IYGB GCE

Mathematics FS2

Advanced Level

Practice Paper O

Difficulty Rating: 3.3733/1.5228

Time: 1 hour 30 minutes

Candidates may use any calculator allowed by the regulations of this examination.

Information for Candidates

This practice paper follows closely the Pearson Edexcel Syllabus, suitable for first assessment Summer 2018.

The standard booklet "Mathematical Formulae and Statistical Tables" may be used.
Full marks may be obtained for answers to ALL questions.
The marks for the parts of questions are shown in round brackets, e.g. **(2)**.
There are 8 questions in this question paper.
The total mark for this paper is 75.

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.
Non exact answers should be given to an appropriate degree of accuracy.
The examiner may refuse to mark any parts of questions if deemed not to be legible.

Question 1

A random sample of 8 observations, taken from a Normally distributed population, is listed below.

$$10, 13, 10, 9, 7, 12, 14, 9 .$$

Determine a 95% confidence interval for the variance of this Normally distributed population. **(4)**

Question 2

The weights of female bodybuilders are Normally distributed with mean 60 kg and standard deviation 4 kg . The weights of male bodybuilders are Normally distributed with mean 100 kg and standard deviation 6 kg .

Determine the probability that the total weight of 6 randomly selected female bodybuilders is more than 10 kg lighter than 4 times the weight of a randomly selected male bodybuilder. **(8)**

Question 3

The data in the table below shows the time, in seconds, for the fastest qualifying lap for 8 different Formula One racing drivers, and their finishing order in the actual race.

Fastest Qualifying Lap	49.12	49.34	49.07	48.55	49.40	49.27	49.77	48.87
Finishing Position	5	6	1	3	7	4	8	2

a) Calculate Spearman's rank correlation coefficient for this data. **(4)**

b) Test whether or not there is any association between the fastest qualifying lap time and the finishing position for Formula One racing drivers, at the 5% level of significance, stating your hypotheses clearly. **(3)**

Question 4

Dolphins are thought to communicate with each other by high pitch noises they produce. The frequency, v kHz, of the noise made by a dolphin is recorded at 15 different sea depths, d m. These data are summarized below.

$$\sum d = 385.5,\ \sum d^2 = 11543.25,\ \sum v = 22.5,\ \sum v^2 = 38.25,\ \sum dv = 650.25$$

a) State, with a reason, which is the explanatory variable in the above described scenario and state the statistical name of the other variable. **(2)**

b) Find the value of S_{dd}, S_{vv} and S_{dv} for this data. **(3)**

c) Calculate the product moment correlation coefficient between d and v. **(2)**

d) Interpret the value of the product moment correlation coefficient in the context of this question. **(1)**

e) Give a reason to support the fitting of a regression line of the form

$$v = a + bd,$$

where a and b are constants. **(1)**

f) Determine the value of a and b, correct to three significant figures. **(4)**

g) Interpret in the context of this question the physical meaning of a and b. **(2)**

Question 5

Joe disagrees with the statement made on the label of a packet of crisps, which states that the net content is 40 grams.

He weighs the content, x grams, of 10 randomly chosen packets of these crisps.

His results are summarized below.

$$\sum_{10} x = 387.5 \quad \text{and} \quad \sum_{10} x^2 = 15096.25$$

Test, at the 5% level of significance, whether there is evidence to support Joe's belief. **(8)**

Question 6

A group of 1200 soldiers completed an assault course, early in the morning.

A random sample of 60 soldiers was selected from the group of 1200. The time taken by each of these 60 soldiers to complete the assault course, x minutes, was recorded and the following information is known.

$$\sum_{i=1}^{60} x_i = 1350 \quad \text{and} \quad \sum_{i=1}^{60} x_i^2 = 30685$$

a) Find unbiased estimates for the mean and variance of the time taken by the 1200 soldiers who completed the course early in the morning. **(3)**

A group of 1500 soldiers completed the same assault course, late in the afternoon.

A random sample of 60 soldiers was selected from the group of 1500. The time taken by each of these 60 soldiers to complete the assault course, y minutes, was recorded and the following information is known.

$$\bar{y} = 24.1 \quad \text{and} \quad s_y^2 = 5.48$$

b) Test, at the 5% significance level, whether or not the mean time of the 1500 soldiers which completed the assault course in the afternoon is greater than that of the 1200 soldiers which completed the same course in the morning.

State the hypotheses clearly and any assumptions and validations made. **(8)**

Question 7

The continuous random variable X is uniformly distributed.

It is further given that

$$\mathrm{P}(X > 27) = 0.75 \quad \blacklozenge \quad \mathrm{Var}(X) = 300 \quad \blacklozenge \quad 4\,\mathrm{P}(X < k - 10) = \mathrm{P}(X > k + 20)$$

Determine the value of k. **(8)**

Question 8

The continuous random variable X has probability density function, $f(x)$, given by

$$f(x) = \begin{cases} \frac{1}{60}x^3 & 2 \le x \le 4 \\ 0 & \text{otherwise} \end{cases}$$

a) Find the value of $\mathrm{E}(X)$. **(3)**

b) Show that the standard deviation of X is 0.516, correct to 3 decimal places. **(4)**

The cumulative distribution function of X, is denoted by $F(x)$.

c) Find and specify fully $F(x)$. **(3)**

d) Determine $P(X > 3.5)$. **(2)**

e) Calculate the median of X, correct to two decimal places. **(2)**