Cambridge
O Level

Cambridge International Examinations
Cambridge Ordinary Level

CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

9399991908 7

STATISTICS **4040/12**

Paper 1 **October/November 2015**

2 hours 15 minutes

Candidates answer on the Question Paper.

Additional Materials: Pair of compasses
Protractor

READ THESE INSTRUCTIONS FIRST

Write your Centre number, candidate number and name on all the work you hand in.
Write in dark blue or black pen.
You may use an HB pencil for any diagrams or graphs.
Do not use staples, paper clips, glue or correction fluid.
DO **NOT** WRITE IN ANY BARCODES.

Answer **all** questions in Section A and not more than **four** questions from Section B.
If working is needed for any question it must be shown below that question.
The use of an electronic calculator is expected in this paper.

At the end of the examination, fasten all your work securely together.
The number of marks is given in brackets [ ] at the end of each question or part question.

This document consists of **19** printed pages and **1** blank page.

CAMBRIDGE International Examinations

Section A [36 marks]

Answer **all** of the questions 1 to 6.

1 Four types of sample which may be obtained from a population by a researcher are: simple random, stratified, quota, and systematic.

State for which of these types of sample

(i) the individual items are selected at regular intervals from a sampling frame,

.....[1]

(ii) the choice of which individual items are selected is left to the researcher,

.....[1]

(iii) the sample is selected so that the proportions of different categories in the sample correspond with those of the population.

.....[1]

2 The frequency distribution of a discrete variable, X, is given in the table below.

x	1	2	3	4	5	6 or more
Frequency, f	3	6	4	5	6	7

For this distribution,

(i) name a measure of central tendency which **cannot** be found exactly,

.....[1]

(ii) name, but do **not** find, a measure of central tendency which **can** be found exactly,

.....[1]

(iii) name a measure of dispersion which **cannot** be found exactly,

.....[1]

(iv) name, **and find**, a measure of dispersion which **can** be found exactly.

Name .....

.....[3]

3 Randa's friend Sonia claims that, of the two drinks tea and coffee, males generally prefer tea, whilst females generally prefer coffee. To investigate this Randa asks her friends and relatives their preferences.

She records whether the person asked is male (M) or female (F), and whether they prefer tea (T) or coffee (C), or express no preference (X).
Her raw data is as follows:

FC	MT	FC	MX	MC	FC	FT	MC	FC	FC
FX	MC	FT	FC	MC	FT	FC	MT	FX	MC

For example, the first person asked was female and preferred coffee.

(i) Summarise the data in a two-way table.

[4]

(ii) Explain whether or not Randa's survey has shown Sonia's claim to be correct.

.....

.....

.....[2]

4 A man owns three shops in a town. For a trial period of 12 days he offers for sale in each shop a new type of chocolate bar.

He records the number of these bars sold each day in each shop over this period, and calculates the measures shown in the table below for the daily sales in each shop.

Shop	*Mean*	*Median*	*Standard deviation*
A	3.42	4	1.66
B	4.67	5	2.17
C	3.75	3.5	0.92

(i) State in which one of the shops, A, B or C, daily sales were

(a) generally highest,

.....[1]

(b) generally most similar,

.....[1]

(c) definitely fewer than 4 bars on six of the days.

.....[1]

(ii) Find the total number of these chocolate bars sold in all three shops combined over this period.

.....[3]

5 In a game, a turn consists of throwing three unbiased six-sided dice, each with faces numbered 1, 2, 3, 4, 5 and 6. The score for a turn is the sum of any numbers which appear more than once.

For example, if 5, 2, 5 appear, the score is 10; if 5, 2, 1 appear, the score is zero.

