GCE Examinations

Advanced Subsidiary / Advanced Level

Decision Mathematics
Module D1

Paper B

MARKING GUIDE

This guide is intended to be as helpful as possible to teachers by providing concise solutions and indicating how marks should be awarded. There are obviously alternative methods that would also gain full marks.

Method marks (M) are awarded for knowing and using a method.

Accuracy marks (A) can only be awarded when a correct method has been used.

(B) marks are independent of method marks.

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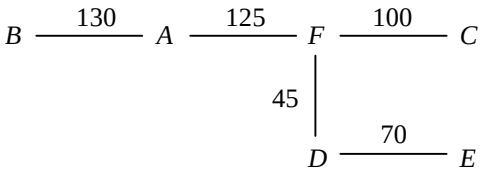
D1 Paper B – Marking Guide

1.

order:	5	6	4	1	3	2
	A	*B*	*C*	*D*	*E*	*F*
A	–	130	190	155	140	(125)
B	(130)	–	215	200	190	170
C	190	215	–	110	180	(100)
D	155	200	110	–	70	45
E	140	190	180	(70)	–	75
F	125	170	100	(45)	75	–

giving



M2 A2

lowest cost = £470 A1 **(5)**

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2. *(a)*

n	x_n	*a*	Any more data?	x_{n+1}	*b*	$(b-a)>0$?	*a*
1	8	8	Yes	2	2	No	2
2	–	–	Yes	4	4	Yes	–
3	–	–	Yes	3	3	Yes	–
4	–	–	Yes	5	5	Yes	–
5	–	–	Yes	1	1	No	1
6	–	–	Yes	7	7	Yes	–
7	–	–	No				

Final Output = 1 M2 A4

(b) it finds the smallest value in the set of data B1 **(7)**

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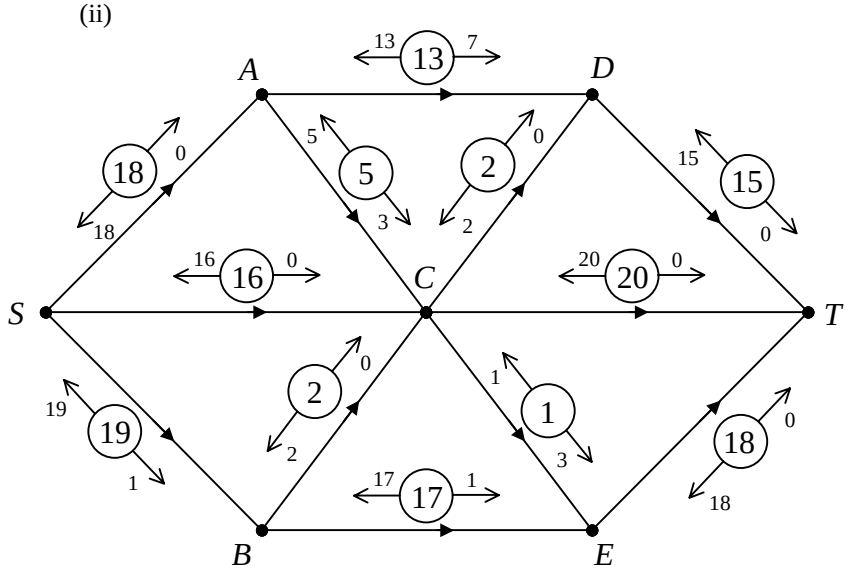
3. *(a)* $x = 2,\ y = 14$ M2 A1

(b) (i) e.g. augment *SCT* by 2 and *SBECADT* by 3 giving:

(ii)



M3 A3

maximum flow = 53 A1

(c) (i) minimum cut = 53, passing through *DT*, *CT* and *ET* B1

(ii) max flow = min cut
it is not possible to get any more flow across this cut B1 **(11)**

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4. *(a)* each node is joined to each other node by exactly one arc
no node is joined to itself by a loop B1

(b) (i) *ABCDA*, *ABDCA*, *ACBDA*, *ACDBA*, *ADBCA*, *ADCBA* = 6 M1 A1
(3 choices for 2nd node, 2 for 3rd, 1 for 4th $\therefore 3 \times 2 \times 1$)

(ii) $4 \times 3 \times 2 \times 1 = 24$ M1 A1

(iii) $9 \times 8 \times 7 \times 6 \times 5 \times 4 \times 3 \times 2 \times 1 = 362\,880$ M1 A1

(c) 27 25 29 32 [19] 24 17 26 (pivot in box)

17 [19] 27 25 29 [32] 24 26
L_1 L_2

17 19 27 25 [29] 24 26 [32]
L_3

17 19 27 25 [24] 26 [29] 32
L_4

17 19 [24] 27 [25] 26 29 32
L_5

17 19 24 [25] 27 [26] 29 32
L_6

17 19 24 25 [26] 27 29 32
L_7 now complete M2 A2 **(11)**

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5. *(a)* odd vertices are C and E — B1
shortest $CE = 28$ — M1
lowest total = sum of all arcs + shortest CE — M1
$= 218 + 28 = 246$ — A1

