CAMBRIDGE INTERNATIONAL EXAMINATIONS
GCE Advanced Level

MARK SCHEME for the May/June 2014 series

9694 THINKING SKILLS

9694/32   Paper 3 (Problem Analysis and Solution),
maximum raw mark 50

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1 (a) When creating a new maze, with no bungs currently in position, in how many different places can the first bung be put without blocking off any section of the maze space? **[2]**

7+ 7 + 9 = 23 places in total. 7 of these would block off sections of the maze (B2, B4, B5, D2, D4, F2 and F4). So answer = <u>16</u>.

1 mark for identifying 6 of the places that would block off sections of the maze (implied by 17) OR for the answer 7 (the number of places which would block off a section of the maze).

SC1: 11 places (correct answer for the maze shown in the QP, with the bungs in place).

(b) List all the pairs of places where just two bungs would block off a section of the maze, even though neither bung on its own would. **[2]**

B3 & C2, B3 & C4, E2 & F3, E4 & F3, C2 & C4, E2 & E4

1 mark for 4/5 correct pairs (and up to 4 incorrect) or up to 3 errors of judgment.

(c) What is the greatest and least number of pockets that a maze could have, if it contains three bungs, and no areas are blocked off? **[2]**

1 mark for max = <u>10</u>
1 mark for min = <u>6</u>

If neither max nor min is correct, award 1 mark for the number of pockets calculated for any clearly-defined example.

SC: 1 mark for clearly and correctly calculating max and min for two bungs:
max = 11, min = 7.

(d) State the starting square from which the ball cannot escape with fewer than three tilts. List three directions, in the order that they occur, that will allow the ball to escape. **[2]**

1 mark for B1
1 mark for any of {SE, N, SW} or {S, E, SW} or {SW, E, SW}

If the correct starting point is not given, award 1 mark for a clearly-defined starting point requiring 2 tilts, with attempted directions given.

(e) State where two bungs should be placed, and where the ball should start, if it is to require a route involving four tilts in order to get out. **[2]**

1 mark for bungs placed at D4 & D5
1 mark for E4 or F5 (accept F4)

1 mark for placing of bungs and a pathway which yields a three-tilt exit.

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2 (a) Show that Mark has left the program in state 3. Write down which state the program was in after each time Mark pressed a button. **[2]**

1 mark for identifying state 1 after the second press (B).
1 mark for identifying state 2 after the third press (C) and state 3 after the fourth (A).

(b) What two further button presses would unlock the door? **[1]**

C and D in the correct order.

(c) Explain why the program is designed so that it will always be in state 1 after B is pressed. **[1]**

B is not part of the code to open the door.

(d) Explain why the program is designed so that pressing A while the program is in state 4 will return the program to state 3, rather than state 1. **[2]**

State 4 means that the previous key pressed was C [1 mark].
Pressing A means that the correct first two digits have now been pressed [1 mark].

(e) Draw a table to show the next state for the program when different inputs are made while it is in states 1 to 6. **[4]**

		Input			
		A	B	C	D
State	1	2	1	1	1
	2	3	1	1	1
	3	3	4	1	1
	4	2	1	1	5
	5	6	1	1	1
	6	3	1	7	1

1 mark for the entries at A1, A2, B3, D4, A5 & C6
1 mark for entry at A4
1 mark for remainder of column A
1 mark for all the 1s

3 **(a)** **Suggest a simple way to choose fairly between three people, using a single roll of a die.** **[1]**

Any map that maps each person from two numbers without overlap will be acceptable.
e.g. {1, 2} = A, {3, 4} = B, {5, 6} = C
OR gives each person a number and ignores the rest.

(b) **Describe a method he could use. (Do not list all the cases.)** **[2]**

24 ways using a 6-sided die. There are various possibilities including:
The nearest edge (of 12) can be seen in two orientations (up or down).
A combination of nearest edge and whether it is left or right of centre.

Award 1 mark if an answer offers a way of doubling the 12 options given in the question – but is not clear how this is to be applied.

(c) **(i)** **How many different results are possible?** **[2]**

6	6	6	6	5	4	3	5	5	4	2	3
4	5	3	2	4	2	2	3	1	1	1	1
±2	±1	±3	±4	±1	±2	±1	±2	±4	±3	±1	±2

<u>8</u>: –4, –3, –2, 1, 1, 2, 3, 4

Award 1 mark for a 10 (implying the inclusion of –5 & 5) or 4 (ignoring signs) or listing at least 4 correct.

