

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.



Written by Shaun Armstrong & Dave Hayes

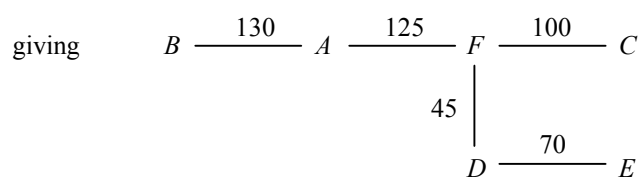
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D1 Paper B – Marking Guide

1.

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



M2 A2

lowest cost = £470

A1 (5)

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

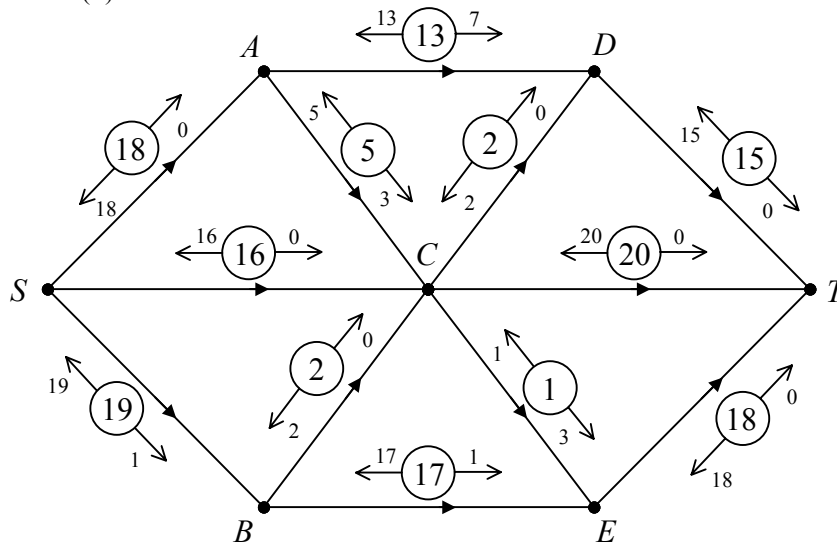
(b) it finds the smallest value in the set of data

B1 (7)

3. (a) $x = 2, y = 14$

M2 A1

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



maximum flow = 53

M3 A3

A1

- (c) (i) minimum cut = 53, passing through DT, CT and ET
(ii) max flow = min cut
it is not possible to get any more flow across this cut

B1

B1 (11)

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) $ABCD A, ABDCA, ACBDA, ACDBA, ADBCA, ADCBA = 6$
(3 choices for 2nd node, 2 for 3rd, 1 for 4th $\therefore 3 \times 2 \times 1$)
(ii) $4 \times 3 \times 2 \times 1 = 24$
(iii) $9 \times 8 \times 7 \times 6 \times 5 \times 4 \times 3 \times 2 \times 1 = 362880$

M1 A1

M1 A1

M1 A1

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

$\underbrace{17 \quad \text{19}}_{L_1} \quad \underbrace{27 \quad 25 \quad 29 \quad \text{32}}_{L_2} \quad 24 \quad 26$

17 19 $\underbrace{27 \quad 25 \quad \text{29}}_{L_3} \quad 24 \quad 26 \quad \text{32}$

17 19 $\underbrace{27 \quad 25 \quad \text{24}}_{L_4} \quad 26 \quad \text{29} \quad 32$

