generally increasing left to right.
 1A1: cao.
 2M1: Bottom boxes completed generally decreasing right to left.
 2A1: cao.
- (b) 1B1: cao
- (c) 1M1: Correct calculation seen – all three numbers at least once.
 1A1ft: One float correct ft on their 56 (only).
 1B1: cao two correct floats (even if method not seen)
- (d) 1M1: At least 7 activities placed, at least 3 floats visible (cascade not scheduling)
 1A1: All critical activities correct cao
 2A1=2M1: All 13 activities placed, 9 floats visible (cascade not scheduling)
 3A1=2A1: All non-critical activities correct cao
- (e) 1B1ft: cao or ft from their 13 activity cascade diagram
 2B1ft: condone one extra or one absence cao or ft from their 13 activity cascade diagram
 3B1ft: cao or ft from their 13 activity cascade diagram