IYGB GCE

Mathematics FS2

Advanced Level

Practice Paper M

Difficulty Rating: 3.5067/1.6043

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 7 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

An electrical appliances supplier wishes to investigate the impact of advertising on the sales of his washing machines.

He records the number of monthly advertisements placed on the local radio station and the number of washing machines sold.

This is a table of his results.

Number of Advertisements (x)	52	37	66	45	77	27	80	19	47	40
Number of Washing Machines Sold (y)	80	75	81	76	77	49	84	50	63	64

Find, by detailed calculations, the value of the product moment correlation coefficient between x and y, and explain what conclusions the electrical appliances supplier should make from this value. **(6)**

Question 2

When the fat content of a 100 gram slice of cheesecake is measured, using a certain machine, the reading obtained in grams is a Normally distributed variable with mean the actual fat content and standard deviation of 1.1 grams.

The fat content of 16 slices, 8 from each of two varieties of cheesecake are recorded. All 16 slices have a mass of 100 grams.

The fat content of these slices is shown below.

Variety A : 21.9, 23.0, 23.9, 22.0, 24.5, 23.4, 25.1, 24.2.

Variety B : 22.0, 22.5, 24.0, 20.5, 22.4, 23.5, 21.9, 22.2.

a) Calculate a 98% confidence interval for the difference between the mean fat content of a 100 gram cheesecake slice of variety A and variety B. **(6)**

b) Determine the percentage confidence level if the confidence interval for the difference between the mean fat content of the two varieties is $[0.315, 1.935]$. **(5)**

Question 3

A coffee machine, placed in the waiting room of a garage, dispenses coffee into cups. The volume of the coffee in a cup is Normally distributed with mean 250 ml.

The manager of the garage claims that the mean volume of coffee in a cup is no longer 250 ml due to the age of the machine.

He records the volume, x ml, of 10 randomly selected cups, producing the following summary statistics.

$$\sum_{i=1}^{10} x_i = 2390 \quad \text{and} \quad \sum_{i=1}^{10} x_i^2 = 574495.$$

a) Test, at the 5% significance level, the garage manager's claim. **(7)**

b) Carry another test, at the 5% significance level, if instead the garage manager claimed that the mean amount of coffee dispensed by the machine in every cup is less than 250 ml. **(3)**

Question 4

Nine gymnasts performed in a gymnastics competition.

Their names were Arnold (A), Brian (B), Christian (C), Damon (D), Eli (E), Fabian (F), Gordon (G), Harry (H) and Ian (I).

Rank	1	2	3	4	5	6	7	8	9
Judge 1	D	C	E	B	F	A	I	H	G
Judge 2	D	E	F	C	I	B	A	G	H

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

b) Test whether or not the judges are generally in agreement, at the 1% level of significance, stating your hypotheses clearly. **(3)**

Question 5

A piece of string of length a, where a is a positive constant, is cut into 2 pieces at a random point. The continuous random variable X represents the length of the longer piece of the string.

a) Assuming that X is uniformly distributed show by integration that

$$\mathrm{Var}(X) = \frac{a^2}{48}. \qquad (\mathbf{6})$$

b) Find the probability that the length of the longer piece is more than 4 times the length of the shorter piece. $(\mathbf{4})$

Question 6

The weight of a bag of sugar, of a particular supermarket brand, is modelled by a Normal distribution with mean 1008 grams and standard deviation of 4 grams.

a) Determine the probability that the weight of 2 randomly chosen bags of sugar will differ by more than 12 grams.

Bags of sugar are randomly selected and packed shrink-wrapped onto wooden pallets.

The weight of a pallet and the wrapping is also modelled by a Normal distribution with mean 9.6 kg and standard deviation of 0.5 kg $(\mathbf{6})$

Each full pallet is loaded with 160 bags of sugar.

b) Find the probability that the weight of a randomly selected, fully loaded pallet, will be less than 170 kg. $(\mathbf{5})$

Question 7

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

$$f(x)=\begin{cases} \frac{1}{10}x & 0\le x<4 \\ 2-\frac{2}{5}x & 4\le x\le 5 \\ 0 & \text{otherwise} \end{cases}$$

a) Sketch the graph of $f(x)$ for all x. **(3)**

b) State the mode of X. **(1)**

c) Show clearly that $\mathrm{E}(X)=3$. **(4)**

d) Calculate the value of $\mathrm{Var}(X)$. **(6)**

e) Find and specify fully the cumulative distribution function of X, $F(x)$. **(6)**