17 19 24 $\underbrace{27 \quad \text{25}}_{L_5} \quad 26 \quad 29 \quad 32$

17 19 24 25 $\underbrace{27 \quad \text{26}}_{L_6} \quad 29 \quad 32$

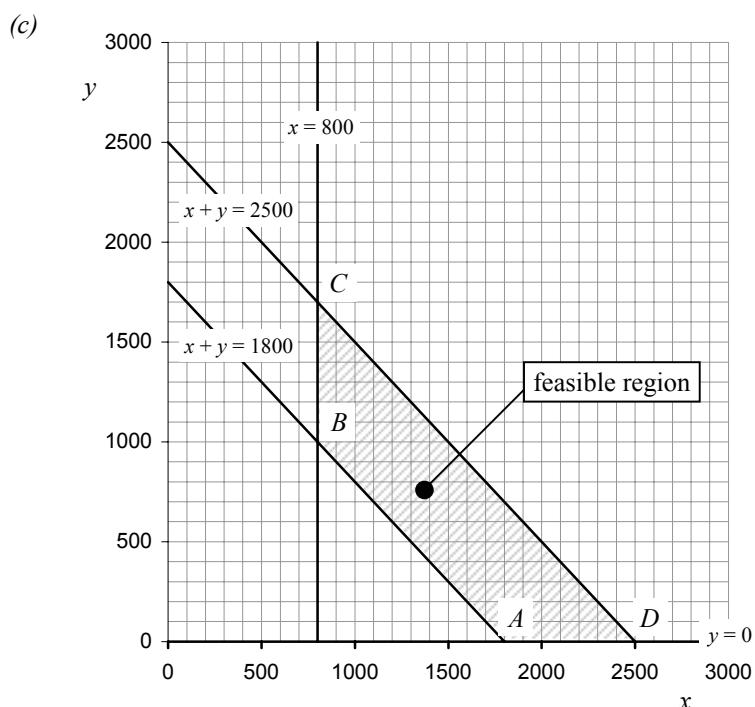
17 19 24 25 26 $\underbrace{27}_{L_7} \quad 29 \quad 32$

now complete

M2 A2 (11)

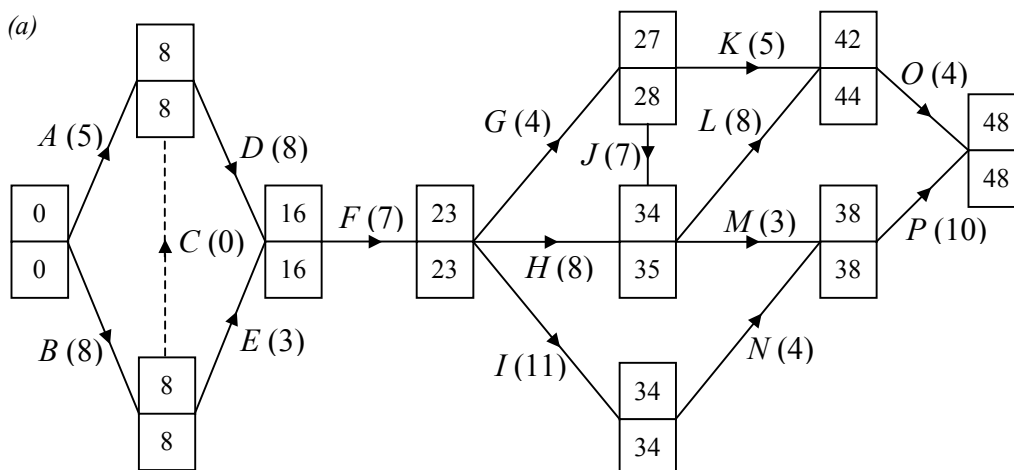
5. (a) odd vertices are C and E B1
 shortest $CE = 28$ M1
 lowest total = sum of all arcs + shortest CE M1
 $= 218 + 28 = 246$ A1
- (b) odd vertices are C, E, P and Q B1
 shortest CE and $PQ = 13 + 18 = 31$
 CP and $EQ = 33 + 28 = 61$
 CQ and $EP = 15 + 20 = 35$; $\therefore$ lowest is 31 M2 A1
 total = sum of all arcs + 31 = 213 + 31 = 244 M1 A1
- (c) Logo 2 requires 2 cm less stitching B1 (11)

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



- (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)

7. (a)



M3 A3

(b) B, C, D, F, I, N, P

M1 A1

(c) 48 days

A1

(d) F on critical path $\therefore$ £150 000 penalty
if reduce N by more than 1 day it is no longer on critical path
 $\therefore$ 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 $\therefore$ profitable

B3 (15)

Total (75)

Performance Record – D1 Paper B

[illegible]