Cambridge International AS & A Level

THINKING SKILLS **9694/31**

Paper 3 Problem Analysis and Solution **May/June 2023**

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 2023 series for most Cambridge IGCSE, Cambridge International A and AS Level and Cambridge Pre-U components, and some Cambridge O Level components.

This document consists of **7** 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.

Annotations

Where the answer is underlined in the mark scheme, and a candidate's correct final answer is both clear and clearly identified (encircled, underlined etc.), it is not necessary to annotate that item; nor is it necessary to annotate when there is No Response.

Where there is a response that scores 0, either SEEN should be used, or some other annotation(s) to indicate why no marks can be awarded (Caret, TE, NGE, Cross).

Partial credit should be indicated with a 1 (or, occasionally, a 2) at the point at which that mark has been earned.

The highlighter should be used anywhere it is helpful to clarify the marking.

✔	Correct item
✘	Incorrect item
1	Individual mark of partial credit
2	Double mark of partial credit
∧	Essential element of answer/working missing
NGE	Judged to be not good enough to earn the relevant credit
BOD	Benefit of doubt
FT	Correct follow through
TE	Transcription error
SC	Special case
SEEN	Working seen but no credit awarded; blank page checked
Highlight	Use anywhere it is helpful to clarify the marking

There must be at least one annotation on each page of the answer booklet.

Question	Answer	Marks
1(a)	<u>21</u> *1 mark for sight of 12 (black squares not already revealed at the start of the round) or 9 (crosses + ticks)* *SC 1 mark for answer of 57*	**2**
1(b)	<u>117</u> *1 mark for sight of 90 (score at the end of round two) OR 27 (score so far in this round) OR 93 seen (forgets bonus points)*	**2**
1(c)	There are no crosses in squares next to either of these two T-shapes / there are crosses in squares next to each of the other (three) T-shapes.	**1**
1(d)	66 and 68 **[1]** 8, 9, 10 and 19 **[1]** 43, 52, 53 and 54 **[1]**	**3**
1(e)	117 points so far and will score a further 26 in round three = 143 points **[1]** so 131 needed . **ft** *their 117 + 26 for 143* There are a total of 70 + 80 = 150 points available for the last two rounds so he can afford <u>19</u> crosses maximum. *Alternatively* Tom's maximum possible game score is 293 **ft** *their 117 + 176* A maximum of 26 crosses allows a score of 274 *1 mark for either* He has already revealed 7 so can afford <u>19</u> more. *SC 1 mark for answer of 20*	**2**

Question	Answer	Marks
2(a)(i)	Red: 17 (points) **[1]** Yellow: 11 (points) **[1]** *1 mark for either of the following:* *(Red) 34 AND (Yellow) 22* *11,17 without teams being identified*	**2**
2(a)(ii)	<u>Ochre</u>	**1**
2(b)	<u>Ocean</u>	**1**
2(c)	<u>41</u> (points)	**1**
2(d)	The total number of (team) points (145) is not divisible by 3.	**1**
2(e)	<u>49, 53 and 57</u> (points) *Award one mark for each correct total, max 2 if any incorrect.* *Award up to 2 marks for correct descriptions without totals calculated.* *Max 1 if 5 answers, 0 if more than 5.* *If 0 scored, award 1 mark for answer of just 47.*	**3**
2(f)	<u>Brick & Cherry</u> <u>Flame & Ruby</u> <u>Madder & Scarlet</u> *1 mark for one or two correct pairs with no more than 3 pairs given.* *1 mark for fully correct answer with another set of 3 given.*	**2**
2(g)	Only Flame, Scarlet and Mustard can achieve a winning score: • Lemon (and no-one below Lemon) can match (or surpass) Flame's current score (of 29) **[1]** • Mustard and Saffron are paired together, so Mustard will finish (2 points) ahead of Saffron **[1]** There will not be a tie for first place: • There is no way for two peoples' scores to differ by 6 points (so Flame cannot be tied with Mustard or Scarlett) **[1]** • Mustard and Scarlett are not paired, so must score different numbers of points (unless they both score 0, in which case Flame will have a higher score. **[1]** *Award 1 mark for an answer which notes both features of the explanation, but does not score either mark for one of the parts.*	**4**

Question	Answer	Marks
3(a)(i)	<u>201</u>	**1**
3(a)(ii)	<u>299</u>	**1**
3(b)	(9 × '299') + 600 = <u>3291</u> **ft** *their 299*	**1**
3(c)	Minimum to meet 50% rule is 101 **[1]** 0 votes in 4 constituencies 101 × 6 = <u>606</u> *SC 1 mark for answer of 1206 (assuming full turnout)*	**2**
3(d)	If elected with 150 votes, the maximum in that constituency is 448 **[1]** The maximum is achieved by considering only one representative elected, and other 9 constituencies having 100% turnout (600). (9 × 600) + 448 = <u>5848</u>	**2**
3(e)	1 mark each (max 2 if final answer not calculated). • Green only receives votes in the constituencies they won. • Red receives 1 fewer vote than Green in each of the six constituencies won by Green / Red receives 6 × (g-1) votes in constituencies won by Green. • Red receives 600 votes in constituency won and '299' votes in each constituency won by Blue. e.g. 600 + 3 × '299' + 6 × … **ft** *their 299* Total difference is 600 + 3 × 299 – 6 × 1 = <u>1491</u>	**3**

Question	Answer	Marks
4(a)	She will start installing on Day 21 She will take 34 days to install. *1 mark for either of the above.* And finish on <u>Day 54</u> *SC 1 mark for answer of 55*	**2**
4(b)	Day 44 **ft** *their 4(a) – 10 if 53 or 55*	**1**
4(c)(i)	The optimum sizes for the deliveries are approximately in the ratio 3 : 5. A first delivery of size 34 to 40 leads to a finishing date of <u>Day 42</u> *1 mark for a trial starting 35, 37, 38, 40* *OR* *1 mark for starting day 30 getting 44 OR day 45 getting 43.*	**2**
4(c)(ii)	34 *Condone 35*	**1**
4(c)(iii)	40	**1**
4(d)(i)	Installing the 100 computers will require at least 34 Days, so she must start work on Day 4 at the latest.	**1**
4(d)(ii)	Delivery 1: 15 computers will arrive on Day 4 Delivery 2 must arrive by Day 9 (25 computers) **[1]** Delivery 3 must arrive on Day 17 or 18 (40 or 45 computers) It is not possible to deliver all the remaining computers in Delivery 3 **[1] soi** Delivery 4 **[1]** can contain the remaining computers and be timed such that she can finish before Day 38	**3**
4(e)	From Day 21, $(17 \times 3) + (10 \times 2) = 71$ computers can be installed **[1]** The other 29 must have been installed before Day 21, which would take 10 Days So the latest Day she could start is <u>Day 11</u>	**2**
4(f)	To finish on 37 rather than 42, 5 days to be gained **[1]** so 13 or 14 computers. It can be done in 7 days **[1]**. *OR* *1 mark for any worked solution that has the assistant employed for 8 or 9 days after the second delivery*	**2**