Cambridge O Level

CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

STATISTICS **4040/13**

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.

[Turn over

Section A [36 marks]

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

1 A teacher gives her pupils a test consisting of 5 questions, in which each question is worth 1 mark. The test scores of the pupils are shown in the following chart.
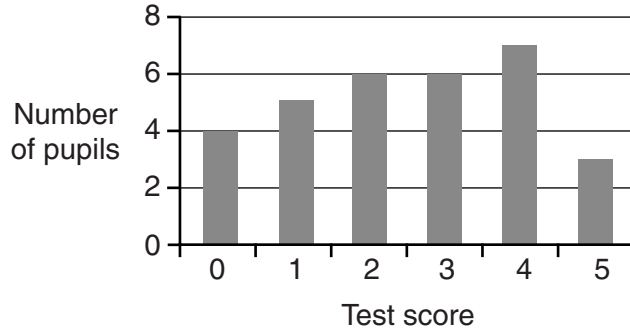
(i) State the number of pupils whose test score is 1 mark.

....[1]

(ii) Find the number of pupils taking the test.

....[2]

(iii) State the modal test score.

....[1]

(iv) Find the median test score.

....[2]

2 A bird protection society is concerned by the declining numbers of certain birds, particularly blackbirds and sparrows. To monitor the situation, members of the public were asked to count the number of birds in their gardens during a 1-hour period last Sunday.

Andy took part in the survey and altogether he counted 212 birds. His results are shown in the pie chart below, which has a radius of 3 cm.
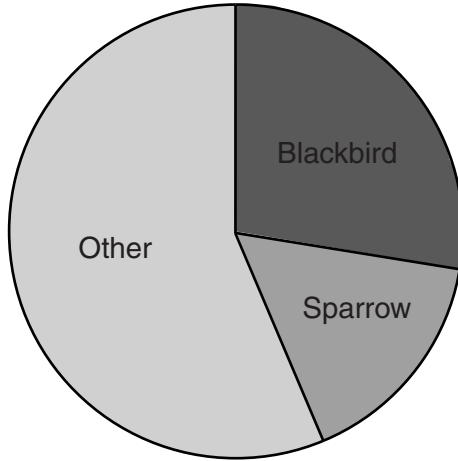
(i) Measure the angle for blackbirds. Give your answer correct to the nearest degree.

....[1]

(ii) Calculate the number of blackbirds that Andy saw.

....[2]

Katrina also took part in the survey and counted 137 birds in total.
She wants to show this information in a comparative pie chart.

(iii) Calculate the radius of Katrina's pie chart, correct to 2 decimal places.

....[2]

Katrina saw the same number of sparrows as Andy.

(iv) Explain why the angle for sparrows on Katrina's pie chart will be larger than the angle for sparrows on Andy's pie chart. You are **not** required to find either of these angles.

....

....[1]

3 Rishi and Rakhi are conducting a survey about the meals at the school canteen. They decide to interview pupils aged 12, 13 and 14.
The table below shows the number of pupils of each age.

Age	Number of pupils
12	60
13	63
14	52
TOTAL	175

Rather than asking all the pupils they decide to take a sample.

(i) Explain how they should select a systematic sample of size 25.

....

....

....[3]

Alternatively, they could take a stratified sample of size 25.

(ii) If they choose this method, calculate the number of pupils aged 14 that would be interviewed.

....[2]

After discussion they each conduct their own survey independently. They both take a systematic sample of size 25. When they compare their results, Rishi notices that he has interviewed one more student aged 12 than Rakhi has.

(iii) Explain why this is possible.

....

....[1]

4 Students at a local college have the option of taking a 1-year vocational Computing course. At the end of the course the students achieve either a PASS or a FAIL.
Information about the numbers taking the course is shown in the table below.

Year	Number of students taking the Computing course		Number of PASSES		Total number of students
	Boys	Girls	Boys	Girls	
2010	41	52	36	38	470
2011	48	53	39	40	463
2012	56	49	46	42	501
2013	62	50	57	45	492

(i) State the number of girls who took the Computing course in 2012.

