Cambridge International AS & A Level

THINKING SKILLS   **9694/31**

Paper 3 Problem Analysis and Solution   **May/June 2025**

                                                                                           2 hours

You must answer on the enclosed answer booklet.

You will need: Answer booklet (enclosed)
                          Calculator

INSTRUCTIONS
● Answer **all** questions.
● Follow the instructions on the front cover of the answer booklet. If you need additional answer paper, ask the invigilator for a continuation booklet.
● You should use a calculator where appropriate.
● Show your working.
    Where a final answer is incorrect or missing, you may still be awarded marks for correct steps towards a solution.
    In some questions, if you do not show your working, full marks will not be awarded.

INFORMATION
● The total mark for this paper is 50.
● The number of marks for each question or part question is shown in brackets [ ].

This document has **8** pages. Any blank pages are indicated.

                                                                                           [Turn over

1 All the episodes of four recent television dramas are available to rent in boxsets. Information about these boxsets is given in the following table.

Drama	Number of boxsets	Number of episodes per boxset	Running time per episode
Caspian	1	13	30 minutes
Day of the Dawn	3	8	50 minutes
Jubilee	4	12	40 minutes
The King	1	8	30 minutes

Each boxset can be rented from *Dramaflick* for 1 day or for 2, 5 or 10 consecutive days. The rental costs are given in the following table.

Length of rental	Cost per boxset
1 day	$5
2 days	$8
5 days	$21
10 days	$38

Max will watch the whole of Jubilee, starting on a Monday, from 13:00 to 19:00 each day.

(a) On which day and at what time will the final episode of Jubilee end? [1]

Max will rent the boxsets for Jubilee so that the total rental cost is as low as possible.

(b) What is this lowest cost? State what lengths of rentals he will need to purchase on which days. [2]

Katy is planning to watch one episode of The King every day of the week except Thursdays. She wants the rental cost to be as low as possible.

(c) What is this lowest cost, and on which days of the week could she start watching in order to achieve it? [3]

Harriet is planning to watch all the episodes of Caspian, Day of the Dawn and Jubilee. She will watch for 4 hours 30 minutes each day and she will only watch complete episodes. She is happy to switch from one drama to another as long as the episodes of each drama are in order.

Harriet claims that she will be able to complete her viewing in 13 days.

(d) Is Harriet correct? [4]

[Turn over for Question 2]

 [Turn over

2   *Gold Grab* is a computer game for one player, in which gold coins are collected in a treasure chest as it moves around a 5 × 5 grid of squares. An example of the appearance of the grid at the beginning of a game is shown below.

The rows and columns have been labelled to identify positions on the grid. For example, the centre square containing the treasure chest is identified as Cc. The chest is located in this square at the beginning of every game.

In every game the grid has eight squares that contain one coin, eight squares that contain two coins and eight squares that contain three coins.

The chest is directed through the grid by entering direction commands. The keys U, D, L and R are used to instruct the chest to move up, down, left and right respectively.

There is a set route through each different grid. The chest will not move from the square it occupies at any time until the correct direction command is entered.

The game is played as follows:

- A timer displayed on the screen starts to count down in seconds from 300 as soon as the grid appears. Each time a direction command is entered that is incorrect, the time left is reduced by 10 seconds, and the message 'try again' appears above the grid.
- When the first correct direction command is entered, the chest will move one square and collect all the coins in that square, removing them from the grid.
- Subsequently, each correct direction command moves the chest the same number of squares as the number of coins that were collected at the square it is moving from. All the coins in the destination square are collected each time and removed from the grid.
- The game finishes as soon as the coins have been collected from the final square, or when the timer reaches 0, whichever occurs first.

When Cora played *Gold Grab* for the first time she ran out of time after collecting coins from just seven squares. Her grid was the grid shown in the example above. Her seven correct direction commands, in order, were U L R D R L U.

(a) Identify, in order, the seven squares that Cora collected coins from and state how many coins she collected in total. [3]

Paul is playing *Gold Grab*. This is how his grid appeared at the start of the game.

	a	b	c	d	e
A	○○	○○	○○	○	○ ○○
B	○	○ ○○	○ ○○	○ ○○	○○
C	○	○ ○○	[chest]	○○	○○
D	○ ○○	○ ○○	○ ○○	○	○
E	○	○	○○	○○	○

A total of 8 coins have been collected so far from four squares, including the chest's current location. The first coins were collected from square Dc.

(b) In which square is the chest now? [2]

Jeanne is playing *Gold Grab*. This is the appearance of her grid at present.

	a	b	c	d	e
A	○○	○○	○○	○ ○○	○ ○○
B	[chest]				
C	○	○			○
D		○ ○○			○
E					

It is 83 seconds since the timer began to count down, but Jeanne has entered a total of four incorrect direction commands during this time.

