IYGB GCE

Mathematics FS2

Advanced Level

Practice Paper Q

Difficulty Rating: 2.8800/1.2821

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 10 observations, taken from a Normally distributed population of known variance of 100.

The sample produced a variance of 78.

Test at 10% level of significance whether there is evidence that the variance is less than 100. **(4)**

Question 2

The table below shows the marks obtained by a group of students, in two separate tests.

Student	A	B	C	D	E	F	G	H	I	J
Test 1	17	11	16	9	12	12	11	4	7	15
Test 2	24	21	24	20	22	18	18	9	15	21

Let x and y represent the marks obtained in Test 1 and Test 2, respectively.

a) Find the value of S_{xx}, S_{yy} and S_{xy}. **(3)**

b) Show that the product moment correlation coefficient between x and y is approximately 0.9. **(2)**

c) Determine the equation of the regression line between x and y, giving the answer in the form

$$y = a + bx,$$

where a and b are constants.

Detailed calculations must be shown in this part. **(4)**

Question 3

The random variables A and B are Normally distributed, such that

$$A \sim \mathrm{N}(30, k) \quad \text{and} \quad B \sim \mathrm{N}(40, 2k),$$

where k is a positive constant.

Determine the value of k if $\mathrm{P}(3A - 2B > 18.5) = 0.1587$.

You may assume that A and B are independent of one another. **(8)**

Question 4

The actual ages, in complete years, of seven cats is shown below.

Cat Name	Riri	Loulou	Ginge	Puss	Ollie	Rex	Mog
Age in years	3	4	18	21	5	11	9

These seven cats were seen by a vet, during a day's surgery, and the vet was asked to order them according to their age by examination only.

He ordered the cats' ages, older first, as follows.

Ginge, Puss, Mog, Rex, Loulou, Riri, Ollie.

a) Calculate Spearman's rank correlation coefficient between the actual age of the cats and the vet's order. **(5)**

b) Test whether or not the vet has the ability to identify the age of cats, at the 1% level of significance, stating your hypotheses clearly. **(4)**

Question 5

The time T, taken by a mechanic to service a certain model of car, has mean μ minutes and standard deviation 20 minutes.

A random sample of 100 servicing times showed a mean time of 45 minutes.

a) Explain, with full justification, why T is unlikely to be Normally distributed but the sample mean of the random 100 servicing times $\bar{T}$ can be modelled by a Normal distribution. **(4)**

b) Construct a 99% confidence interval for μ and hence comment on the claim that the typical servicing time could be about one hour. **(4)**

Question 6

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

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

a) Show clearly that $k = \frac{1}{120}$. **(4)**

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

b) Find and specify fully $F(x)$. **(4)**

c) State the median of X. **(1)**

d) Show that $\mathrm{E}(X) = \frac{58}{25}$. **(4)**

e) Calculate the interquartile range of X. **(5)**

Question 7

A minicab driver feels that his daily mileage figures this year have increased compared to those of last year. He knows that his daily mean mileage last year was 145.

He records the next current 56 daily mileage figures, x miles, and he obtains

$$\sum x = 8596 \quad \text{and} \quad \sum x = 1409600$$

Explain briefly what conclusions can be drawn from a suitable test, at the 5% level of significance.

(8)

Question 8

A Mathematics exam was given to the Year 8 pupils of a certain school.

The percentage marks for some of the boys and some of the girls that sat this exam are given below.

Boys: $67, 72, 56, 91, 55, 68, 55, 45, 80$.

Girls: $58, 97, 65, 69, 57, 57, 77, 69$.

The Head of Maths thinks that the Year 8 boys have a different mean mark than the Year 8 girls.

Test, at the 5% level of significance, whether the claim of the Head of Maths is justified. State your hypotheses clearly, stating any additional assumptions made.

(11)