....[1]

(ii) Of the boys who took the Computing course in 2010, calculate the percentage who achieved a PASS.

....[2]

(iii) Of all the students at the college in 2013, calculate the percentage who took the Computing course and achieved a PASS.

....[2]

(iv) Identify one trend in the number of students taking the Computing course from 2010 to 2013.

....[1]

5 A bag contains 10 counters, of which 3 are red. Basil selects counters from the bag one at a time, at random, without replacement. He stops if he selects a red counter or if he has selected a total of 4 counters.

Let X be the number of counters selected.

(i) Find P($X = 1$).

....[1]

(ii) Show that P($X = 2$) = 7/30.

[2]

(iii) Complete the following table:

x	1	2	3	4
Probability		7/30		

[3]

6 A child's toy consists of a box of coloured pieces. Each piece is green or blue, a square or a triangle, and made of wood or plastic.

   (i) Write down a variable of the pieces which is
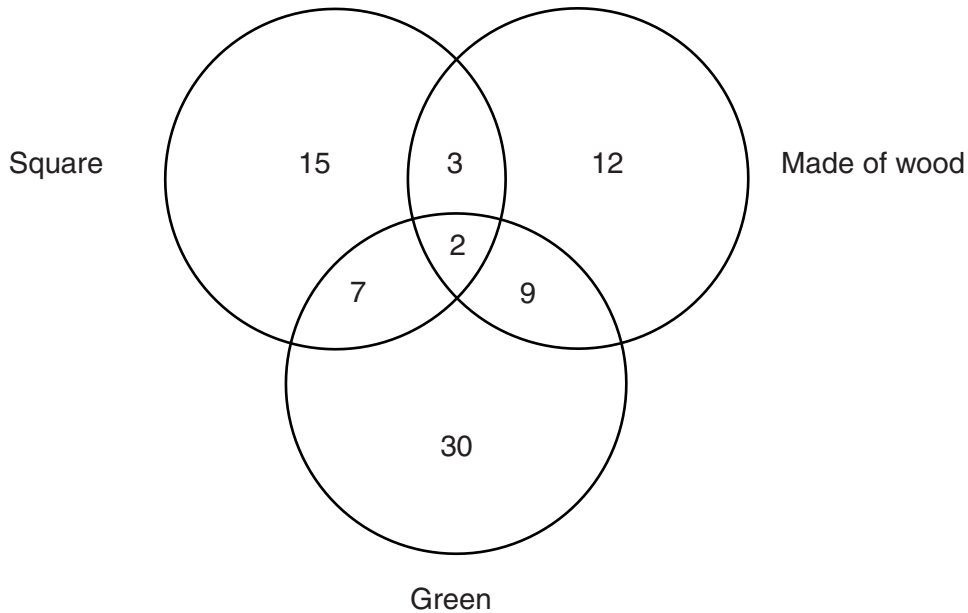
    (a) qualitative,

    ....[1]

    (b) quantitative and discrete,

    ....[1]

    (c) quantitative and continuous.

    ....[1]

The diagram below shows the number of pieces which have one or more of the properties square, made of wood, and green.

   (ii) Find the number of pieces which are

    (a) green and made of wood,

    ....[1]

    (b) squares which are made of plastic,

    ....[1]

    (c) green plastic triangles.

    ....[1]

Section B [64 marks]

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

Each question in this section carries 16 marks.

7 **(a)** Gary drives to work every day. On his journey he has to pass through two sets of traffic lights. The probability that he has to stop at the first set of traffic lights is 0.62 . The probability that he has to stop at the second set is 0.45 . These events are independent.

Find the probability that on any particular journey to work he has to stop at at least one set of traffic lights.

....[3]

(b) Alex and Beatrice play a series of games. In each game they throw, alternately, a dart at a dart board. The first player to hit the bull's-eye (centre) wins the game. They play a number of games until one of them wins the series by winning three games.

In any game, if Alex throws first the probability that he wins the game is 0.64 . If Beatrice throws first the probability that she wins the game is 0.78 .

