GCE Examinations

Advanced Subsidiary / Advanced Level

Decision Mathematics
Module D1

Paper F

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.

Solomon Press

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D1 Paper F – Marking Guide

1. *(a)* list of 14 names $\therefore$ mid-point = 8th = KINCARDINE
PENICUIK is after this alphabetically so reduced list is:

LARGS
MALLAIG
MONTROSE
PENICUIK
ST. ANDREWS
THURSO

list of 6 names $\therefore$ mid-point = 4th = PENICUIK $\therefore$ found — M2 A1

(b) list of 14 names $\therefore$ mid-point = 8th = KINCARDINE
PENDINE is after this alphabetically so reduced list is:

LARGS
MALLAIG
MONTROSE
PENICUIK
ST. ANDREWS
THURSO

list of 6 names $\therefore$ mid-point = 4th = PENICUIK
PENDINE is before this alphabetically so reduced list is:

LARGS
MALLAIG
MONTROSE

list of 3 names $\therefore$ mid-point = 2nd = MALLAIG
PENDINE is after this alphabetically so reduced list is:

MONTROSE list of 1 name, not PENDINE $\therefore$ not in list — M2 A1

(c) it means each new list is at most half of previous list — B1 **(7)**

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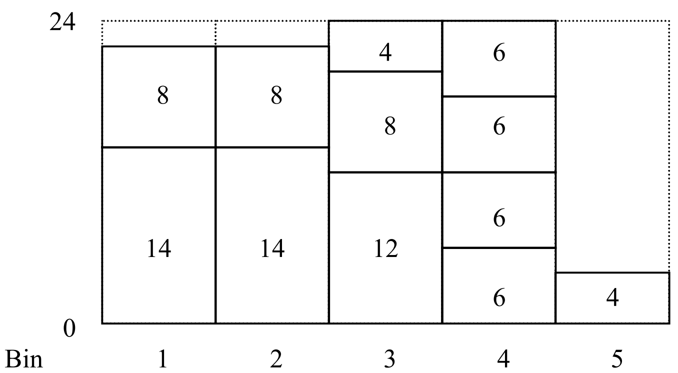
2. *(a)* total of lengths = 96 m; $96 \div 24 = 4$ $\therefore$ least no. of rolls = 4 — A1

(b) by inspection we have: 14, 14, 12, 8, 8, 8, 6, 6, 6, 6, 4, 4



$\therefore$ 5 rolls needed — M2 A1

(c) full-bins: (14 + 6 + 4), (14 + 6 + 4), (12 + 6 + 6) and (8 + 8 + 8) — M1 A1

(d) first-fit decreasing algorithm does not always give an optimal solution — B1 **(7)**

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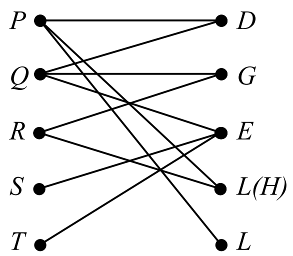
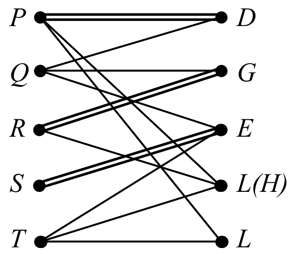
3. *(a)*



A1

(b) both S and T can only be linked with E, $\therefore$ not possible — B1

(c)



A1

(d) initial matching shown by — B1

(e) search for alternating path giving e.g. $T - L$ (breakthrough) — M1 A1
change status giving $T = L$ — M1
alternating path e.g. $Q - D = P - L(H)$ (breakthrough) — M1 A1
change status giving $Q = D - P = L(H)$ — M1
complete matching e.g. $P - L(H)$, $Q - D$, $R - G$, $S - E$, $T - L$ — A1 **(11)**

