

General Certificate of Education
Advanced Level Examination

MATHEMATICS A

Statistics 1

Paper A

Time allowed: 1 hour 20 minutes

Instructions and Information

- A graphics calculator may be used.
- Answer **all** questions..
- All necessary working should be shown or marks for method may be lost.
- The maximum mark for this paper is 60.
- You are reminded of the need for good English and clear presentation.
- Final answers to questions requiring the use of statistical tables or calculators should normally be given to three significant figures.



Written by Shaun Armstrong, Aidan Burrows & Chris Huffer

© Solomon Press

These sheets may be copied for use solely by the purchaser's institute.

1. A golfer believes that the distance, in metres, that he hits a ball with a 5-iron, follows a continuous uniform distribution over the interval [100, 150].

(a) Find the median and interquartile range of the distance he hits a ball that would be predicted by this model.

(3 marks)

(b) Explain why the continuous uniform distribution may not be a suitable model.

(2 marks)

5 marks

2. The continuous random variable X has the probability density function $f(x)$ defined by

$$f(x) = \begin{cases} kx, & 0 \leq x \leq 4, \\ 0, & \text{otherwise.} \end{cases}$$

(a) Sketch the graph of $f(x)$ for all values of x .

(2 marks)

(b) Find the value of k .

(2 marks)

(c) Find $P(X > 3)$.

(2 marks)

6 marks

3. (a) Explain briefly what you understand by the terms

(i) population,

(ii) sample.

(2 marks)

(b) Giving a reason for each of your answers, state whether you would use a census or a sample survey to investigate

(i) the dietary requirements of people attending a 4-day residential course,

(ii) the lifetime of a particular type of battery.

(4 marks)

6 marks

4. An athlete believes that her times for running 200 metres in races are normally distributed with a mean of 22.8 seconds.
- (a) Given that her time is over 23.3 seconds in 20% of her races, calculate the variance of her times. (5 marks)
- (b) The record over this distance for women at her club is 21.82 seconds. According to her model, what is the chance that she will beat this record in her next race? (3 marks)
-
- 8 marks

5. A tetrahedral die has four sides numbered 1, 2, 3 and 4. The die is unbiased and the random variable, X , is the score obtained on a single throw.
- (a) Write down the probability distribution of X . (2 marks)
- (b) Write down the mean of X . (1 mark)
- (c) Find $E(4X - 1)$. (2 marks)
- (d) Find $\text{Var}(4X - 1)$. (5 marks)
-
- 10 marks

6. As part of a business studies project, 8 groups of students are each randomly allocated 10 different shares from a listing of over 300 share prices in a newspaper. Each group has to follow the changes in the price of their shares over a 3-month period.
- At the end of the 3 months, 35% of all the shares in the listing have increased in price and the rest have decreased.
- (a) Find the probability that, for the 10 shares of one group,
- (i) exactly 6 have gone up in price,
- (ii) more than 5 have gone down in price. (5 marks)
- (b) Using a distributional approximation, estimate the probability that of the 80 shares allocated in total to the groups, more than 55 will have decreased in value. (6 marks)
-
- 11 marks

TURN OVER

7. A sweet factory produces a sweet called a *Chumpa*. The weights of *Chumpas* are normally distributed with mean a grams and standard deviation b grams.

Four *Chumpas* are selected at random and weighed. The weights, in grams, are

5.21, 4.99, 5.01 and 4.87

- (a) Use this sample to calculate unbiased estimates of a and b . (5 marks)
- (b) What assumption must be made to use these values as unbiased estimates? (1 mark)

A sample of 50 *Chumpas* is taken and used to calculate further unbiased estimates of a and b giving values of 5.06 and 0.136 respectively.

- (c) State, with a reason, which of the unbiased estimates are likely to be more accurate. (2 marks)
- (d) Using the values from the sample of 50 *Chumpas*, calculate a 95% confidence interval for the mean weight of a *Chumpa*. (4 marks)

The manufacturer claims that the mean weight of a *Chumpa* is 5 grams.

- (e) Comment on this claim. (2 marks)

14 marks

Total 60 marks

END