To decide who starts the first game in the series an unbiased coin is tossed. Subsequent games in the series are started by the winner of the previous game.

Find the probability that

(i) Beatrice wins the toss and wins the first game,

....[2]

(ii) Alex wins the toss and Beatrice wins the first game,

....[2]

(iii) Alex wins the first game,

....[2]

(iv) Beatrice wins the series by three games to zero.

....[2]

They start a new series. Beatrice wins the first game and Alex wins the second game.

(v) Find the probability that Beatrice wins the series.

....[5]

8 Konrad is conducting an experiment. He attaches a spring to a stand, then attaches a mass to the bottom of the spring, and then measures the length of the spring. He repeats this experiment for eight different masses. His results are shown in the table below.

Mass, x (g)	30	35	40	45	50	55	60	65
Length of spring, y (cm)	26.1	27.7	34.5	38.5	40.8	44.1	48.2	49.7

(i) Plot these data on the grid below.
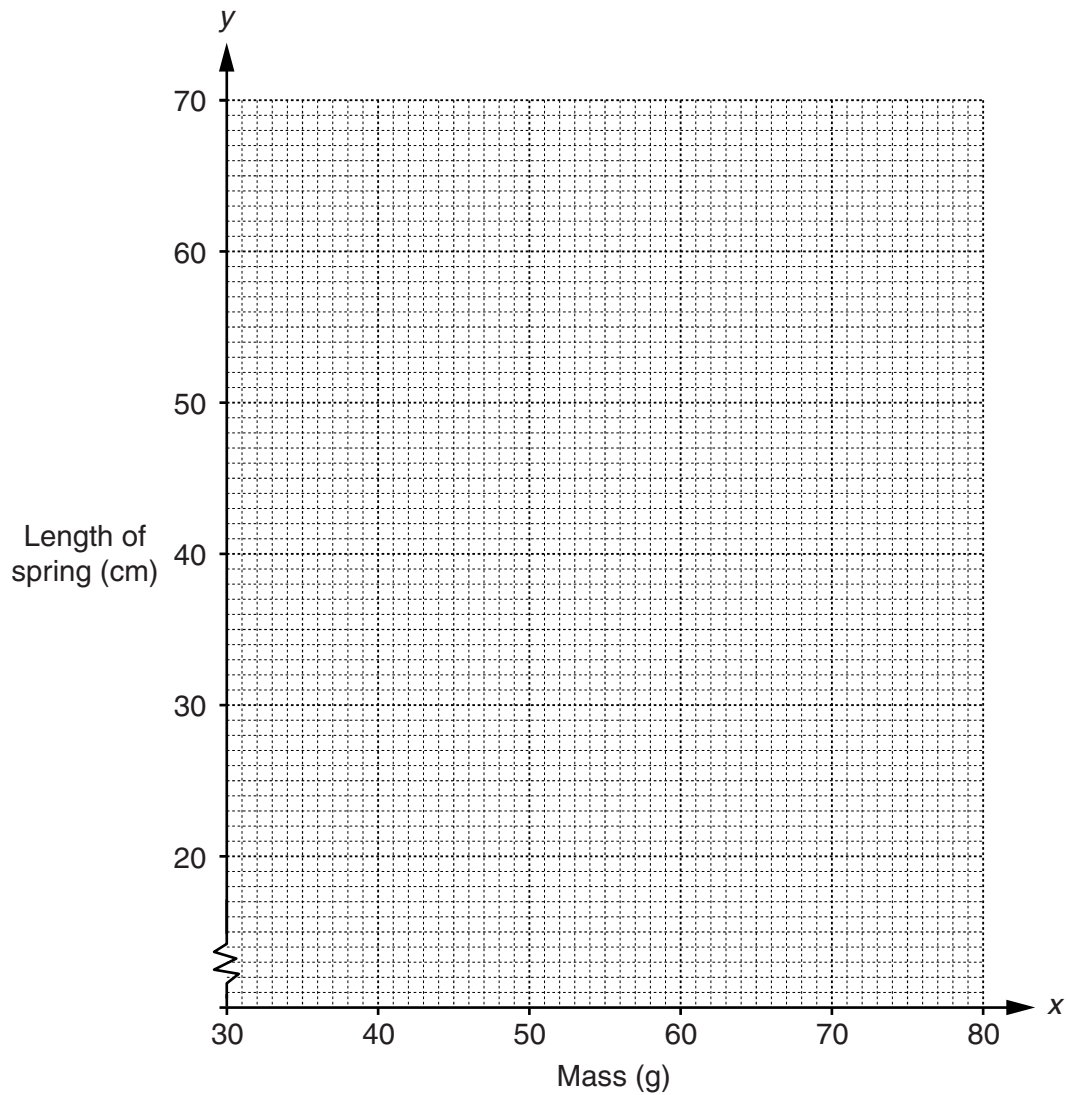
[2]