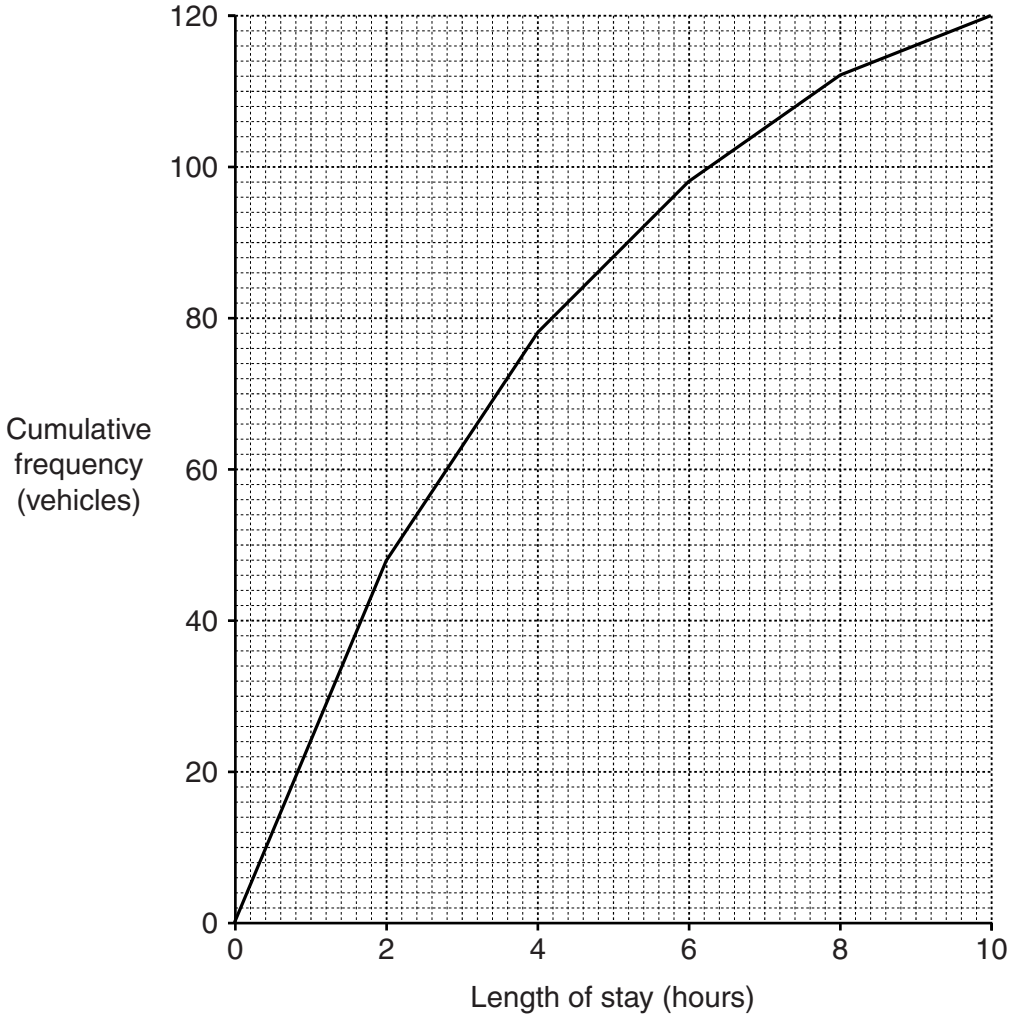
(i) Write down four integers between 0 and 18 which it is impossible to score in one turn.

.....[2]

(ii) Find the probability of obtaining a score of 12 in one turn.

.....[5]

6 At a town centre car park the electronic barrier records the length of stay of all vehicles parked there. When a vehicle leaves the car park, it is not allowed to return the same day.
The lengths of stay for the 120 vehicles using the car park on one particular day are summarised in the graph below.



(i) Write down the name of this type of graph.

.....[1]

Use the graph to estimate, in hours,

(ii) the median length of stay,

.....[1]

(iii) the 85th percentile length of stay.

.....[2]

For the first two hours parking is free. For stays lasting from 2 hours up to 5 hours the charge is $6, from 5 hours up to 8 hours it is $9, and from 8 hours up to 10 hours it is $12.

(iv) Use the graph to estimate the total amount paid in parking charges on this particular day.

.....[4]

Section B [64 marks]

Answer not more than **four** of the questions 7 to 11.

Each question in this section carries 16 marks.

7 In a school science experiment, a beaker of hot water is allowed to cool, and its temperature is measured every 5 minutes. The results are shown in the following table.

Time, x (minutes)	0	5	10	15	20	25
Temperature, y (°C)	96	76	61	49	42	38

(i) Calculate the overall mean and the two semi-averages of these data.

.....

.....