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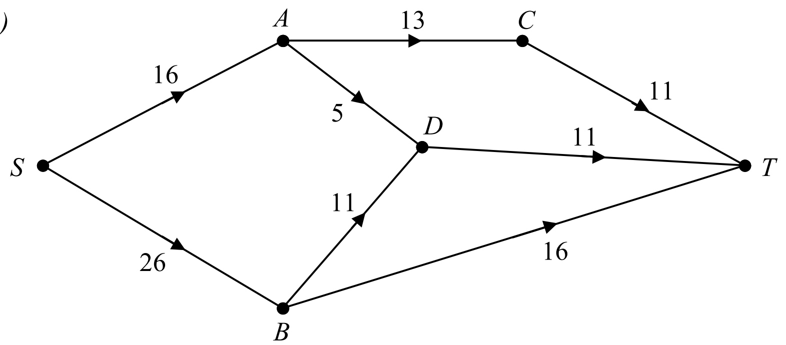
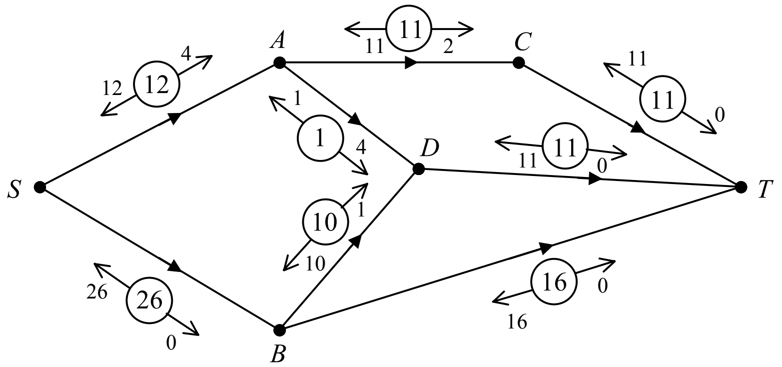
4. *(a)*



M1 A2

(b) minimum cut = $\{S, A, B, C, D\} \mid \{T\} = 38$ — M1 A1

(c) e.g. augment $SACT$ by 11, SBT by 16,
$SBDT$ by 10 and $SADT$ by 1, giving



M2 A2

maximum flow = 38 — A1

(d) maximum as = to minimum cut — B1 **(11)**

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5. *(a)*

x	a	b	$(a-b) < 0.01$?
100	50	26	No
–	26	14.923	No
–	14.923	10.812	No
–	10.812	10.0305	No
–	10.0305	10.00004	No
–	10.00004	10	Yes

Final Output = 10 M2 A4

(b) it finds the square root of 100 — B1

(c)

x	a	b	$(a-b) < 0.01$?
100	5	12.5	Yes

e.g. it stops instead of looping because $(a-b)$ becomes negative — A1 B1

(d) $a \geq 10$ — A2 **(11)**

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6. *(a)* let x = no. of children and y = no. of adults

maximise $R = 50x + 100y$

subject to $x + y \leq 90$

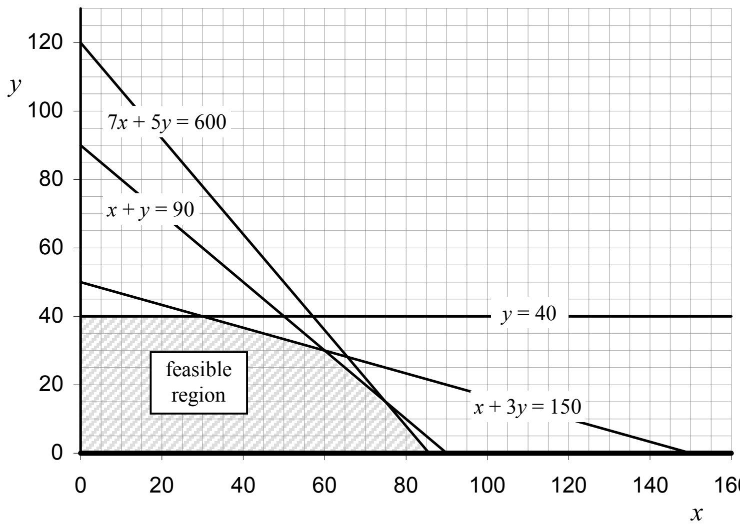
$y \leq 40$

$7x + 5y \leq 600$

$2x + 6y \leq 300 \;\; (x + 3y \leq 150)$

$x \geq 0, y \geq 0$ — M2 A2

(b)