The overall mean is (47.5, 38.7).

(ii) Calculate the lower semi-average and the upper semi-average.

....

....[3]

(iii) Plot these three averages on your graph and hence draw the line of best fit. [2]

(iv) Calculate the equation of the line of best fit in the form $y = mx + c$.

....[4]

(v) State what the value of c represents.

....[1]

(vi) Estimate the length of the spring for a mass of

(a) 42 g,

....[1]
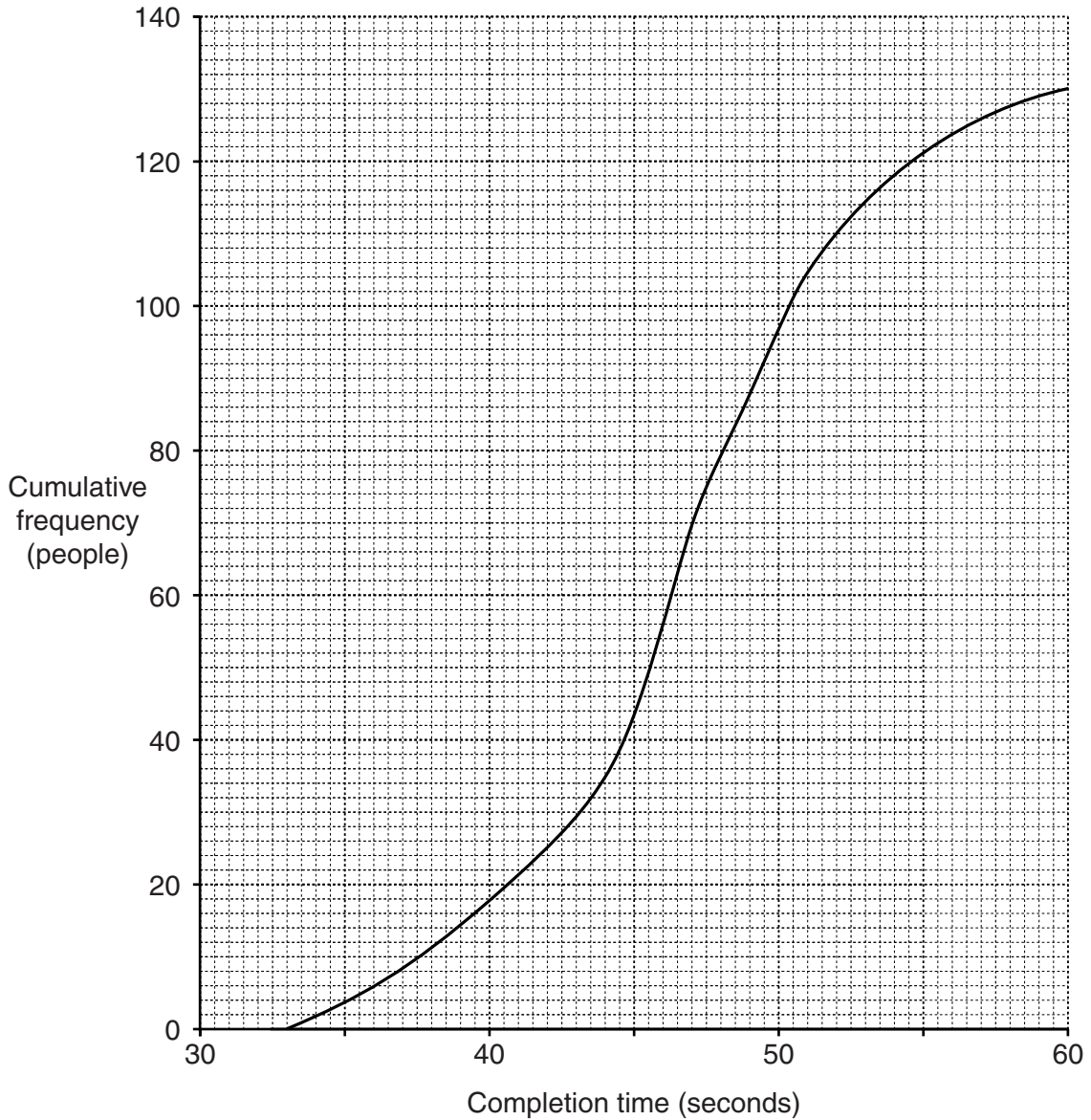
(b) 75 g.