.....[5]

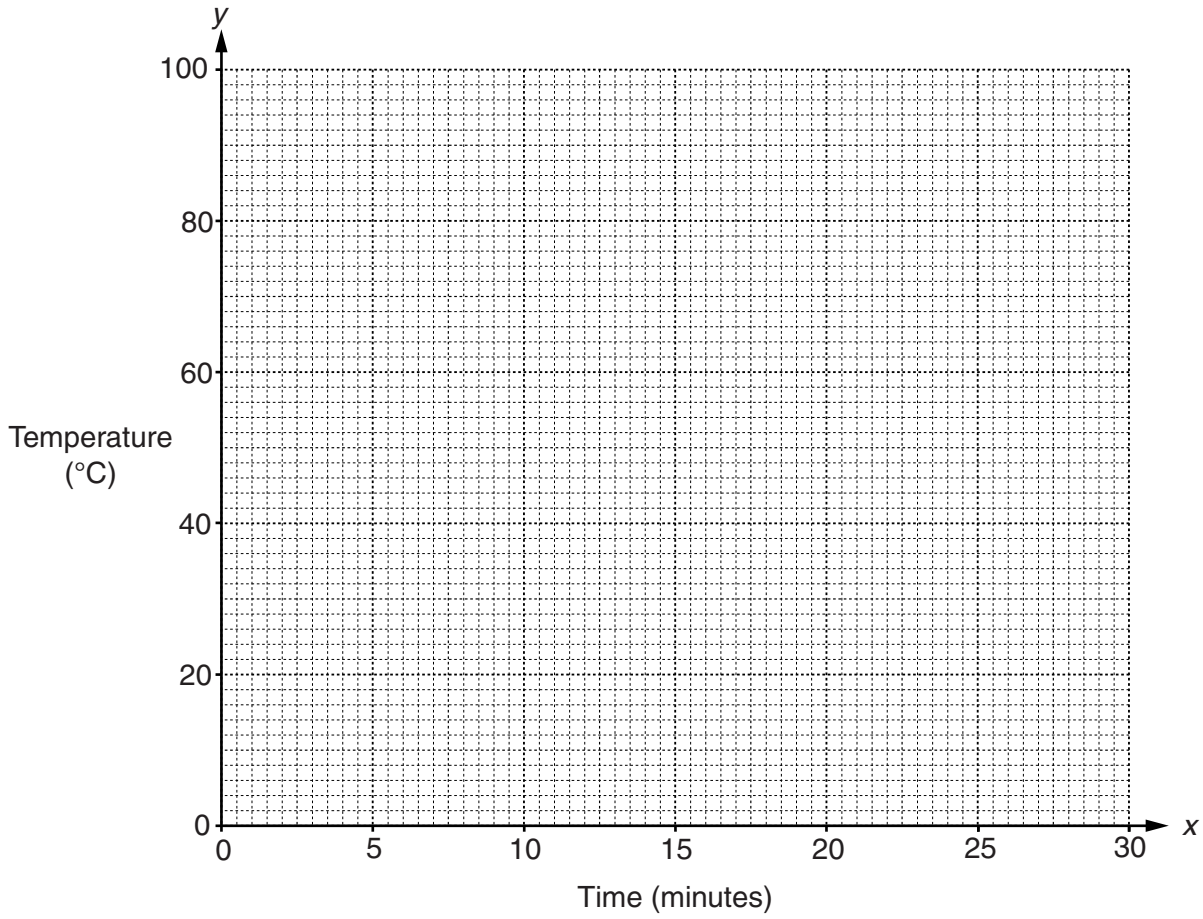
(ii) Use the values obtained in part **(i)** to find the equation of the line of best fit to these data in the form $y = mx + c$.

.....[3]

(iii) Use your equation to estimate the temperature of the water after 30 minutes, giving your answer to the nearest degree.

.....[2]

(iv) On the grid below, plot the data given in the table at the start of the question.



[2]

(v) Draw on the grid the line whose equation you found in part **(ii)** for times between 0 and 30 minutes.

[2]

(vi) By inspecting the points plotted, explain briefly why it can be considered that it was inappropriate to find a line of best fit in the form $y = mx + c$ in this case.

.....

.....[1]

(vii) State how the actual water temperature after 30 minutes will compare with the value calculated in part **(iii)**.

.....[1]

8 At a college, students are enrolled into one of four departments: Arts, Languages, Science, or Technology. The ages of students in these departments, for the year 2014, are shown in the table below. Students aged 25 – under 30 are classed as 'mature' students.

Age (years)	*Department*			
	Arts	Languages	Science	Technology
18 – under 19	60	37	125	107
19 – under 20	78	50	153	138
20 – under 22	101	66	112	96
22 – under 25	62	72	84	70
25 – under 30	53	60	51	39
TOTAL	354	285	525	450

(i) Find the number of students at the college who are under 20 years of age.

