Cambridge International AS & A Level

THINKING SKILLS	**9694/33**
Paper 3 Problem Analysis and Solution	**May/June 2024**
	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 **12** pages. Any blank pages are indicated.

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1 A small car park is open all day. Yesterday, 12 cars used the car park, and their times of entry and exit are given below.

Car	Entry	Exit
1	08:22	15:51
2	08:58	10:25
3	09:43	11:06
4	10:21	15:45
5	10:30	14:12
6	10:52	17:08
7	12:10	12:41
8	12:38	16:30
9	14:13	15:50
10	16:25	18:10
11	16:38	18:15
12	17:22	19:01

(a) State which cars were in the car park at 11:00. [1]

(b) What is the largest number of cars in the car park at any time? State a time at which this occurs. [2]

(c) Which two cars stayed for the same number of minutes as each other? [1]

Cars parking for less than 90 minutes take advantage of a special parking rate of $0.10 per minute.

(d) State which cars were eligible for this special rate. [1]

Parking is free for any minutes before 09:00 and any minutes after 16:00. At all other times, unless the special rate applies, parking costs $0.20 per minute.

(e) Which cars parked for free? [1]

(f) What was the largest amount of money paid for any of the 12 cars to park? [2]

If the exit time for one of the cars had been 8 minutes later than the time shown in the table, the cost for its parking would have been $9.90 more.

(g) Which car is this? [2]

[Turn over for Question 2]

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2 Every summer, from May to September, Ashley operates sightseeing boat trips in his vessel *Anteros* around Cambass Bay, departing from and returning to the dock at Cambass Quay. It is not safe to be away from the dock when the tide is too low, or when it is too dark, so Ashley must follow these rules:

- He must not leave the dock earlier than 200 minutes before high tide.
- He must not return to the dock later than 200 minutes after high tide.
- His last trip of the day must finish no later than 30 minutes before sunset.

Every day Ashley makes as many trips as possible and he plans his timetable as follows:

- Each trip lasts 60 minutes and the next trip departs 20 minutes after the return of the previous one.
- He times trips to depart at multiples of 10 minutes past the hour (i.e. 00, 10, 20 etc.).
- The first trip of the day departs at 09:30 whenever the rules allow.
- When he cannot start at 09:30 and when he is able to re-start before a high tide, his first departure time is always the first possible multiple of 10 minutes past the hour.

(a) Show that on any day when the whole of the 400-minute period around high tide is between 09:30 and 30 minutes before sunset he can **always** make five trips during this period. [2]

There were 4 trips yesterday, with departures at 09:30, 10:50, 18:00 and 19:20. Sunset yesterday was at 20:56.

(b) (i) How many minutes before the latest possible time allowed by the rules did the last trip of the day return to the dock yesterday? [1]

(ii) Give the earliest time (in the form hh:mm) that yesterday evening's high tide might have occurred at. [2]

Ashley's vessel can carry a maximum of 30 passengers. He charges \$16 per trip for each adult and \$10 per trip for each child. Yesterday there was the same number of passengers aboard each of the four trips and the total income was \$1618.

(c) How many passengers were aboard each of yesterday's trips? [3]

This year Ashley has decided to finish on September 16. He is working out his timetable for September. The times of high tides and sunset for the relevant dates are detailed below.

High Tides			Sunset	High Tides			Sunset
September 1	02:51	15:12	20:01	September 9	11:24	23:42	19:42
September 2	03:33	15:57	19:59	September 10	–	12:09	19:40
September 3	04:24	16:56	19:57	September 11	00:26	12:53	19:37
September 4	05:35	18:18	19:54	September 12	01:07	13:31	19:35
September 5	07:03	19:46	19:52	September 13	01:48	14:10	19:32
September 6	08:27	21:01	19:49	September 14	02:27	14:47	19:30
September 7	09:37	22:02	19:47	September 15	03:05	15:27	19:27
September 8	10:34	22:55	19:44	September 16	03:48	16:12	19:25

(d) (i) Give all the departure times that Ashley will schedule for his trips on September 3.   [2]

(ii) On which dates in September will he be able to start his first trip of the day at 09:30? [2]

Ashley has worked out that there will be only four trips on September 16. As it will be the last day of his season, he wants to try to fit in one further trip within the time period allowed by the rules. He thinks he can do this if he starts his first trip at the first possible multiple of 5 minutes past the hour and reduces the time at the dock between trips from 20 minutes to 15 minutes during the day.

(e) Can Ashley schedule a fifth trip on September 16? Explain your answer.   [3]

[Turn over for Question 4]

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4 The competition *7-Quiz* is held each year between 7 contestants. In total 7 rounds are played and 3 of the contestants take part in each round. The rounds are organised so that every player competes against every other player exactly once during the competition.

Each round consists of a maximum of 30 questions. Each question is asked to just one contestant and the contestants take it in turns to attempt to answer questions until they have been eliminated from the round or all 30 questions have been asked. Each contestant also has a 'power' rating, which begins at Bronze at the beginning of each round.

Following each answer to a question:

- A correct answer scores points according to the contestant's power rating.
- A correct answer increases the contestant's power rating, if possible:
  Bronze goes to Silver or Silver goes to Gold.
- An incorrect answer scores no points.
- An incorrect answer reduces the contestant's power rating:
  Gold goes to Silver or Silver goes to Bronze.
- If a contestant answers incorrectly while their power rating is Bronze then that contestant is eliminated and receives no further questions during that round.

The points that are scored for correct answers on each power rating are as follows:

Power rating	Points
Bronze	1
Silver	3
Gold	6

At the end of the competition the contestant with the highest total score is the winner.

(a) In a round in which none of the 3 contestants is eliminated:

  (i) What is the highest score that one contestant could achieve? [1]

  (ii) What is the lowest score that one contestant could achieve? [1]

(b) What is the highest score that a contestant could achieve in a round? [2]

Round 7 is about to start. The results of rounds 1 to 6 are shown in the table below, along with the current totals for each of the contestants.

Contestant	Round 1	Round 2	Round 3	Round 4	Round 5	Round 6	Round 7	Total
Michael	13		17	22				52
Paul		55		49				104
Jan				19	7	1		27
Gareth			39			100		139
Sally	19				2			21
Alice		28	22		65			115
Kevin	22	19				10		51

(c) In round 1, Michael was eliminated following his answer to his 11th question.

What was the number of points that Michael scored for each of his answers, in order, including the zeros? [2]

(d) Jan and Sally were both eliminated in the fifth round, allowing Alice to achieve a high score without being eliminated from the round.

(i) How many questions did Sally answer incorrectly in round 5? [1]

(ii) What is the minimum number of questions that could have been asked to Jan in round 5? [2]

(iii) In fact Jan was asked 11 questions in round 5.

How many questions did Alice answer incorrectly in round 5? [3]

At the start of the seventh round, Gareth was feeling very confident as he already had the highest score before the round began. Sally got the first question wrong and was eliminated, Paul then got his question correct and it is now Gareth's question.

(e) If Paul and Gareth both continue to answer their questions correctly, after how many questions of the round will Paul know for certain that he cannot win the competition? [3]

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