....[1]

(vii) Which of your estimates in part **(vi)** is likely to be more reliable? Give a reason for your answer.

....

....[2]

9 140 people applied to be contestants in a quiz show. As part of the selection process they were given 60 seconds to solve a set of simple puzzles. The times taken by those who completed the puzzles are summarised in the cumulative frequency graph below.

(i) State the number of people who failed to complete the puzzles within the allotted time.

....[1]

(ii) Find, for all 140 people,

    (a) the median completion time,

                                                  ....[1]

    (b) the interquartile range of the completion times,

                                                  ....[4]

    (c) the completion time of the quickest person.

                                                  ....[1]

The people were graded for speed. Those who took less than 40 seconds were graded A. Those who took 40 seconds or more, but less than 49 seconds, were graded B. Those who took 49 seconds or more were graded C.

(iii) Find the number of people who were graded

    (a) A,

                                                  ....[2]

    (b) B.

                                                  ....[2]

(iv) Find the percentile of the quickest grade C person.

                                                  ....[2]

The people who completed the puzzles within the allotted time were also graded A, B or C for accuracy. The table shows the cumulative percentages of these people graded A, B or C.

Grade for accuracy	A	A or B	A or B or C
Percentage	15	75	100

(v) Find the maximum number of people that could have been graded B for both speed and accuracy.

                                                  ....[3]

