Cambridge International A Level

Cambridge International Examinations
Cambridge International Advanced Level

THINKING SKILLS **9694/32**

Paper 3 Problem Analysis and Solution **October/November 2015**

2 hours

Additional Materials: Electronic Calculator

2022014328

READ THESE INSTRUCTIONS FIRST

An answer booklet is provided inside this question paper. You should follow the instructions on the front cover of the answer booklet. If you need additional answer paper ask the invigilator for a continuation booklet.

Answer **all** the questions.

Show your working. Marks may be awarded for correct steps towards a solution, even if the final answer is not correct. Marks may be lost if working needed to support an answer is not shown.

Calculators should be used where appropriate.

The number of marks is given in brackets [ ] at the end of each question or part question.

This document consists of **9** printed pages, **3** blank pages and **1** insert.

CAMBRIDGE International Examinations

1 The *Qualis?* magazine uses a five-star rating in its reports on consumer goods:
1 star indicates barely adequate; 5 stars indicate perfection. Items which would get no stars in at least one category are simply not listed.

Jack and Jill are considering which bucket to purchase.

The available choices are:

Name	*Capacity*	*Handle*	*Pouring*	*Base*	*Price*
kova	5 litres	★★★	★★★	★	$11
pail	5 litres	★★	★★★★	★★★	$12
seau	4 litres	★★★	★★	★★★★	$11
emmer	6 litres	★★	★	★★	$13
ndoo	5 litres	★	★★★★★	★★	$15
kopp	6 litres	★★★	★★★	★★★★	$14

Jack's priorities are to have both the largest capacity and the best handle.

(a) Which one would Jack select if he ignored other considerations? [1]

Jill wants to pay the minimum, but also wants the pouring to be the best available.

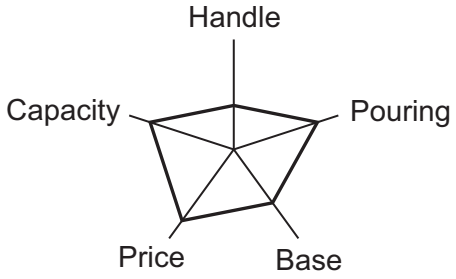
(b) (i) What stops Jill having both her priorities? [1]

(ii) Which one would she select if her main requirement were cost, and then she would look for best pouring given minimum price, ignoring Jack's preferences? [1]

Jack and Jill make a joint decision, and agree to take a bucket that gives the best available score for at least one of Jack's priorities and at least one of Jill's.

(c) Which one do they select? Explain why. [2]

Mervyn suggests that the best way to look at the information in the table is by showing each option as a pentagon, where the five ratings are displayed on five axes. For example:



It is normal to arrange the ratings along the axes so that being further away from the centre represents being 'better'. Here, having a larger capacity is considered to be better.

(d) Since a lower price is a better price, suggest what to do with the rating for price. [1]

(e) **(i)** Bucket A is better than bucket B in precisely two categories and bucket B is better than bucket A in precisely two categories. Sketch, on one set of axes, two possible pentagons for buckets A and B. [1]

(ii) If the pentagon for bucket C touches but does not go outside that of bucket D, would any customer be disadvantaged if bucket C were no longer available? Explain your answer. [1]

(f) Give an example of ratings for a seventh bucket, the *spand*, which doesn't have the worst rating of any of the buckets in the table for any factor, but which nobody would choose to buy based on the *Qualis?* assessment. Explain why they would not. [2]

2 The following details of the suspects for a crime are available to Detective Inspector Rory Kilmartin.

	Suspect A	*Suspect B*	*Suspect C*	*Suspect D*	*Suspect E*
Gender	Female	Female	Female	Male	Male
Eye colour	Blue	Brown	Green	Blue	Brown
Handedness	Left	Right	Right	Right	Left
Hair	Dark	Dark	Dark	Dark	Dark

DI Kilmartin wants to know the height of the suspects, but is only able to access summary data, because of a technical problem in the database. He is able to get the median height of any group referred to by a descriptor in the table (e.g. the median height of the blue-eyed suspects).

Below is the summary data that is accessible to DI Kilmartin:

Median (Female) = 168	Median (Male) = 181	
Median (Blue) = 185	Median (Green) = 155	Median (Brown) = 170
Median (Left) = 176	Median (Right) = 168	
Median (Dark) = 172		

He realises that only one suspect has green eyes and so is able to deduce that the height of suspect C is 155 cm.

(a) DI Kilmartin believes that the fact that the median (Female) and the median (Right) are both 168 must mean that suspect B has a height of 168 cm.

