Cambridge International AS & A Level

Cambridge Assessment International Education
Cambridge International Advanced Subsidiary and Advanced Level

THINKING SKILLS **9694/31**

Paper 3 Problem Analysis and Solution **May/June 2018**

MARK SCHEME

Maximum Mark: 50

Published

This mark scheme is published as an aid to teachers and candidates, to indicate the requirements of the examination. It shows the basis on which Examiners were instructed to award marks. It does not indicate the details of the discussions that took place at an Examiners' meeting before marking began, which would have considered the acceptability of alternative answers.

Mark schemes should be read in conjunction with the question paper and the Principal Examiner Report for Teachers.

Cambridge International will not enter into discussions about these mark schemes.

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Generic Marking Principles

These general marking principles must be applied by all examiners when marking candidate answers. They should be applied alongside the specific content of the mark scheme or generic level descriptors for a question. Each question paper and mark scheme will also comply with these marking principles.

GENERIC MARKING PRINCIPLE 1:

Marks must be awarded in line with:

- the specific content of the mark scheme or the generic level descriptors for the question
- the specific skills defined in the mark scheme or in the generic level descriptors for the question
- the standard of response required by a candidate as exemplified by the standardisation scripts.

GENERIC MARKING PRINCIPLE 2:

Marks awarded are always **whole marks** (not half marks, or other fractions).

GENERIC MARKING PRINCIPLE 3:

Marks must be awarded **positively**:

- marks are awarded for correct/valid answers, as defined in the mark scheme. However, credit is given for valid answers which go beyond the scope of the syllabus and mark scheme, referring to your Team Leader as appropriate
- marks are awarded when candidates clearly demonstrate what they know and can do
- marks are not deducted for errors
- marks are not deducted for omissions
- answers should only be judged on the quality of spelling, punctuation and grammar when these features are specifically assessed by the question as indicated by the mark scheme. The meaning, however, should be unambiguous.

GENERIC MARKING PRINCIPLE 4:

Rules must be applied consistently e.g. in situations where candidates have not followed instructions or in the application of generic level descriptors.

GENERIC MARKING PRINCIPLE 5:

Marks should be awarded using the full range of marks defined in the mark scheme for the question (however; the use of the full mark range may be limited according to the quality of the candidate responses seen).

GENERIC MARKING PRINCIPLE 6:

Marks awarded are based solely on the requirements as defined in the mark scheme. Marks should not be awarded with grade thresholds or grade descriptors in mind.

MARK SCHEME NOTES

Abbreviations

The following abbreviations may be used in a mark scheme:

AG answer given (on question paper)
awrt answer which rounds to
cao correct answer only
ft follow through (from earlier error)
oe or equivalent
SC special case
soi seen or implied
www without wrong working

Question	Answer	Marks
1(a)	If he uses 4 Long questions, he has only 10 marks remaining **soi [1]** for the other six questions. This is an average of less than 2 marks per question / lowest total for remaining questions is (6×2 =) 12 / lowest total is 52 / only 5 questions possible **[1]**.	**2**
1(b)	The only possibility is 1S, 2P and 6C (244555555) *1 mark if one condition not satisfied:* *10Qs, 50 marks, 1 Long, 1 of each type.*	**2**
1(c)	1S, 7P, 0C is ruled out because there would be no Conceptual questions, and 3S, 1P, 4C would be ruled out because the total number of Short and Procedural questions would be smaller than the total number of Conceptual and Long questions. So the only possibility is 2S, 4P, 2C. *1 mark if one condition not satisfied:* *10Qs, 50 marks, 2 Long, 1 of each type, S+P>C+L*	**2**
1(d)	The **only** possible composition is 4 Short, 3 Procedural and 3 Long questions in each paper **[1]**; therefore the number of papers he can make will be limited by the number of Short questions available **[1]**. This means that he can make 4 examination papers **AG**.	**2**
1(e)	His options are (1S, 7P, 0C, 2L), (2S, 4P, 2C, 2L) and (4S, 3P, 0C, 3L). The maximum number possible of each of these patterns by themselves would be 3, 6 and 3. Using $6 \times$ (2S, 4P, 2C, 2L) allows him to assemble a seventh paper of (4, 3, 0, 3). A total of 7. *Award 1 mark for 6 with (2S, 4P, 2C, 2L)* *OR explicit listing of just the three exam paper options available*	**2**