B4

(c) considering vertices / lines of constant revenue

maximum R where $x + y = 90$ meets $x + 3y = 150$ giving $x = 60$, $y = 30$

$\therefore$ should accept 60 children and 30 adults giving revenue of £6000 — M2 A2

(d) no, as the windsurfing restriction is not a factor in optimal solution — B2 **(14)**

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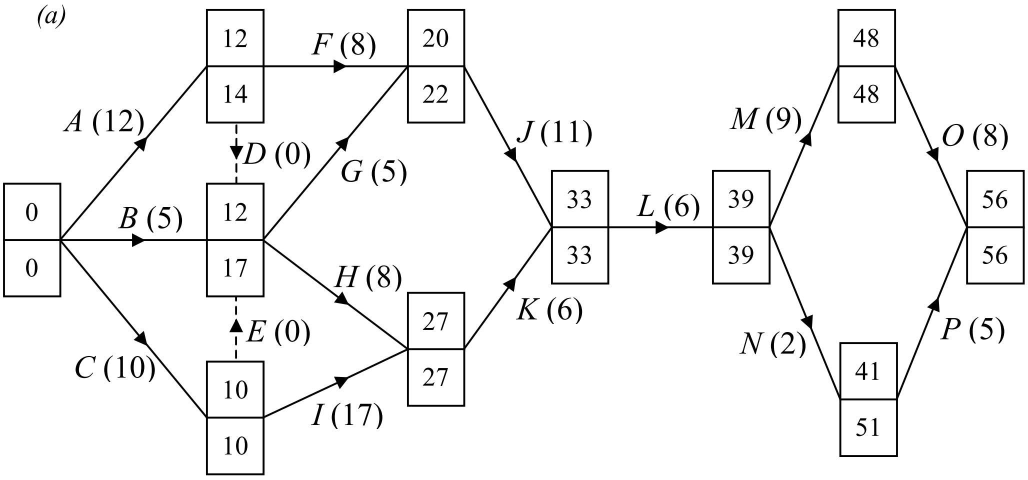
7. *(a)*

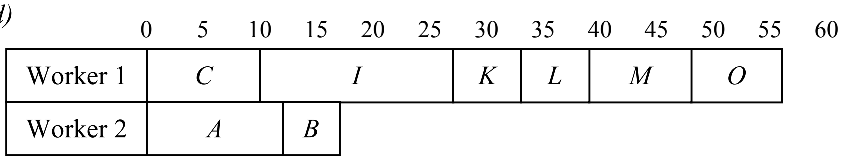


M3 A3

(b) C, I, K, L, M, O — M1 A1

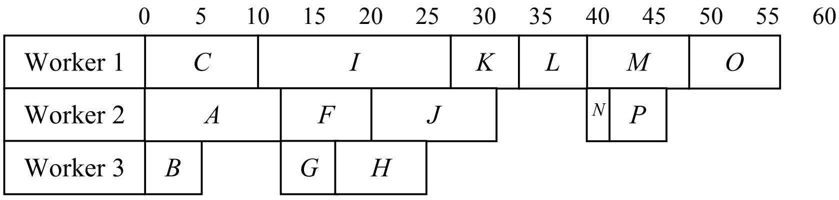
(c) 56 days — A1

(d)



with worker 1 doing tasks on critical path, worker 2 can do A and B
but no worker is available to start F after 14 minutes so not possible — B2

(e) e.g.



M1 A2 **(14)**

Total **(75)**

Performance Record – D1 Paper F

Question no.	**1**	**2**	**3**	**4**	**5**	**6**	**7**	Total
Topic(s)	binary search	bin packing	matching	flows	flow chart	linear prog. - graphical	critical path, schedul’g	
Marks	7	7	11	11	11	14	14	75
Student								