(i) What alternative hypothesis about some suspects' heights would be consistent with these two medians? [1]

(ii) Identify one of the other medians which confirms that DI Kilmartin was in fact correct. [1]

(b) DI Kilmartin uses another median to conclude the height of suspect E. State which median he uses and the height of suspect E. [2]

(c) Explain how the heights of the remaining two suspects can be found, stating clearly which medians are used. [2]

A colleague working on another crime has five suspects with the following data, and there is the same problem with the raw data of their heights.

	Suspect H	*Suspect I*	*Suspect J*	*Suspect K*	*Suspect L*
Gender	Male	Female	Male	Male	Male
Eye colour	Blue	Blue	Brown	Blue	Brown
Handedness	Left	Right	Right	Right	Left
Hair	Dark	Fair	Fair	Dark	Dark

Median (Female) = 181	Median (Male) = 182
Median (Blue) = 181	Median (Brown) = 177
Median (Left) = 173	Median (Right) = 186
Median (Dark) = 178	Median (Fair) = 183.5

(d) Suspect K is the tallest of the five. Explain why it is not possible to deduce his height from the medians. [1]

(e) Deduce the heights of the other four suspects. [3]

[Turn over

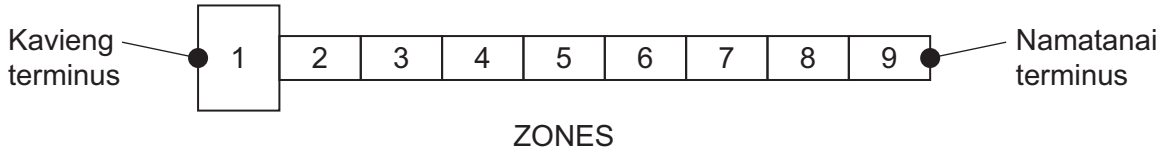
3 The Bulominski highway runs from the town of Kavieng to Namatanai. It is served by buses whose price and capacity are controlled, but the departure times are not, although they may only run during daylight hours – from 06:00 to 18:00. The population is spread thinly along the highway, but all the shops and offices are in Kavieng, so most people using the buses want to go to or from the Kavieng terminus.

The highway is split into 9 zones and there are many buses. Each bus is registered in one of the zones, and only travels from the far end of its registered zone to the Kavieng terminus and back.

Anyone starting in zone 1 has to pay the price to the registered zone of the bus. For all other journeys the passenger pays the fare set for travel from the zone they start in to the zone they go to and the fare is the same in each direction. Journeys entirely within any single zone cost the same, regardless of which zone they are in.

Each bus can take at most 15 passengers. Drivers do not know where a passenger intends to get off. All fares are one-way and paid at the end of the journey.

Not to scale



(a) Buses from how many zones might pick up someone travelling from zone 6 to zone 5? [1]

(b) What is the maximum possible number of different fares? [2]

A resident of zone 4 would pay the same amount to travel to zone 1 whatever bus they took. On the return journey the price varies according to the registered zone of the bus (the higher the zone number, the higher the price).

(c) Explain how this helps the bus system to run more efficiently. [1]

As they aim to get the maximum income from fares, drivers starting at the Kavieng terminus usually wait until the bus is full, but they have to leave in time to get to the far end of their destination zone by 18:00. Assume that all buses travel at the same constant speed at all times.

The last buses need to leave the Kavieng terminus by

To Zone	1	2	3	4	5	6	7	8	9
	17:40	17:25	17:10	16:40	16:25	16:10	15:45	15:20	15:00

(d) After what time is there no chance that there will be a bus to take someone to Namatanai from the border of zones 6 and 7? [2]

The distance from Kavieng terminus to the other end of zone 1 is 20 km.

(e) (i) What is the distance from Kavieng terminus to the far end of zone 4? [1]

(ii) Show that the distance from the middle of zone 5 to the middle of zone 7 is 35 km. [2]

One proposal is to set the fare for a journey by adding two components: a fixed amount that is charged for all journeys and an additional amount per kilometre from the middle of the starting zone to the middle of the destination zone.

Under this proposal, the fare from zone 5 to zone 7 is $4.30 and the fare from zone 3 to zone 2 is $3.10.

