CAMBRIDGE INTERNATIONAL EXAMINATIONS

GCE Advanced Level

MARK SCHEME for the May/June 2014 series

9694 THINKING SKILLS

9694/31 Paper 3 (Problem Analysis and Solution), maximum raw mark 50)

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.

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CAMBRIDGE
International Examinations

1 (a) Gloria has one set with an outermost doll of width 20 cm. List all the different possible numbers of dolls in this set. [2]

2, 4, 5, 10, 20

2 [20, 10] or 4 [20, 15, 10, 5] or 5 [20, 16, 12, 8, 4] or 10 [20, 18, 16, 14, 12, 10, 8, 6, 4, 2] or 20 [20, 19, 18].

Award 2 marks for a correct set of numbers.
Award 1 mark for a list with up to 2 incorrect inclusions/omissions.

(b) What is the total weight of the heaviest set of dolls whose outermost width measures 6 cm? [1]

91 g [1, 2, 3, 4, 5, 6]

(c) She is able to determine whenever a set is made up of only two dolls. What total weights, less than 100 g, could such a set of dolls have? [2]

5 g [1, 2] or 20 g [2, 4] or 45 g [3, 6] or 80 g [4, 8]

Award 1 mark for two or three correct answers with no extras, or 4 correct answers with one extra.

(d) What are the four lightest total weights that a set of dolls could have? [3]

5 g, 14 g, 20 g, 30 g

Award 2 marks for one additional inclusion/omission/arithmetic error in working.
Award 1 mark for two additional inclusions/omissions/arithmetic errors in working.

(e) Describe two sets of dolls which might not be distinguished by their weights as registered on Gloria's measuring scales. [2]

The most likely suggestions are:
[1, 2, 3, 4, 5] weighs 55 g and [2, 4, 6] weighs 56 g
[5, 10] weighs 125 g and [3, 6, 9] weighs 126 g

Award 1 mark if the weights are given (e.g. just 55 g & 56 g), but the sets of dolls are not described.

2 (a) Give an example of percentages of the electorate voting for each of the three candidates on the first Sunday that could have led to this situation. [1]

Any three numbers, all between 12.5 and 50 that add up to not more than 100, with the largest less than the sum of the other two.

(b) (i) What is the theoretical maximum possible number of candidates in the second round? [1]

Assumption requires different numbers, so cannot all have exactly 12.5%, hence only 7.

(ii) What was the theoretical maximum possible number of candidates in the second round before the threshold was changed? [1]

9

(c) (i) Which rule stopped David from being elected on the first Sunday? [1]

10 502 is more than 50% of votes cast (4273 + 53 + 5370 + 651 = 10 347), so failure must be because it doesn't include a quarter (25%) of the electorate.

(ii) What does this indicate about the number of people entitled to vote who did not vote? [2]

Electorate must be at least 10 502 × 4 + 1 = 42009, of whom 20 849 voted.
So at least 21 160 did not.

Award 1 mark if 42 009 or 42 008 or 21 159 seen.

(iii) Alain qualified for the second round. What does this indicate about the size of the electorate? [2]

42 730 or fewer.

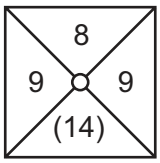
Award 1 mark for sight of 42 730 or 42 371 or 34 184 (derived from the new threshold).

(d) What difference, if any, would that have made? Explain your answer briefly. [2]

David would have won on the first round by having 10 524 > 42 070/4 (as well as more than 50% of the votes cast).

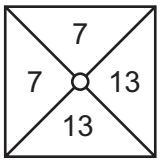
Award 2 marks if a correct judgment and a precise comparison of votes is given.
Award 1 mark if appropriate working is shown, but an incorrect judgment is given
OR a correct judgment is given with a correct qualitative justification
(e.g. "David would have won because he had more than a quarter of the electorate's vote".)
Award 0 marks for a judgment with no correct justification.

