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**THINKING SKILLS**

**9694/31**

Paper 3 Problem Analysis and Solution

**May/June 2019**

MARK SCHEME

Maximum Mark: 50

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**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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This document consists of **8** printed pages.

**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.

**Abbreviations**

The following abbreviations may be used in a mark scheme:

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

Question	Answer	Marks
1(a)	For example, 8.7, 4.6, 1.1 (= 14.4) 6.5, 3.2, 2.1, 1.6, 1.5 (= 14.9)  <i>Award two marks for any correct pair of sets.            Award one mark for one correct set and one incorrect set            OR one correct set and the other incomplete/not defined.</i>	<b>2</b>
1(b)	Yes. The file sizes are now 1.4, 1.5, 1.6, 1.8, 3.2, 5.0, 6.5, 8.7, so, for example, if Barry puts 6.5, 3.2 and the 5 together (total 14.7) then the others can go together (total 15) in the other email.	<b>1</b>
1(c)	<u>5. [1]</u> <u>{8.1}, {7.9}, {6.4, 2.7}, {5.3, 4.5}, {4.5, 4.5} [1]</u>  <i>If neither mark is awarded, award 1 mark for {6.4, 2.7} seen.</i>	<b>2</b>
1(d)	Small: 7 envelopes = \$3.50, postage \$28 + \$2.10, total \$33.60 Medium: 5 envelopes = \$3.50, postage \$25 + \$3.00, total <u>\$31.50</u> Large: 3 envelopes = \$4.80, postage \$30 + \$2.30, total \$37.10  <i>5 marks for \$31.50 as final answer            4 marks for \$31.70 as final answer (fills 4 M envelopes so has only 30 sheets in the fifth)            3 marks for correct total costs for any two sizes (allow \$31.70 M)            2 marks for correct total cost for any one size (allow \$31.70 M)</i>  <i>If no other marks can be awarded, 1 mark for correct number of envelopes for all three sizes OR correct cost of envelopes for any one size (\$3.50 for S, \$3.50 for M, \$4.80 for L).</i>	<b>5</b>

Question	Answer	Marks
2(a)	Income = $(\$2 + 10 \times \$1 =)$ \$12. Cost = $10 \times 2 \times \$0.2 =$ \$4. Difference = \$8 <b>AG</b>	<b>1</b>
2(b)	A profit of \$14 would require a journey distance of $(14 - 2)/0.6 =$ <u>20</u> km  <i>1 mark for \$0.60 soi</i> <i>Trial &amp; Improvement approach: a correct calculation for a distance greater than 10km, and an improvement attempt [1]</i>	<b>2</b>
2(c)	The average number of jobs per hour will be $40/(2 \times 10) = 2$ , so he estimates that he will do $12 \times 2 = 24$ during his shift. So he will make a profit of $24 \times 8 =$ <u>\$192</u> .  <i>Award 1 for 24 journeys OR for a correct hourly profit of \$16.</i>	<b>2</b>
2(d)	He will be able to complete 12 trips at \$14 profit each, so will only make \$168. This is less than \$192. OR His hourly profit will drop from \$16 to \$14. OR Longer journeys means fewer fixed fares <b>oe</b>	<b>1</b>
2(e)	A total profit per shift of \$240 corresponds to 30 journeys earning \$8 per journey. This is 600 km, so he will need to travel at <u>50 km/h</u> . OR A total profit per shift of \$240 corresponds to an hourly profit of \$20. To achieve this, an average speed of $20/16 \times 40 =$ <u>50 km/h</u> will be needed.  <i>1 mark for either 30 journeys, or 5/4 oe</i>	<b>2</b>
2(f)	For each 10 km journey, his fuel cost will increase by $20 \times \$0.05 =$ \$1. <b>[1]</b> Therefore, he will need to charge $\$1 \div 10$ more per kilometre, so <u>\$1.10</u> .  <i>If neither of the above marks can be awarded, award 1 mark for a correct algebraic expression for the profit :</i> Hourly : $2(2 + 10r - 5) =$ \$16 <b>oe</b> OR Shift profit: $(\$2 \times 24 + 240r) - \$0.25 \times 480 (= \$192)$ <b>oe</b> OR Journey Profit: $(2+10r)-(0.25 \times 2 \times 10) =$ \$8 <b>oe</b>	<b>2</b>

Question	Answer	Marks
3(a)(i)	<u>ZYHRAK</u>	1
3(a)(ii)	<u>O TEW</u> (Beth) [1] <u>CIDD</u> (Ross) [1] <i>SC: 1 mark for QTEW and NBDD (translating 'the wrong way')</i>	2
3(a)(iii)	<i>Award 1 mark for each of the following (maximum 2 marks):</i> <u>May 26th</u> <u>June 26th</u> <u>July 25th</u>  (It can only occur when O, P, Q, R and S are positioned consecutively in the ciphertext alphabet. At least one of these letters appears in each of the other nine keywords.)	2
3(b)	<u>312</u> ( $12 \times 26$ )	1
3(c)(i)	<u>21st</u> <i>1 mark for evidence of <math>Z \rightarrow R</math></i> <i>OR</i> <i>for answer of 20<sup>th</sup> (failing to discount the second O).</i>	2
3(c)(ii)	<u>14</u> <i>1 mark for once in each month (12)</i> <i>1 mark for a second date in April and August</i>	2
3(d)	<u>W and X</u> [1] <u>are the only consecutive pair of letters of which neither appear in any of the keywords</u> <u>oe</u> (so they are never separated in the ciphertext alphabet). [1] <i>SC: 1 mark for A and Z, justified by an appeal to the fact that they will be adjacent throughout April and August.</i> <i>OR</i> <i>1 mark for S and T, justified by an appeal to the fact that they will be adjacent throughout August.</i>	2

