A level Applied Mathematics

Paper 3A Statistics

Practice Paper 1

Time: 67 mins

Information for Candidates

- This practice paper follows the Edexcel GCE A Level Specifications
- There are 8 questions in this question paper
- The total mark for this paper is 56.
- The marks for **each** question are shown in brackets.
- Full marks may be obtained for answers to ALL questions

Advice to candidates:

- You must ensure that your answers to parts of questions are clearly labelled.
- You must show sufficient working to make your methods clear to the Examiner
- Answers without working may not gain full credit

Question 1

The times, in seconds, spent in a queue at a supermarket by 85 randomly selected customers, are summarised in the table below.

Time (seconds)	Number of customers, f
0 − 30	2
30 − 60	10
60 − 70	17
70 − 80	25
80 − 100	25
100 − 150	6

A histogram was drawn to represent these data. The 30 – 60 group was represented by a bar of width 1.5 cm and height 1 cm.

(a) Find the width and the height of the 70 – 80 group.   **(3)**

(b) Use linear interpolation to estimate the median of this distribution.   **(2)**

Given that x denotes the midpoint of each group in the table and

$$\sum fx = 6460 \qquad \sum fx^2 = 529\,400$$

(c) calculate an estimate for

   (i) the mean,
   (ii) the standard deviation,
   for the above data.   **(3)**

(Total 8 marks)

Question 2

The mark, x, scored by each student who sat a statistics examination is coded using

$$y = 1.4x - 20$$

The coded marks have mean 60.8 and standard deviation 6.60

Find the mean and the standard deviation of x.   **(4)**

(Total 4 marks)

Question 3

For the events *A* and *B*,

$$P(A' \cap B) = 0.22 \text{ and } P(A' \cap B') = 0.18$$

(a) Find P(*A*). **(1)**

(b) Find P(*A* ∪ *B*). **(1)**

Given that P(*A* | *B*) = 0.6

(c) find P(*A* ∩ *B*). **(3)**

(d) Determine whether or not *A* and *B* are independent. **(2)**

(Total 7 marks)

Question 4

In a factory, three machines, *J*, *K* and *L*, are used to make biscuits.

Machine *J* makes 25% of the biscuits.

Machine *K* makes 45% of the biscuits.

The rest of the biscuits are made by machine *L*.

It is known that 2% of the biscuits made by machine *J* are broken, 3% of the biscuits made by machine *K* are broken and 5% of the biscuits made by machine *L* are broken.

(a) Draw a tree diagram to illustrate all the possible outcomes and associated probabilities. **(2)**

A biscuit is selected at random.

(b) Calculate the probability that the biscuit is made by machine *J* and is not broken. **(2)**

(c) Calculate the probability that the biscuit is broken. **(2)**

(d) Given that the biscuit is broken, find the probability that it was not made by machine *K*. **(3)**

(Total 9 marks)

Question 5

The table shows some data collected on the temperature, in °C, of a cup of coffee, c, and the time, t in minutes, after which it was made.

t	0	2	4	5	7	11	13	17	25
c	81.9	75.9	70.1	65.1	60.9	51.9	50.8	45.1	39.2

The data is coded using the changes of variable $x = t$ and $y = \log_{10} c$.

The regression line of y on x is found to be $y = 1.89 - 0.0131x$.

a Given that the data can be modelled by an equation of the form $c = ab^t$ where a and b are constants,
   find the values of a and b. **(3)**

b Give an interpretation of the constant b in this equation. **(1)**

c Explain why this model is not reliable for estimating the temperature of the coffee after an hour. **(1)**

(Total 5 marks)

Question 6

Hayden at St Mark's school believes that there is a positive correlation between the amount of sunshine and sales of ice cream. The results are shown below

Sunshine, (hours)	4.6	7.2	5.1	8.3	2.4	6.4	5.7	3.3
Ice Cream Sales, (£100s)	3.1	5.2	3.6	5.6	1.7	4.7	4.0	2.5

a Find the product moment correlation coefficient for these data, correct to 4 decimal places. **(2)**

b State what is measured by the product moment correlation coefficient **(1)**

c State, with a reason, whether a linear regression model based on these data
   is reliable or not for when ice cream sales is £720 **(1)**

d Test, at the 2.5% level of significance, whether there is evidence of
   a positive correlation between the amount of sunshine and sales of ice cream.

(3)

(Total 7 marks)

Question 7

A single observation x is to be taken from a binomial distribution B(20,p).

This observation is used to test H_0: $p = 0.3$ against H_1: $p \neq 0.3$

a Under H_0: $X \sim B(20, 0.3)$, using a 5% level of significance, find the critical region for this test. You should state the probability of rejection in each tail, which should be less than 2.5 % **(3)**

b State the actual significance level of this test. **(1)**
The actual value of x obtained is 3.

c State a conclusion that can be drawn based on this value, giving a reason for your answer. **(2)**

(Total 6 marks)

Question 8

A machine fills packets with X grams of powder where X is normally distributed with mean μ. Each packet is supposed to contain 1 kg of powder.

To comply with regulations, the weight of powder in a randomly selected packet should be such that P($X < \mu - 30$) = 0.0005

(a) Show that this requires the standard deviation to be 9.117 g to 3 decimal places. **(3)**

A random sample of 10 packets is selected from the machine. The weight, in grams, of powder in each packet is as follows

999.8   991.6   1000.3   1006.1   1008.2   997.0   993.2   1000.0   997.1   1002.1

(b) Assuming that the standard deviation of the population is 9.117 g, test, at the 1% significance level, whether or not the machine is delivering packets with mean weight of less than 1 kg. State your hypotheses clearly.

(7)

(Total 10 marks)

TOTAL FOR PAPER IS 56 MARKS