3 (a) How many balloons will be in each of the other compartments at this moment? [1]



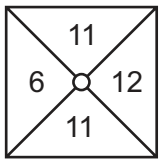
Award 1 mark for 9, 8, 9 in any order.

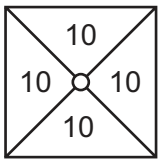
(b) (i) Draw a diagram showing the number of balloons now in each compartment. [1]



Award 1 mark for the four correct numbers **in a diagram**, ordered correctly

(ii) Draw two further diagrams showing the number of balloons in each compartment after the next two times the balloons have been moved. [2]

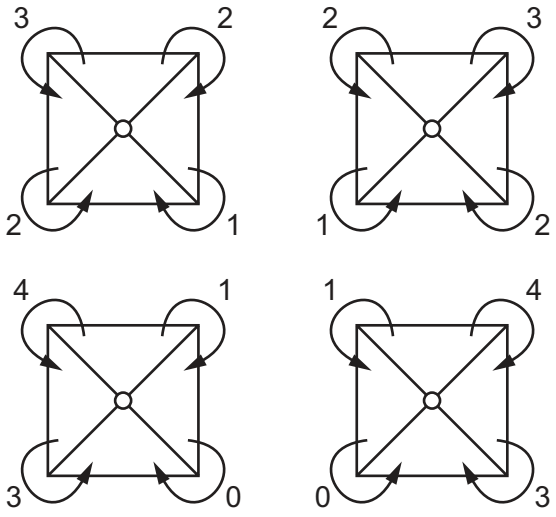




Award 1 mark for each diagram.

(c) Draw a diagram to show an example of the numbers of balloons that might have been moved between the compartments. [3]

Likely correct answers:



The six constraints on the balloon movements are as follows:

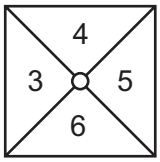
The left hand section must increase by 1: L: +1
The right hand section must increase by 1: R: +1
The top section must decrease by 5: T: –5
The bottom section must increase by 3: B: +3
The movements must all be integers
The number of balloons moved must not exceed the number in a compartment – allowing for any that might have been contributed from other compartments.

Award 3 marks if balloon movements are offered which satisfy 6 of these constraints.
Award 2 marks if balloon movements are offered which satisfy 4 or 5 of these constraints.
Award 1 mark if balloon movements are offered which satisfy 3 of these constraints.

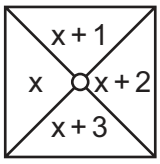
SC: If a candidate calculates the relevant differences (+1, +1, –5, +3), but no balloon movements are offered, award 1 mark.
SC: If a candidate offers a solution which would lead to the right-hand diagram when the balloons were moved prior to rotating, award 1 mark.

(d) How must a total of 18 balloons be distributed among the compartments in order to achieve a stable situation? [3]

Award 3 marks for the correct solution:

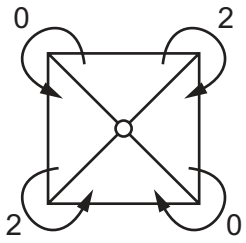


If 3 marks cannot be awarded:
Award 1 mark for compartment numbers which leave 2 or 3 compartments unchanged.
Award 2 marks for compartment numbers which leave 4 compartments unchanged.



(e) What movements of balloons must be taking place between the four compartments? [2]

2 marks for the correct solution:



The six constraints on the balloon movements are as follows:

The left hand section must decrease by 2:	L: –2
The right hand section must increase by 2:	R: +2
The top section must decrease by 2:	T: –2
The bottom section must increase by 2:	B: +2

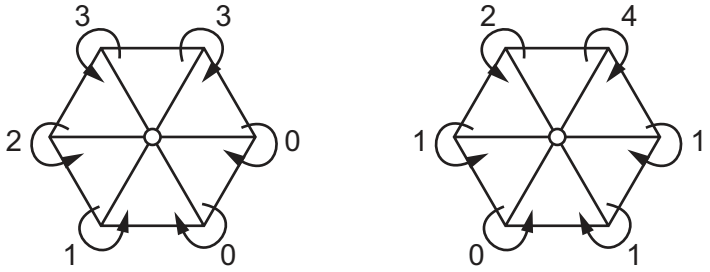
The movements must all be integers
The number of balloons moved must not exceed the number in a compartment – allowing for any that might have been contributed from other compartments.