Question	Answer	Marks
3(e)	<p><u>August 14th</u></p> <p><i>If 3 marks cannot be awarded, award 2 marks for concluding that it must be 'August' If 2 marks cannot be awarded, award 1 mark: For showing the cipher text alphabet for the 10 letters in HAPPY BIRTHDAY OR For explicitly eliminating January, February, March, April, September, October, November, and December due to R not being in a keyword OR For appreciating that R adjacent to V means that month must contain STU OR For appreciating that T must be in a keyword (so month must be August, September, October)</i></p> <p><i>SC: 1 mark for 14<sup>th</sup> without a reference to the month.</i></p>	3

Question	Answer	Marks															
4(a)	<p><i>Award 1 mark each (maximum 2 marks) for any of the following five possibilities (accept words or digits):</i></p> <p><u>SEVEN, EIGHT, NINE, FOUR, TEN</u>  <u>SEVEN, NINE, TEN, FOUR, EIGHT</u>  <u>EIGHT, NINE, SEVEN, FOUR, TEN</u>  <u>NINE, EIGHT, SEVEN, FOUR, TEN</u>  <u>TEN, NINE, SEVEN, FOUR, EIGHT</u></p>	<b>2</b>															
4(b)	<table border="0"> <tr> <td><u>row 1, to the left</u> (of the fixed E)</td> <td>NE (row 1)</td> <td></td> </tr> <tr> <td><u>row 1, to the right</u> (of the fixed E)</td> <td>EN (row 1)</td> <td></td> </tr> <tr> <td><u>row 2, to the left</u> (of the fixed I)</td> <td>NI (row 2)</td> <td></td> </tr> <tr> <td><u>row 2, to the right</u> (of the fixed I)</td> <td>IN (row 2)</td> <td><b>Given</b></td> </tr> <tr> <td><u>row 4, to the right</u> (of the fixed O)</td> <td>ON (row 4)</td> <td></td> </tr> </table> <p><i>Ignore repetition of the location given (i.e. row 2, to the right of the fixed I)</i>  <i>Award 1 mark for two or three correct.</i></p>	<u>row 1, to the left</u> (of the fixed E)	NE (row 1)		<u>row 1, to the right</u> (of the fixed E)	EN (row 1)		<u>row 2, to the left</u> (of the fixed I)	NI (row 2)		<u>row 2, to the right</u> (of the fixed I)	IN (row 2)	<b>Given</b>	<u>row 4, to the right</u> (of the fixed O)	ON (row 4)		<b>2</b>
<u>row 1, to the left</u> (of the fixed E)	NE (row 1)																
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<u>row 2, to the right</u> (of the fixed I)	IN (row 2)	<b>Given</b>															
<u>row 4, to the right</u> (of the fixed O)	ON (row 4)																
4(c)	<p><u>Greg scored 14 points; Ingrid scored 16 points</u>  <u>Order : EIGHT – SIX – TEN – FOUR – TWO</u></p> <p><i>1 mark for appreciation that SIX must be on the second row and FOUR on the fourth row.</i></p>	<b>2</b>															
4(d)	<p><u>H, W and X</u> (it is possible to place all the other available tiles on at least one row)</p> <p><i>2 marks for all three letters in any order.</i>  <i>Award 1 mark for two correct letters.</i></p>	<b>2</b>															
4(e)(i)	<u>S</u> (the second S – placed by Greg)	<b>1</b>															
4(e)(ii)	<u>There was not another I in the bag</u> (with which to spell EIGHT).	<b>1</b>															
4(e)(iii)	<p><u>Greg scored 11 points</u> [1]  <u>Ingrid scored 13 points</u> [1]</p> <p>(Greg completed SIX with the first S and FIVE with the second F; Ingrid completed FOUR with the R and NINE with the N.)</p> <p><i>Allow 1 mark for 11 points and 13 points, either credited the wrong way round or not specified who scored which.</i></p> <p><i>SC: 1 mark for Greg scores 19 and Ingrid scores 5 (if S is disregarded rather than discarded).</i></p>	<b>2</b>															
4(f)	<p>Greg should play his H next to the T (on either side, making EIGHT or THREE) [1]  Forcing Ingrid to play either  her X (to the right of the I), in which case Greg can use S (to make SIX) [1]  or her W (to the left of the O), in which case Greg can use T (to make TWO) [1]</p>	<b>3</b>															