(b) odd vertices are C, E, P and Q — B1
shortest CE and $PQ = 13 + 18 = 31$
CP and $EQ = 33 + 28 = 61$
CQ and $EP = 15 + 20 = 35$; $\therefore$ lowest is 31 — M2 A1
total = sum of all arcs + 31 = 213 + 31 = 244 — M1 A1

(c) Logo 2 requires 2 cm less stitching — B1 **(11)**

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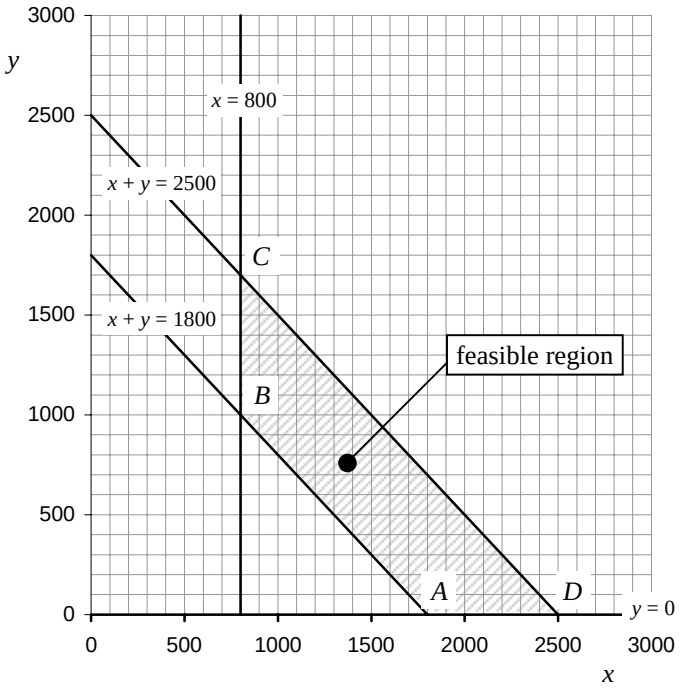
6. *(a)* (i) $x + y + z = 800 + 1000 + 700$
$\therefore z = 2500 - x - y$ — M1 A1
(ii) costs $= 500x + 800y + 600z + 100(x - 800) + 150(x + y - 1800)$ — M1 A1
sub in for z giving: costs $= 150x + 350y + 1\,150\,000$ — M1 A1

(b) $x + y \geq 1800$ and $x + y \leq 2500$ — A2

(c)



B4

(d) considering vertices A, B, C and D
minimum cost at A: $y = 0$ meets $x + y = 1800$
$\therefore$ should produce 1800 in Sep, 0 in Oct and 700 in Nov — M1 A1
total cost = £1 420 000 — A1 **(15)**

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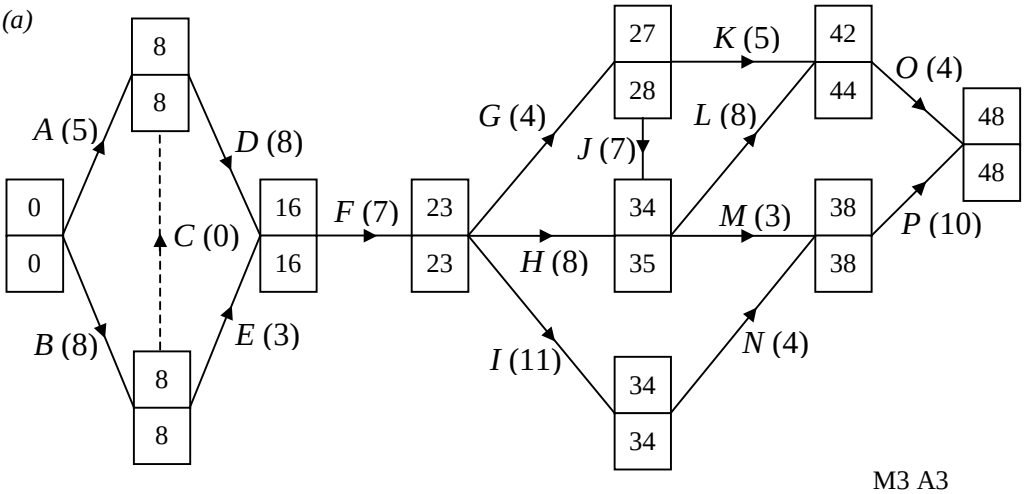
7. *(a)*



M3 A3

(b) *B, C, D, F, I, N, P* M1 A1

(c) 48 days A1

(d) *F* on critical path ∴ £150 000 penalty
if reduce *N* by more than 1 day it is no longer on critical path
∴ only reduces penalty by £50 000 at cost of £90 000 B3

(e) *B*, *D* and *P*:
reducing any of these by 2 days reduces minimum time by 2 days
this reduces penalty by £100 000 at cost of £80 000 ∴ profitable B3 **(15)**

Total **(75)**

Performance Record – D1 Paper B

Question no.	**1**	**2**	**3**	**4**	**5**	**6**	**7**	Total
Topic(s)	Prim's	flow chart	flows	graphs, Hamiltonian cycles, quick sort	route inspection	linear prog. - graphical	critical path	
Marks	5	7	11	11	11	15	15	75
Student								