If balloon movements are offered which satisfy 4 or 5 of these constraints, award 1 mark.

SC: If a candidate offers a solution which would lead to the right hand diagram when the balloons were moved prior to rotating, award 1 mark.

(f) Suggest movements of balloons which would lead to a stable situation for the tray shown below. This tray has six compartments and each turn is 60° anticlockwise. [3]

Award 3 marks for movements which leave 6 compartments unchanged, e.g.:



If 3 marks cannot be awarded:
Award 1 mark for movements which leave 3 compartments unchanged.
Award 2 marks for movements which leave 4 (or 5) compartments unchanged
OR which leave 6 compartments unchanged but require more balloons to be moved than are available.

4 (a) (i) What is the greatest number of points that one player can score in an empuda match? [1]

140 (5 × 10 as deliverer; 9 × 10 as recipient)

(ii) What is the greatest possible number of points that a player can win an empuda match by, having won fewer strands than the loser? [2]

The greatest score from 9 strands is 81 points (9 lenks as recipient). In this situation, the loser will have won 1 strand as deliverer (minimum 1 point) and 10 strands as recipient (minimum 20 points).

60 points (accept 81 – 21)

1 mark for appreciation that the winner's greatest possible score is 81 points.
OR a correct answer for the player who won 11 and lost 9: 95 – 18 = 77.

(b) Which two players will not play on all three courts today? [1]

Brow will not play on Court 2.
Lyne will not play on Court 3.

Brow and Lyne

(c) One of the matches played earlier today was tied. Which two players both registered a win as a result? [1]

Knutt and Shaw

(d) There was only one strand in which 5 points were scored. Did Philip Knutt win this strand with a lenk or a torf? Explain your answer. [3]

Brow scored 5 lenks (9 points each) and 2 grods (2 points each) as recipient and 2 torfs (3 points each) and 2 grods (1 point each) as deliverer.

This means that Knutt won 3 strands as deliverer and 6 as recipient.

Knutt scored 4 lenks (9 points each, or 36 points in total) and 1 grod (2 points) as recipient. So the 5-pointer must have been a torf (as recipient).

1 mark for correct identification of at least three of the point scores (rows of the table) as lenks, torfs or grods.
1 mark for correctly calculating the number of strands won by EITHER Brow as deliverer (4), OR Brow as recipient (7), OR Knutt as deliverer (3), OR Knutt as recipient (5 or 6). This may be implied by a supported statement that 9 strands involve Brow as deliverer OR 10 strands involve Knutt as deliverer.
1 mark for correct division of the strands into recipients and deliverers AND the conclusion that the 5-point score was a torf.

No marks for "torf" without explanation.

(e) How many grods, how many torfs and how many lenks has Craig scored? [4]

1 grod, 1 torf, 4 lenks
(2 lenks and a grod as recipient; 2 lenks and 1 torf as deliverer)

6 numbers that sum to 33 (using 1, 2, 3, 5 & 9) – Award 1 mark
999222 or 999321 or 995532
Identifying 9 + 9 + 5 + 5 + 3 + 2 as the solution – Award 1 mark
Converting their 6 numbers into grods, torfs and lenks (dependent on 1 mark already given) – Award 1 mark

(f) Who is currently in second place, and who is currently in third place? [3]

Serrar is second; Feaver is third

If 3 marks cannot be awarded, award 1 mark each for evidence of appreciation of the following (maximum 2):

- **Only** Feaver and Serrar have 3 wins – stated or implied by a complete list
- Feaver has 137 points
- Serrar has 144 points