(ii) **How many times more likely is a difference of 2 than a difference of 3?** **[2]**

<u>Twice</u> as likely.

Award 1 mark for correctly listing the combinations which yield a difference of two (4 – 6, 3 – 1, 4 – 2 and 3 – 5) OR three (6 – 3 and 1 – 4).

(d) **What is the sum of opposite faces?** **[1]**

<u>13</u>

(e) **How can John achieve this in an unbiased way using a single roll?** **[3]**

<u>Vertices</u> yields multiples of five. <u>Allocate amongst equally amongst players</u>. Based on some <u>unique identifier</u> (closest point – dependent on at least 1 mark awarded).

He must do something with the <u>edges</u> or <u>vertices</u> [1 mark for either] (as there are a multiple of 5 of them).
There must be a way for them to be <u>assigned uniformly to the 5 players</u> [1 mark].
The selected edge or vertex needs to be identified (e.g. nearest at top, rightmost) [1 mark].

(f) (i) **Suggest a way for Alexander to get 60 equally likely options from one roll of a dodecahedron.** **[1]**

A combination of the face in a specific orientation (e.g. top, nearest slanting)
and a specified edge or vertex (e.g. nearest vertex is to left or right).

(ii) **Zoe finds a way to get 120. How can she do this?** **[1]**

This could be done using the orientation (2 ways) of an edge (30 ways) combined with another feature with 2 possibilities independent of the above (e.g. the back of the top pentagon slopes to left or right).

(g) **Charlotte says that by rolling the standard die and the dodecahedron once each, she can fairly choose between 45 options. Suggest a way that she could achieve this.** **[2]**

1 mark for correctly splitting 45 into 3 and 15.
1 mark for explaining how these can be achieved using two dice.

4 (a) (i) **How many points did Xavier score in the first round?** **[1]**

Answer: <u>23</u> (5 + 1 + 6 and 5 + 4 + 2)

(ii) **How many points did Yvette score in the first round?** **[1]**

Answer: <u>19</u> (1 + 3 + 4 and 6 + 3 + 2)

Allow 1 mark for Xavier = 19 AND Yvette = 23.

(b) **Draw a completed grid that would produce this result.** **[2]**

For example,

3	4	3
5	5	4
6	2	6

2 marks for any correct grid.
A correct grid contains two 6s, 5s and 3s and one 2 AND has pairs in each row AND does not have pairs in any column.

If 2 marks cannot be awarded, award 1 mark for one of the following:

- a 90° rotation of a correct grid (i.e. rows scoring 38 and columns scoring 0)
- a grid in which the columns score a total of 38 points
- a grid in which the rows score 0

(c) **Explain why it is not possible for both players to score zero in a round of Trypples.** **[2]**

2 marks for a clearly-expressed, correct explanation.
Award 1 mark for identifying a relevant aspect, such as:

- there are 6 lines (that can potentially score points)
- (but) only 4 pairs of numbers can appear in the grid
- A pair in each row leaves only 3 spaces to fill
- *x x w*
  y y w   or alternative symbolic representation
  z z t
- if completed with pairs – the final number entered would have to be a "third digit".

(d) **Which three tiles were left in the bag at the end of the third round? Explain how you can be sure it was these three tiles.** **[3]**

(The other) 3 and both 4s [1 mark]
A further 2 marks, 1 for each valid element of reasoning, e.g.

- the scoring lines must be 1 + 3 + 6 and 2 + 3 + 5
- 1, 2, 5 and 6 must be repeated
- a valid grid:

2	1	1
2	3	5
6	6	5

(e) **Draw the completed fourth round grid.** **[3]**

If 3 marks cannot be awarded, award 1 mark for completing the middle column and/or award 1 mark for any two pairs of numbers in the other two columns, provided no number appears more than twice in the grid, and/or award 1 mark for a grid in which Xavier scores 21.

2	1	5
6	4	4
6	2	5

(f) **Explain fully how Yvette can be sure that she will win with this move.** **[3]**

Award 1 mark for each of the following:

- Xavier could score 21 at most
- Yvette will score at least 28
- Yvette will have more than 100 points with a 10-point lead