(c) (i) How many coins in total have been collected so far during this game? [2]

   (ii) What figure is displayed on the timer now? [1]

   (iii) Explain how it can be deduced that the square Ba contained one coin. [1]

   (iv) Explain how it can be deduced that the chest's final move must be from De to Ce. [1]

   (v) Give the ten correct direction commands, in order, that will collect the rest of the coins, starting from the chest's current position in cell Ba. [2]

Joseph has successfully completed a grid of *Gold Grab*. As he entered his first direction command the timer showed 293 and as he entered his final command it showed 75. In between, he entered commands at an average time interval of 4 seconds each.

(d) How many incorrect direction commands did Joseph enter during the game? [3]

3 Alfred and Zoe are planning their wedding and need to send invitations to the guests. The company that produces the invitations offers two services – either the invitations can be fully printed and sent, or Alfred and Zoe can hand-write part of the invitation before it is sent. The company sends all of the invitations, whether they are fully printed or hand-written. It is possible to have some of the invitations printed and the rest hand-written.

Alfred and Zoe believe that it will take 2 minutes to write 1 invitation. They will take a break of 30 minutes after every 2 hours of writing invitations. There will be a total of 200 invitations.

(a) If Alfred and Zoe write half of the invitations each and both start at 09:00, what time will it be when they have finished writing all 200 invitations? [1]

Alfred and Zoe decide to have some of the invitations fully printed. Zoe is writing all of the hand-written invitations. They have worked out that Zoe will finish writing invitations at exactly 12:00 if she starts at 09:00.

The company charges $3 for each fully printed invitation and $4 for each hand-written invitation.

(b) What will be the total charge for the 200 invitations? [2]

The company that sends out the invitations also collects the replies. There are three possible replies for each invitation:

- Unable to attend
- One guest attending
- Two guests attending

144 replies have been received. The number of guests attending the wedding from the replies received so far is 195. There are twice as many replies indicating two guests attending as there are indicating one guest attending.

(c) How many of the replies were 'Unable to attend'? [2]

(d) What is the largest number of guests that there might be at the wedding? [1]

Each guest will have a meal at the wedding reception. Alfred and Zoe are able to pre-order meals now at a cost of $40 each; this cost is not refundable. Any extra meals that are ordered later will cost $50 each.

After the wedding, Alfred and Zoe will calculate the amount that they have overspent on meals. They will do this by finding the difference between the amount that they spent on meals and the amount that they would have spent if they had pre-ordered the correct number of meals.

Alfred and Zoe have estimated that there will be between 205 and 250 guests at the wedding.

(e) Suppose that 205 meals for guests are pre-ordered, but 250 guests attend the wedding.

Show that Alfred and Zoe would have overspent by $450. [1]

Alfred and Zoe will pre-order the number of meals so that the greatest possible amount by which they have overspent is as small as possible if there are between 205 and 250 guests at the wedding.

(f) How many meals for guests will they pre-order? [3]

4 A game for two players is played with a set of cards. Each card has three numbers on it, which are written in three different colours.

The red number is 1, 2 or 3, the blue number is 4, 5 or 6 and the green number is 7, 8 or 9.

The set of cards contains one card for each of the possible combinations of three numbers that can be made.

At the start of each game, the set of cards is shuffled. The players each take 3 cards and the next card is turned face up to start a pile of cards. The player who is to play first chooses one of their cards. The card is compared with the card on the top of the pile and points are scored as follows:

- 1 point is scored for every number that appears on both cards.
- 2 points are scored for each pair of colours for which the total is the same on both cards.
- 4 points are scored if the total of the three numbers is the same on both cards.

The player's card is then placed on top of the pile and becomes the card to be compared with the next player's chosen card. The game continues until both players have played all three of their cards.

In their first game, the first two cards played by Fiona and Yvette are shown below.

1	3	2	2	3
4	4	5	4	6
9	7	7	9	7
Starting card	Fiona's 1st card	Yvette's 1st card	Fiona's 2nd card	Yvette's 2nd card

(a) Show that Fiona scored 7 points when she played her first card. [2]

(b) How many points would Fiona have scored on her first turn if she had played the 2-4-9 card first instead of the 3-4-7 card? [2]

On each of her first two turns, Fiona found that one of her cards would score more points than any other, and she chose to play that card.

(c) What are the two possibilities for the card that Fiona has left? [3]

In their second game, the card that was turned over to start the pile was the 1-5-7 card.

(d) (i) How many of the cards would score exactly 1 point if played as the first turn of the game? [3]

(ii) How many of the cards would score exactly 4 points if played as the first turn of the game? [2]

In the third game, Fiona and Yvette both managed to score the maximum possible score of 7 points on each of their three turns.

This was possible because all the cards had the same total.

(e) (i) What must have been the total of the three numbers on each card? [2]

(ii) Give an example of the order in which these cards might have been added to the pile (including the card that was turned over to start the pile). [1]

8

BLANK PAGE