Cambridge International AS & A Level

Cambridge Assessment International Education
Cambridge International Advanced Subsidiary and Advanced Level

THINKING SKILLS **9694/32**

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.

Cambridge International is publishing the mark schemes for the May/June 2018 series for most Cambridge IGCSE™, Cambridge International A and AS Level and Cambridge Pre-U components, and some Cambridge O Level components.

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)(i)	3	**1**
1(a)(ii)	*1 mark for use of opposite faces adding to 7 anywhere in explanation.* *1 mark for reference to matching the orientation seen on die C or deduced about D.*	**2**
1(b)	The total excluding the spots on die A is 1+1+5+2+4+4=17. The two faces of die A that are included in the total are either 6–3 or 1–4 as it must match the orientation of numbers that is true for die B, so these add to either 5 or 9. The totals are 22 and 26 *2 marks for one or other, without or without a second number* *OR max 2 of* *1 mark for 17 B+C+D* *1 mark for either 6–3 or 1–4 for die A* *1 mark for difference of 4 (min 19 max 29)* **ft** *from 4 in* ***(a)(i)*** *16 BCD and 21 and 25*	**3**
1(c)	5 and 9	**1**
1(d)(i)	A must be the Sicherman die with 1,2,2,3,3,4 (is the only die without a 5 or 6) B cannot be a Sicherman because it has a 2 and a 6. C cannot be a Sicherman because the 4 and 5 would have to be opposite. Since neither B nor C for above reasons, A and D must be the Sicherman pair. *2 marks for correct pair with reasons for excluding B and excluding C.* *1 mark for any of three deductions above, or answer A and D without justification.*	**2**
1(d)(ii)	The hidden face of die B is still a 4. The hidden face of die D could be 3 or a 6, so choose 3. The two back faces of die A could be 1 and 2 – total 3. The smallest possible total is 19.	**1**

Question	Answer	Marks
2(a)	120 + (24 – 12) + (30 – 44) – 10 = <u>108</u> *1 mark for correct processing at Banta (132), or* **ft** *from error at Banta, or 118.*	**2**
2(b)(i)	12 of original people get off at Banta, leaving 108A (+ 24B). At Chanta, (44 get off: 24B +) 20A, leaving 88A (+ 0B + 30C) For greatest number of A to arrive at Ethos, none will get off at Danter, so greatest number who travel Athos to Ethos is <u>88</u>. *1 mark for 88(A) at Danter with subsequent wrong working* *OR* *1 mark for identifying that the limit is when the maximum number of non-As get off at Chanta.* **ft** *clear Banta number from* ***(a)****–20*	**2**
2(b)(ii)	All the people who started at Athos who are still on the train at Danter can get off at Danter Least number who travel Athos to Ethos is <u>0</u>	**1**
2(c)	130 people on train before people got on at Chanta (150 + 10 – 30) So 130 = two thirds of people arriving at Chanta So 195 people leave Banta and 195 – 150 = 45 is the reduction at Banta. 45 × 2 = <u>90</u> people got on the train at Banta *2 marks for 195 seen* *or 1 mark for 130 seen OR 3/2x to determine arriving at Chanta OR –150 and double to determine arriving at Banta* *OR* *2 marks for an algebraic statement:* $\frac{2}{3}\left(150+\frac{x}{2}\right)+30-10=150$ (**oe**) *OR 1 mark for* $\frac{2}{3}(attempt)+attempt=150$	**3**
2(d)	Number between Chanta and Danter must be equal to (two thirds of this number) + 30, so number = 90 **[1]** Number at Ethos = (number between Chant and Danta) −10 = <u>80</u>	**2**

<table>
<tr><th>Question</th><th>Answer</th><th>Marks</th></tr>
<tr><td>3(a)</td><td>Price of ingredients for a cake is 61¢ soi [1]
350 g of sugar or flour is 0.35 × $0.60 = $0.21
2 eggs cost $8 ÷ 20 = $0.40
Total is $0.61, so the total cost of making a cake is $3.61.
40 cakes therefore cost $144.40 to make. AG

If 2 marks cannot be awarded, award 1 mark for calculating that the cost to make one cake is $3.61 OR at least one of 3.6 4.8 8.4 or 24.40 for 40.</td><td>2</td></tr>
<tr><td>3(b)</td><td>In the first week the sales amounted to a total of 10 × $5 = $50 [1]
At $4.50 each, 11 would amount to $49.50, so <u>12</u> is the smallest number to make more money than in the first week.

1 mark for “greater than 11”.</td><td>2</td></tr>
<tr><td>3(c)</td><td>The cakes would need to be sold at $4 each [1]
which means that there would be a profit of $0.39 on each one.
30 × $0.39 = <u>$11.70</u>
ft cost from (a)</td><td>2</td></tr>
<tr><td>3(d)</td><td><u>19</u>

Making one extra cake increases the costs by $3.61, but 5¢ is lost from the profit from all of the other cakes that would have been sold. Therefore, for any given number of cakes, the cost of producing one extra can be thought of as $3.61 + $0.05 × the number of cakes.

<table>
<tr><th>Number of cakes</th><th>Total cost for one extra</th><th>Selling price for extra cake</th></tr>
<tr><td>30</td><td>$5.11</td><td>$3.95</td></tr>
<tr><td>20</td><td>$4.61</td><td>$4.45</td></tr>
<tr><td>19</td><td>$4.56</td><td>$4.50</td></tr>
<tr><td>18</td><td>$4.51</td><td>$4.55</td></tr>
</table>
So it is worth making one extra cake when only 18 are made, but not when 19 are made. 19 cakes gives the best profit of $17.86.