.....[1]

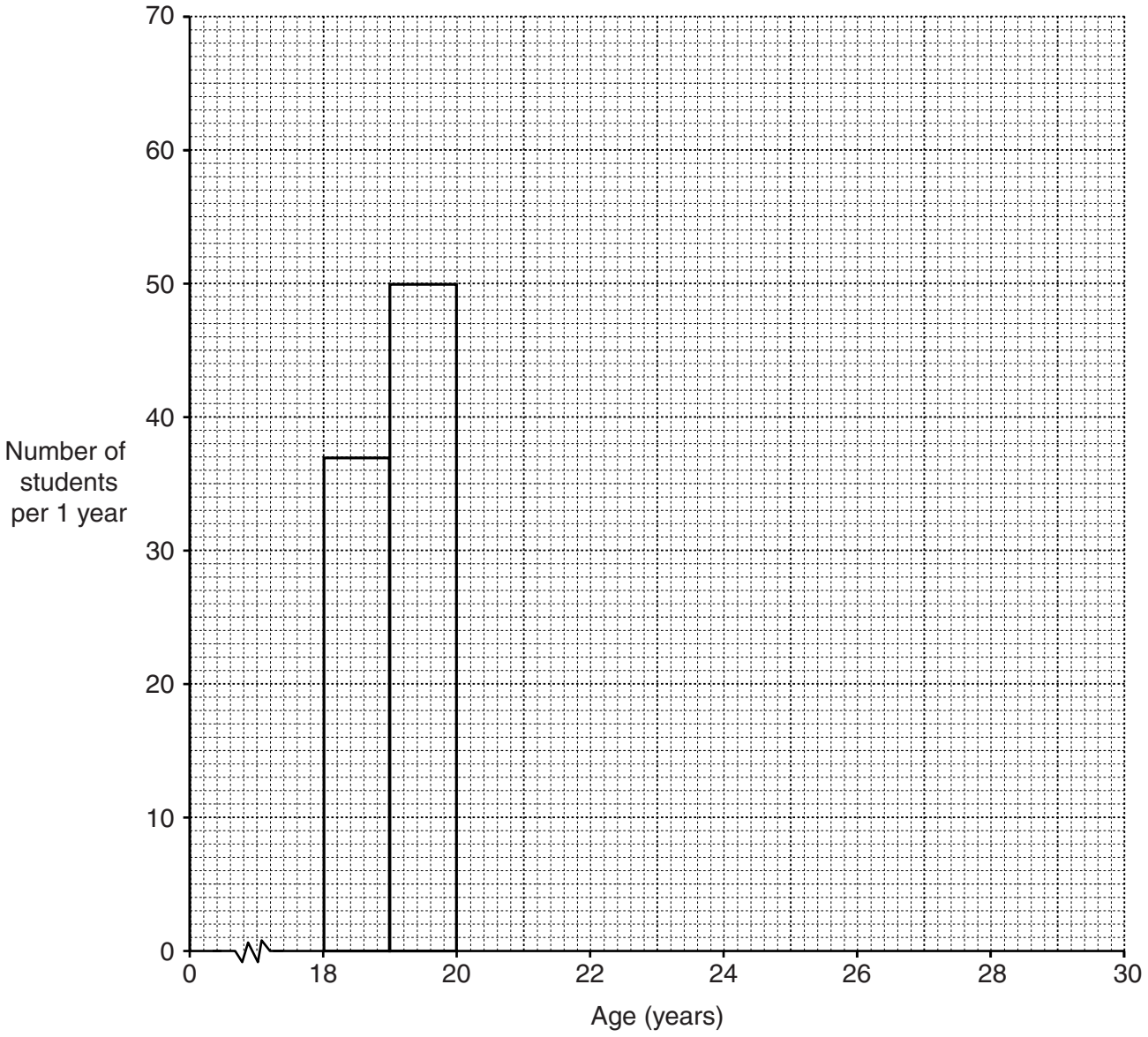
(ii) Of all the students, show that the percentage who are enrolled in Science is 32.5%, correct to 3 significant figures.

[1]

(iii) Of all the students, find the percentage who are mature students.