10 Dirota is a keen gardener. She likes to grow tomatoes in her greenhouse. She sows a packet of seeds in a tray of compost and after five weeks she measures the heights of the plants. The results are summarised in the histogram below.
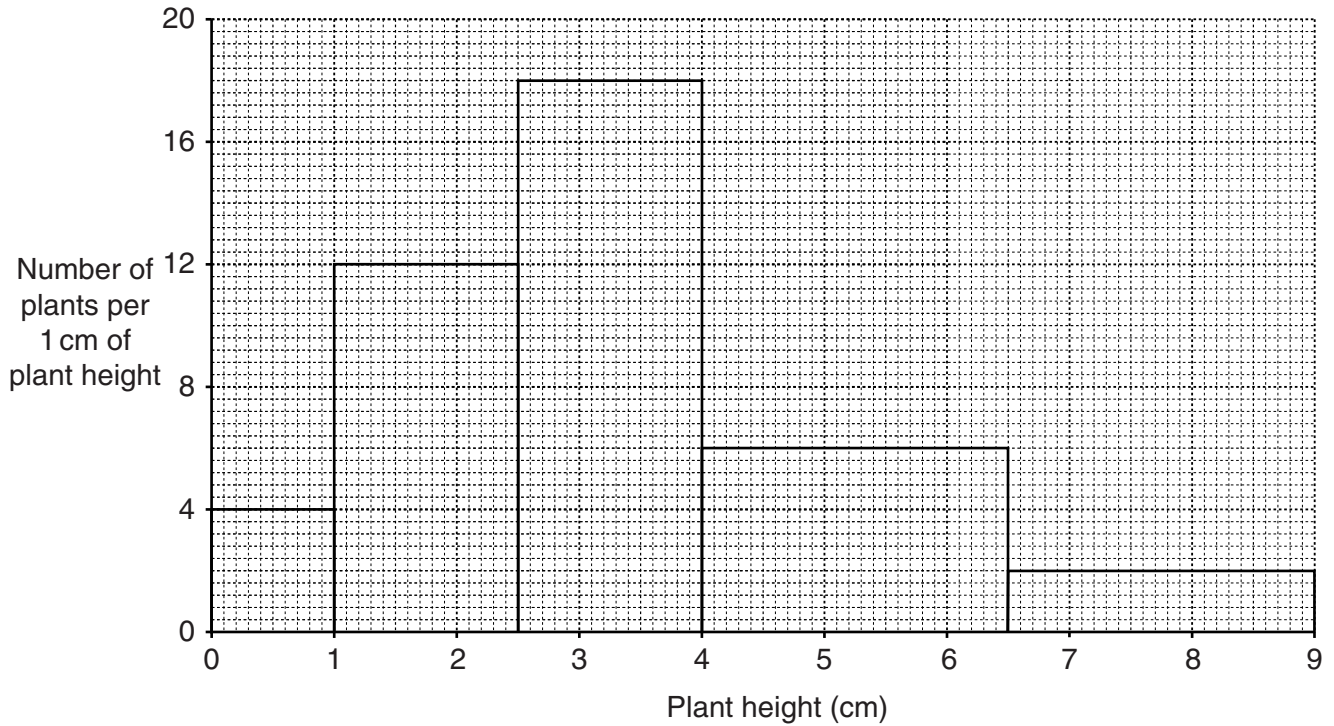
(i) Find an estimate for the mode of the heights.

....[2]

(ii) Estimate the number of plants which are

(a) more than 6.5 cm in height,

....[2]

(b) more than 5 cm in height.

....[2]

Each plant is transferred to its own pot. Dirota puts the plants in order of size, starting with the shortest, and numbers the pots. The pot which contains the shortest plant is numbered 1; the pot with the second shortest plant is numbered 2 etc.

(iii) Estimate the height of the plant in pot number 30.

....[3]

After 8 weeks she has 60 surviving plants. She measures the height, x cm, of each of the plants and finds that $\Sigma x = 443$ and $\Sigma x^2 = 3489$.

(iv) Calculate the mean and standard deviation of x.

Mean ....

Standard deviation ....[5]

Dirota sees an advertisement for a new plant food, which adds 2 cm to plant growth during the first 8 weeks after sowing.

(v) Write down what the mean and standard deviation of the heights of Dirota's plants would have been after 8 weeks if she had used this new plant food.

Mean ....

Standard deviation ....[2]

11 The table below gives information about the population and deaths in the town of Ashville for the year 2012, together with the standard population of the area in which Ashville is situated.

Age group	Number of deaths	Population in age group	Standard population (%)
0 – under 25	a	3500	21
25 – under 45	12	b	29
45 – under 65	27	5400	35
65 and over	15	2000	c

(i) The death rate for the 0 – under 25 age group was 6 per thousand. Show that $a = 21$.

[1]

(ii) The death rate for the 25 – under 45 age group was 2.5 per thousand. Find the value of b.

....[2]

(iii) Calculate the death rates per thousand for the other two age groups.

45 – under 65 group ....

65 and over group ....[2]

(iv) Calculate the crude death rate per thousand for Ashville, correct to 2 decimal places.

....[4]

(v) Write down the value of c.

....[1]

(vi) Calculate the standardised death rate per thousand for Ashville.

....[4]

Birchville is a town in the same area as Ashville. For Birchville, the crude death rate is 5.21 per thousand and the standardised death rate is 3.44 per thousand.

(vii) State, with a reason, which of the two towns appears to have the healthier environment.

....

....[2]

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