If four marks cannot be awarded, award one mark for:
• Calculating the profit for a particular number of cakes made.
• Calculating the profit for a second case.
• Calculating another case which improves on the profit from the first case.

Alternatively, solutions involving calculus should be rewarded thus:
Finding the price (p) as a function of the number of cakes (x):
p = 550 – 5x [1]
Finding profit π = (189 – 5x)x oe [1]
Differentiating and equating to zero or determining mirror line [1]
<u>19</u> cakes
ft their 3.61 from (a)</td><td>4</td></tr>
</table>

Question	Answer	Marks
3(e)(i)	The cakes will all be sold at \$4.05 Profit of 44¢ per cake **[1]** 40 × \$0.44 = \$<u>17.60</u> *Alternatively,* \$4.05 × 40 **soi** **[1]** \$162 – \$144.40 = \$<u>17.60</u> **ft** *their 3.61 from* ***(a)***	**2**
3(e)(ii)	Producing the 40 cakes cost \$144.40. 20 cakes at \$4.50 will bring in \$90, so an extra \$54.40 is required. **[1]** Since both cakes get the 10% discount, the second cakes effectively cost 80% of \$4.50, or \$3.60. **[1]** 15 such cakes would produce \$54, so <u>16</u> customers would need to take advantage of the offer. OR *1 mark for correct calculation of profit when a second cake is bought by a specified number of the 20 customers*	**3**

Question	Answer	Marks
4(a)(i)	<u>C F</u> From B, entries C F D score 5 + 4 + 5 = 14. *Award 1 mark for any of the following:* • *B C (from B, entries B C A score 4 + 5 + 5)* • *C E (from B, entries C E A score 5 + 5 + 4)* • *E F (from A, entries E F D score 4 + 5 + 5)* • *F D (from E, entries F D D score 5 + 5 + 4)*	**2**
4(a)(ii)	<u>29</u> 14 + 3 (D to F) + 3 (F to E) + 5 (E to F) + 4 (F to C) *Award 1 mark for either of the following answers:* • *15, which fails to include the points already scored* • *26, which fails to include the link from D to F*	**2**
4(b)	(She can score 47 points by entering) <u>E C D F A E C E C A</u> OR <u>E C D F A E C A E D</u> *Award 2 marks for either answer.* E C D F A E C is the limit for scoring consecutive 5s (total 35), then either A E D scores 3 + 5 + 4 or E C A scores 4 + 5 + 3. *If 2 marks cannot be awarded, award 1 mark for appreciation that (A) E C D F A E must be the first six entries.*	**2**
4(c)(i)	<u>2880</u> (4 × 6 × 5 × 4 × 3 × 2 × 1)	**1**

Question	Answer	Marks
4(c)(ii)	3, 4, 1, 0, 5, 2 *If 2 marks cannot be awarded, award 1 mark for one the following:* • *4,1,3,5,2,0 (the top row of grid P403215)* • *0,5,4,2,1,3 (the top row of grid Q403215)* • *2,0,5,1,3,4 (the top row of grid S403215)* • *3,1,2,4,5,0 (right-hand column read upwards or R downwards)*	**2**
4(c)(iii)	S540213 Consideration of, for instance, the relative positions of the 2s (the digit in the top left corner), the code letter must be S. The top row of 243105 therefore corresponds to SQUTRP. *If 2 marks cannot be awarded, award 1 mark for any code beginning with S that contains the digits 0 to 5 once.* OR *Award 1 mark for one of the following, which only matches the top row of Inga's grid with the master grid:* • *P253041 (with 243105 corresponding to PTRUSQ)* • *Q325104 (with 243105 corresponding to QUPSTR)* • *R412530 (with 243105 corresponding to RPTQUS)*	**2**

Question	Answer	Marks
4(d)	The 1 point must have been scored for the link from A to D, so A to A and D to D must score 0. This must be a grid with a grid code of the form P0★★★★1 or S★★★01★. *Award 4 marks for any correct grid with a P0★★★★1 or S★★★01★ grid code.* e.g. A B C D E F A 0 2 3 1 4 5 B 3 4 0 5 2 1 C 2 5 1 4 3 0 D 1 3 2 0 5 4 E 5 0 4 3 1 2 F 4 1 5 2 0 3 *If 4 marks cannot be awarded, award 3 marks for any grid with all the 0s and 1s consistent with a P0★★★★1 or S★★★01★ grid code (given)* ***and*** *no digit appearing more than once in any column.* *e.g.* A B C D E F A 0 2 3 1 4 5 B 2 4 0 5 3 1 C 3 5 1 4 2 0 D 1 3 2 0 5 4 E 4 0 5 2 1 3 F 5 1 4 3 0 2 *If 3 marks cannot be awarded, award 2 marks for any grid with all the 0s and 1s consistent with a P0★★★★1 or S★★★01★ grid code, even if code not stated.* *i.e. (pto)*	**4**

Question	Answer	Marks
4(d)		

	A	B	C	D	E	F
A	0			1		
B			0			1
C			1			0
D	1			0		
E		0			1	
F		1			0	

or

	A	B	C	D	E	F
A	0			1		
B					0	1
C		0	1			0
D	1			0		
E					1	0
F		1	0			

If 2 marks cannot be awarded, award 1 mark for valid code seen OR any grid that contains the following:

	A	B	C	D	E	F
A	0					
B						
C						
D	1			0		
E						
F						