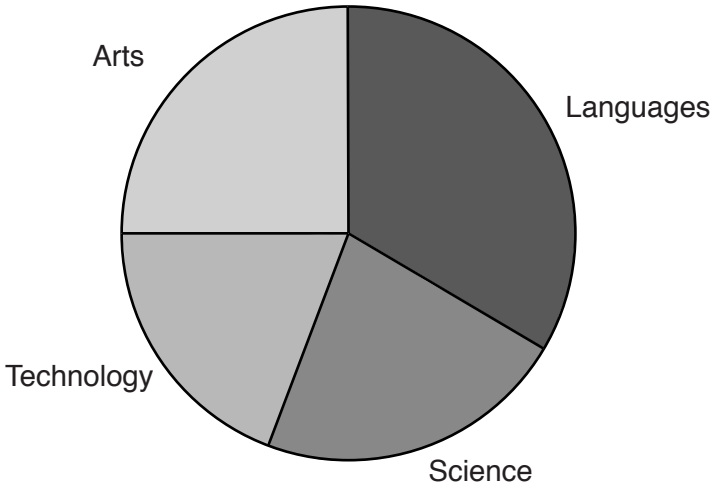
.....[2]

(iv) On the grid below draw a histogram to illustrate the ages of students enrolled in **Languages**. The rectangles representing the 18 – under 19 class and the 19 – under 20 class have already been drawn for you.



[4]

At the end of the year, of all the students, 144 obtained distinctions in their examinations. The departments in which these 144 students were enrolled are represented by the following pie chart, which is drawn to scale.



(v) Find the number of students in Arts who obtained distinctions.

.....[2]

(vi) Of all the students enrolled in Science, find the percentage who obtained distinctions.

.....[3]

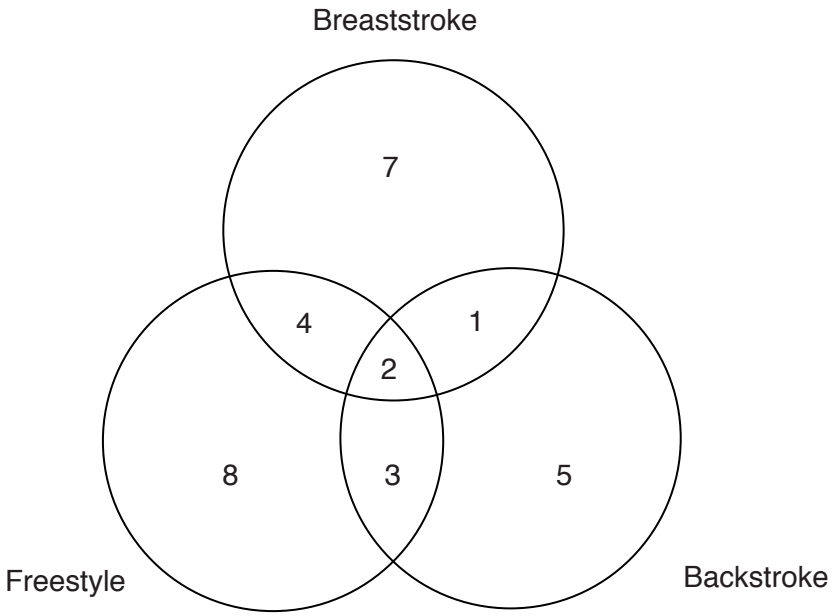
Half of the distinctions in Technology were earned by mature students.

(vii) Of all the mature students, find the percentage who obtained distinctions in Technology.

.....[3]

9 At an international sporting event, the team from a particular country includes swimmers and track athletes.

(i) The diagram below shows the number of swimmers who are specialists in one or more of the styles breaststroke, freestyle and backstroke.



Use this information to find the number of these swimmers who are specialists in

(a) backstroke,

.....[1]

(b) breaststroke and freestyle,

.....[1]

(c) breaststroke and freestyle but not backstroke,

.....[1]

(d) breaststroke or backstroke or both.

.....[1]

One of these swimmers is chosen at random to appear on television. Find the probability of choosing a specialist in

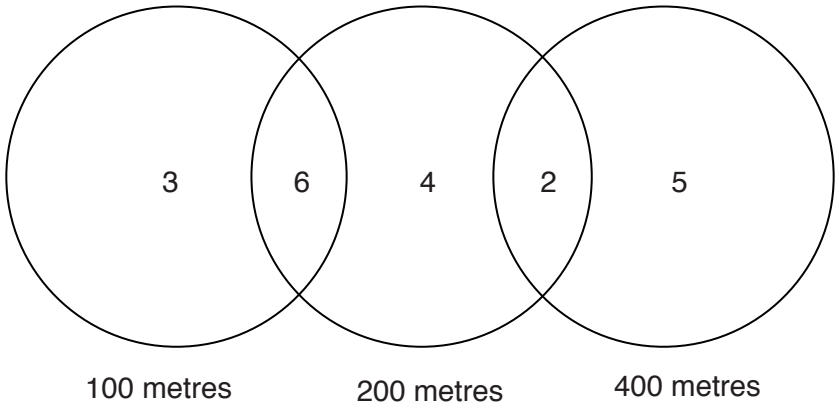
(e) exactly two of these styles,

.....[1]

(f) freestyle, given that the swimmer is a specialist in breaststroke.