Question	Answer	Marks
2(a)	200/32 = 6.25 = 6 200/43 = 4.65 = 5 300/54 = 5.56 = 6 *Award 1 mark for any two correct answers, or for three correct numbers but not rounded, as demanded.* *SC: 1 mark for 6, 4, 5 (all answers truncated)*	**2**
2(b)	She is charged \$3 for January, so must have gone over the limit. **[1]** (The most) she could have in January is 48 + 2 = 50. So it must be "fewer than 50". **[1]**	**2**

Question	Answer	Marks
2(c)	She had (9) spare from January **[1]**, but was still charged the extra dollar in February (when she could not have used up the extra pages gained from January), so no (the unused pages from the extra 10 cannot be used in the next month.) **[1]** *Correct judgment required for 2 marks.*	**2**
2(d)(i)	At least 49 + 5 + 1 = 55 paid for. Thus at least 55 – 36 = 19 blanks paid for. ***ft** from 'no more than 50' in **(b)**: 20*	**1**
2(d)(ii)	If all 36 pages were from 3-page documents, there would be 12 blanks with a total of 48. Changing a 3-page document into three 1-page documents generates (2) further pages, which are blank. 7 more pages are needed to reach 55; this is four 3-page documents being changed into 1-page documents. 12 – 4 = 8 *Any recognition that the optimal solution will involve odd pages coming from only 3 page documents and 1 page documents **[1]**.* *Feasible number of 3 page documents and 1 page documents from shaded rows of table below **[1]**.*	**3**

3 page docs	1 page docs	Printed pages	Paid for pages	Comment
12	0	36	48	<55 so no $3 charge
11	3	36	44+6	<55 so no $3 charge
10	6	36	40+12	<55 so no $3 charge
9	9	36	36+18	<55 so no $3 charge
8	12	36	32+24	56 pages so $3 charge
7	15	36	28+30	58 pages so $3 charge
6	18	36	24+36	60 pages so $3 charge
5	21	36	20+42	62 pages so $3 charge
4	24	36	16+48	64 pages so $3 charge
3	27	36	12+54	>5+49+10 so not possible

Question	Answer	Marks
3(a)	Suitable diagram with suitable calculation.	**1**
3(b)	8 for base $\times$ 5 for height, so <u>40</u>	**1**
3(c)	Type A house: 60 Red + 8 Green; Type B house: 40 Blue + 5 Green Number of blocks required = 1200 Red, 800 Blue and 260 Green Cost = (2 $\times$ \$55 + \$22) + (4 $\times$ \$22) + (\$22 + 2 $\times$ \$6) = <u>\$254</u> **ft** *1 mark for each brick colour, correctly calculated (3 marks, only awarded if correctly summed):* Green bricks cost \$34 Red bricks cost \$132 Blue bricks cost \$88 *If no marks awarded for brick costs, award 1 mark for calculating the best cost for a specified number of bricks, greater than 500 (Type A = \$156 and Type B = \$122).*	**3**
3(d)	\$200 = 3 $\times$ \$55 + 1 $\times$ \$22 + 2 $\times$ \$6 + \$1 OR 2 $\times$ \$55 + 4 $\times$ \$22 + \$2 OR 1 $\times$ \$55 +6 $\times$ \$22 + 2 $\times$ \$6 + \$1 OR 9 $\times$ \$22 + \$2 **[1]** Number of blocks = 1800 so number of Type A houses = 1800/60 = <u>30</u> *Award 1 mark for 1800 seen without supporting working*	**2**
3(e)	In the model, Area of Type A plot is 8 $\times$ 4 + 16 = 48 cm^2 (for 192 m^2) Area of Type B plot = 5 $\times$ 5 + 10 = 35 cm^2 (for 140 m^2) Area for 20 of each type = 20 $\times$ 83 = 1660 cm^2 Actual area = 1660 $\times$ 4 = <u>6640 m^2</u> *1 mark for 48 or 35 or 192 or 140 or 1660* ***soi*** *SC: 1 mark for 26560 m^2*	**2**
3(f)(i)	Area of 10 houses = 5 $\times$ their 48 + 4 $\times$ their 35 + 100 = 480 (cm^2) **[1]** Actual area = 4 $\times$ their 480 = 1920 (m^2) OR available area = 30 000/4 = 7500 (cm^2) **[1]** Divide 30 000 by their 1920 OR 7500 by their 480 (= 15.625) **[1]** Number of houses must be a whole number, so 15 $\times$ 5 = <u>75 Type A</u> 15 $\times$ 4 = <u>60 Type B</u> 15 $\times$ 1 = <u>15 Type C</u> **ft [1]** *Award final* ***ft*** *if ratio is calculated using the integer part of 30 000/their area for plot of 10 houses.*	**4**

