Pearson Edexcel GCE

Centre Number

Candidate Number

A level Further Mathematics
Further Statistics 1
Practice Paper 1

Instructions

- Use black ink or ball-point pen.
- If pencil is used for diagrams/sketches/graphs it must be dark (HB or B).
- Fill in the boxes at the top of this page with your name, centre number and candidate number.
- Answer all the questions and ensure that your answers to parts of questions are clearly labelled.
- Answer the questions in the spaces provided – there may be more space than you need.
- You should show sufficient working to make your methods clear. Answers without working may not gain full credit.
- Inexact answers should be given to three significant figures unless otherwise stated.

Information

- A booklet 'Mathematical Formulae and Statistical Tables' is provided.
- There are **6** questions in this question paper. The total mark for this paper is **75**.
- The marks for each question are shown in brackets – use this as a guide as to how much time to spend on each question.
- Calculators must not be used for questions marked with a * sign.

Advice

- Read each question carefully before you start to answer it.
- Try to answer every question.
- Check your answers if you have time at the end.
- If you change your mind about an answer, cross it out and put your new answer and any working underneath.

1. In a quiz, a team gains 10 points for every question it answers correctly and loses 5 points for every question it does not answer correctly. The probability of answering a question correctly is 0.6 for each question. One round of the quiz consists of 3 questions.

The discrete random variable X represents the total number of points scored in one round. The table shows the incomplete probability distribution of X.

x	30	15	0	-15
P($X = x$)	0.216			0.064

(a) Show that the probability of scoring 15 points in a round is 0.432.

(2)

(b) Find the probability of scoring 0 points in a round.

(1)

(c) Find the probability of scoring a total of 30 points in 2 rounds.

(3)

(d) Find E(X).

(2)

(e) Find Var(X).

(3)

In a bonus round of 3 questions, a team gains 20 points for every question it answers correctly and loses 5 points for every question it does not answer correctly.

(f) Find the expected number of points scored in the bonus round.

(3)

(Total 14 marks)

2. The cloth produced by a certain manufacturer has defects that occur randomly at a constant rate of λ per square metre. If λ is thought to be greater than 1.5 then action has to be taken.

Using H$_0$: $\lambda = 1.5$ and H$_1$: $\lambda > 1.5$ a quality control officer takes a 4 m^2 sample of cloth and rejects H$_0$ if there are 11 or more defects. If there are 8 or fewer defects she accepts H$_0$. If there are 9 or 10 defects a second sample of 4 m^2 is taken and H0 is rejected if there are 11 or more defects in this second sample, otherwise it is accepted.

(a) Find the size of this test.

(4)

(b) Find the power of this test when $\lambda = 2$.

(3)

(Total 7 marks)

3. A company claims that it receives emails at a mean rate of 2 every 5 minutes.

(a) Give two reasons why a Poisson distribution could be a suitable model for the number of emails received.

(2)

(b) Using a 5% level of significance, find the critical region for a two-tailed test of the hypothesis that the mean number of emails received in a 10 minute period is 4. The probability of rejection in each tail should be as close as possible to 0.025.

(2)

(c) Find the actual level of significance of this test.

(2)

To test this claim, the number of emails received in a random 10 minute period was recorded. During this period 8 emails were received.

(d) Comment on the company's claim in the light of this value. Justify your answer.

(2)

During a randomly selected 15 minutes of play in the Wimbledon Men's Tennis Tournament final, 2 emails were received by the company.

(e) Test, at the 10% level of significance, whether or not the mean rate of emails received by the company during the Wimbledon Men's Tennis Tournament final is lower than the mean rate received at other times. State your hypotheses clearly.

(5)

(Total 13 marks)

4. A number of males and females were asked to rate their happiness under the headings "not happy", "fairly happy" and "very happy".

The results are shown in the table below

		Happiness			Total
		Not happy	Fairly happy	Very happy	
Gender	Female	9	43	34	86
	Male	13	25	16	54
Total		22	68	50	140

Stating your hypotheses, test at the 5% level of significance, whether or not there is evidence of an association between happiness and gender. Show your working clearly.

(Total 10 marks)

5. The probability generating function of the random variable X is given by

$$G_X(t) = k(1 + t + 3t^2)^2.$$

(a) Show that $k = \dfrac{1}{25}$.

(2)

(b) Find $P(X = 2)$.

(2)

(c) Calculate $E(X)$ and $Var(X)$.

(8)

(d) Write down the probability generating function of $2X + 1$.

(2)

(Total 14 marks)

6. A child is repeatedly twisting a coloured spinner which has a probability 0.4 of landing on red. After each twist the child records whether or not the spinner lands on red.

(a) Show that the probability that the spinner lands on red for the first time occurs on or before the 7th twist is 0.972, to 3 decimal places.

(3)

Find the probability that

(b) exactly three reds occur during the first 7 twists,

(2)

(c) the 3rd red occurs on the 7th twist,

(3)

(d) the 3rd red occurs on or before the 7th twist.

(4)

On another occasion there are 3 children A, B and C playing with the spinner. The children take turns to twist the spinner. Child A starts, then B, then C, then A again and so on. The winner is the first child to have the spinner land on red.

(e) Find the probability that A wins.

(3)

Given that the first red occurs on or before the 7th twist,

(f) find the probability that A wins.

(2)

(Total 17 marks)

TOTAL FOR PAPER: 75 MARKS