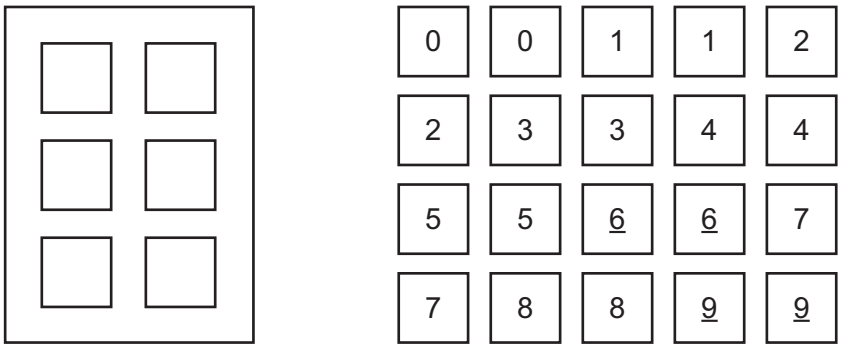
(f) What is the fare from zone 8 to zone 3? [4]

An alternative proposal is to have a fixed amount for all journeys and an additional amount per zone travelled in. Under this proposal, the fare from zone 5 to zone 7 is still $4.30 and the fare from zone 3 to zone 2 is still $3.10.

(g) What is the fare from zone 8 to zone 3 under this alternative proposal? [2]

4 Claddem is a game for two players, played over a number of rounds.

The equipment for playing the game consists of two identical cards (one for each player), 20 numbered tiles, a bag and a scoring rack. One of the cards and the tiles are shown below.



In each round both players attempt to form three 2-digit numbers on their cards that add up to 150.

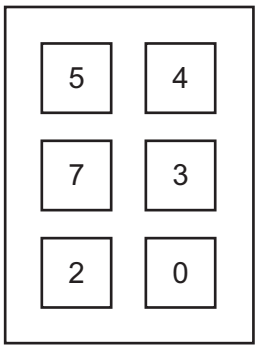
At the beginning of a round all the tiles are placed in the bag and the bag is shaken. The players then take turns to withdraw three tiles at a time from the bag, at random. The players decide what to do with each set of their three tiles:

- One must be placed on a square on the player's own card, from where it may not subsequently be moved.
- One must be given to the other player to be placed by that player later.
- One must be placed on the scoring rack.

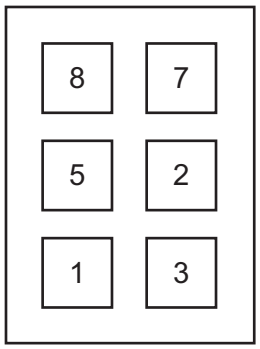
After they have both had three turns, each player has three tiles already in place on their card and three tiles that they have received from the other player. These tiles are now placed on the remaining squares on the cards, and the player who forms the three 2-digit numbers whose sum is closer to 150 wins the round.

The number of points scored by the winner of a round is the sum of the six numbers on the tiles placed on the scoring rack during the round. A player whose three-number sum is exactly 150 also scores a bonus of 10 points. If there is a tie, the player with the highest single 2-digit number wins.

Doug and Sally are playing a game of Claddem. At the end of the first round the tiles left in the bag were numbered 4 and 9, and their completed cards were as follows:



Doug's card



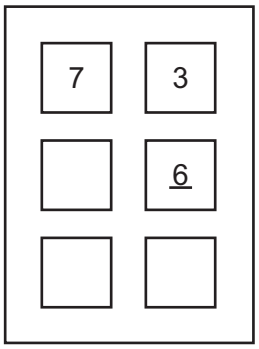
Sally's card

(a) (i) Who won this round? Justify your answer. [1]

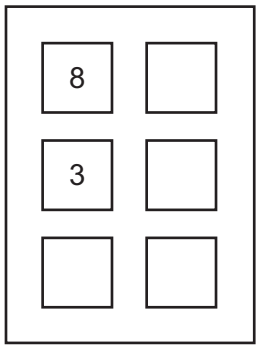
(ii) How many points did the winner score? [2]

Sally has just made the final withdrawal of three tiles from the bag in the second round. She now has to decide what to do with tiles numbered 0, 2 and 9.

This is how the cards look at present.



Doug's card



Sally's card

Doug has given Sally tiles numbered 1, 4 and 6.
Sally has given Doug tiles numbered 2 and 5 so far.
The sum of the numbers on the tiles on the scoring rack so far is 27.

(b) How close to 150 can Sally get if she keeps

(i) the 0 tile? [1]

(ii) the 2 tile? [1]

(iii) the 9 tile? [1]

(c) What must Sally do with these tiles in order to win this round? Explain your answer in detail. [3]

(d) What are the numbers on the two tiles that are left in the bag? [3]

The maximum amount that can be scored by the winner of a round of Claddem is 58 points.

(e) Explain how it is possible for 58 points to be scored, and give an example of a completed card that could score 58 points. [3]

BLANK PAGE

BLANK PAGE

BLANK PAGE