.....[1]

(ii) The diagram below shows the number of track athletes who enter one or more of the events 100 metres, 200 metres and 400 metres.



Use this information to find the number of these track athletes who enter

(a) only the 200 metres,

.....[1]

(b) the 100 metres,

.....[1]

(c) the 100 metres or the 400 metres,

.....[1]

(d) the 100 metres and the 400 metres.

.....[1]

(iii) One of the swimmers in part **(i)** and one of the track athletes in part **(ii)** are chosen at random to undergo blood tests.

Find the probability that the swimmer is a specialist in freestyle and the track athlete enters more than one of the given events.

.....[4]

(iv) Later, one of the track athletes in part **(ii)**, who currently enters both the 100 metres and the 200 metres, decides to enter **also** the 400 metres.

Draw and label a new Venn diagram to represent the track athletes in part **(ii)** after this change has been made.

[2]

10 A postman wears a pedometer, with which he measures the daily distance he walks when delivering mail. The following table summarises the data he collected over 50 working days.

Daily distance walked, x (km)	*Number of days*, f	
0 – under 3	7	
3 – under 6	10	
6 – under 9	15	
9 – under 12	11	
12 – under 15	5	
15 – under 20	2	

(i) State the modal class.

.....[1]

(ii) Estimate, in kilometres, the mean and standard deviation of the daily distance walked. Give your answers correct to 3 significant figures.

Mean = ...

Standard deviation = ...[7]

(iii) State the units in which the variance of the daily distance walked would be measured.

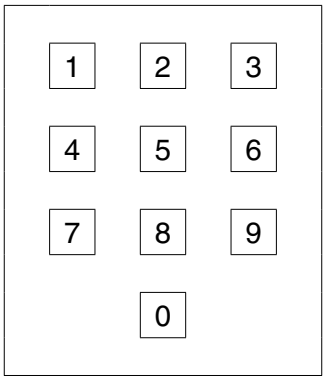
.....[1]

(iv) From the data in the table, possible values for the range, r, are given by $a < r < b$.
Find a and b.

a = ...

b = ...[2]

Later the postman has to deliver mail to a new apartment building. The mail boxes are inside the building, and to gain access he must enter a four-digit security code on a keypad outside the building.



The postman has forgotten the exact code, but he remembers, correctly, that the first digit is 4, and the other digits are odd numbers which are different from each other. He uses this knowledge, but otherwise randomly guesses.

Find the probability that he enters the correct code

(v) on the first attempt,

.....[3]

(vi) on the second attempt.

.....[2]

11 In this question calculate all mortality rates as deaths per thousand admissions. Where values do not work out exactly give your answers to two decimal places.

At Northshore hospital, the medical condition of patients admitted is recorded as one of non-urgent, stable, serious, or extremely serious. The table below gives information on the number of admissions and mortality (number of deaths) at the hospital for the year 2014, together with the standard population of admissions for hospitals in the area.

Medical condition	*Mortality*	*Admissions*	*Medical condition mortality rate*	*Standard population of admissions* (%)
Non-urgent	6	4000		15
Stable	35	5600		25
Serious	680	8500		40
Extremely serious	961	6200		20

(i) Calculate the crude mortality rate for Northshore hospital.

.....[4]

(ii) Calculate the mortality rate for each medical condition and insert the values in the table above.

[2]

(iii) Calculate the standardised mortality rate for Northshore hospital.

.....[4]

The table below gives mortality rate information about Southshore hospital, which is situated in the same area as Northshore hospital, also for the year 2014.

Medical condition	*Medical condition mortality rate* (deaths per thousand admissions)	*Admissions*
Non-urgent	1.4	5000
Stable	6.25	6400
Serious	85	7800
Extremely serious	162	5500

(iv) Calculate the standardised mortality rate for Southshore hospital in the year 2014, using the same standard population as for Northshore hospital.

.....[2]

(v) Find how many fewer deaths there were at Southshore hospital than at Northshore hospital in 2014.

.....[2]

The local government of the area where Northshore and Southshore hospitals are situated has sufficient funds available to improve medical care in one of the hospitals only.

(vi) State, with a reason, to which of these two hospitals the funds should be allocated.

.....

.....

.....[2]

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