Question	Answer	Marks
3(f)(ii)	75 Type A, 60 Type B and 15 Type C have area 1920 × 15 = 28 800 **ft [1]** Area left for car parking is 30 000 – 28 800 = 1200 square metres **ft [1]** OR (0.625/15.625) = proportion unused **ft [1]** × 30 000 = 1200 square metres **ft [1]**	**2**

Question	Answer	Marks
4(a)	23:48 It takes trains 38 minutes (12 × 3 minutes + 2 minutes) to travel from Jabber to Wock (or from Wock to Jabber). The final trains of the day depart from Jabber and Wock at 23:10 and arrive at their final destinations at 23:48. It takes trains 29 minutes (9 × 3 minutes + 2 minutes) to travel from Bander to Snatch (or from Snatch to Bander). The final trains of the day depart from Bander and Snatch at 23:15 and arrive at their final destinations at 23:44. *Award 1 mark for journey time for one of the lines (Jabber–Wock = 38 minutes, OR Bander–Snatch = 29 minutes). Implied by 23:48 or 23:44 seen* *SC: 1 mark for 23:47 or 23:49*	**2**
4(b)	12 8 trains on the Jabber–Wock line (the 10:30 departures from Jabber and Wock are still 3 minutes away from their final destinations) **[1]** 4 trains on the Bander–Snatch line (the 10:30 departures from Bander and Snatch arrive at their final destinations at 10:59) **[1]** SC: *If no marks can be awarded for the above, award 1 mark for a total of 6* OR *4 trains on the Jabber–Wock line* AND *2 trains on the Bander–Snatch line (considering one direction only).*	**2**
4(c)(i)	His first journey of the day costs 50% of $3.50 **[1]** + $1.00 and his journey back costs 50% of $3.50, a daily total of $4.50 **[1]** $100 ÷ $4.50 = 22 (with $1.00 credit remaining) *SC: 1 mark for 28 (omitting the $1 cost at the start of day)*	**3**
4(c)(ii)	$54 (**ft** *their **(i)*** × $7 – $100)	**1**

Question	Answer	Marks
4(d)(i)	$7.60 Wabe to Slithy: 60% of $3.50 + $1.00 = $3.10 Slithy to Bander: 60% of $4.00 = $2.40 Bander to Wabe: 60% of $3.50 = $2.10 *If 2 marks cannot be awarded, award 1 mark for any of the following:* • *an answer of $6.60 (forgetting the extra $1.00 for the first journey)* • *an answer of $8.70 (the total cost with a Lobster card)* • *an answer of $6.50 (the total cost with a Porpoise card)* • *an answer of $12 (forgetting the discount)* • *evidence of correct calculation of the cost for two of the journeys*	**2**
4(d)(ii)	She boarded the 14:43 train from Slithy (the 14:40 from Wock), which arrived at Vorpal shortly before 14:49. She boarded the 14:57 train at Vorpal (the 14:45 from Snatch), arriving at Bander 17 minutes later ($5 \times 3 + 2$) at 15:14. *If 3 marks cannot be awarded, award 1 mark for sight of leaving Slithy at 14:43 or 14:42* *and 1 mark for sight of leaving Vorpal at 14:57 or 14:56* *SC: 2 marks for 15:15 or 15:13*	**3**
4(d)(iii)	She would have arrived at Uffish at / shortly before 15:07 (18 minutes after departure from Vorpal) and could have boarded the 15:09 train from Uffish (the 14:45 from Snatch), so would arrive at 15:14 *If 2 marks cannot be awarded, award 1 mark for appreciation of arrival at Uffish at / just before 15:07 or 15.06* *OR* *18 minutes later than the arrival time at Vorpal seen in (ii)* ***ft***	**2**