Write your name here

Surname	Other names

Pearson Edexcel GCE

Centre Number | Candidate Number

A level Further Mathematics
Further Statistics 1
Practice Paper 5

You must have:
Mathematical Formulae and Statistical Tables (Pink)

Total Marks

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 **7** 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. The discrete random variable X has the following probability distribution, where p and q are constants.

x	-2	-1	$\frac{1}{2}$	$\frac{3}{2}$	2
$P(X = x)$	p	q	0.2	0.3	p

(a) Write down an equation in p and q.

(1)

Given that $E(X) = 0.4$,

(b) find the value of q.

(3)

(c) Hence find the value of p.

(2)

Given also that $E(X^2) = 2.275$,

(d) find $\text{Var}(X)$.

(2)

(Total 8 marks)

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2. The police are carrying out a check on car tyres. The percentage of cars with tyre defects is assumed to be 40%. Let X represent the number of cars checked, up to and including the first one with tyre defects.

(a) State the distribution that could be used to model X and write down the mean of X.

(2)

The police decide that they are going to change the place where they are carrying out the check after they have found two cars with tyre defects. Let W represent the number of cars checked, up to and including the second one with tyre defects.

(b) Determine the mean and the variance of W.

(4)

(c) Calculate the probability that $W = 5$.

(2)

(Total 8 marks)

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3. A company receives telephone calls at random at a mean rate of 2.5 per hour.

(*a*) Find the probability that the company receives

(i) at least 4 telephone calls in the next hour,

(ii) exactly 3 telephone calls in the next 15 minutes.

(4)*

(*b*) Find, to the nearest minute, the maximum length of time the telephone can be left unattended so that the probability of missing a telephone call is less than 0.2.

(3)

The company puts an advert in the local newspaper. The number of telephone calls received in a randomly selected 2 hour period after the paper is published is 10.

(*c*) Test at the 5% level of significance whether or not the mean rate of telephone calls has increased. State your hypotheses clearly.

(5)

(Total 12 marks)

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*Part 3(a)(ii) would be 2 marks in the new specification and 3 marks in the old specification.

4. A factory manufactures batches of an electronic component. Each component is manufactured in one of three shifts. A component may have one of two types of defect, D_1 or D_2, at the end of the manufacturing process. A production manager believes that the type of defect is dependent upon the shift that manufactured the component. He examines 200 randomly selected defective components and classifies them by defect type and shift.

The results are shown in the table below.

Shift \ Defect type	D_1	D_2
First shift	45	18
Second shift	55	20
Third shift	50	12

Stating your hypotheses, test, at the 10% level of significance, whether or not there is evidence to support the manager's belief. Show your working clearly.

(10)

(Total 10 marks)

5. A drug is claimed to produce a cure to a certain disease in 35% of people who have the disease. To test this claim a sample of 20 people having this disease is chosen at random and given the drug. If the number of people cured is between 4 and 10 inclusive the claim will be accepted. Otherwise the claim will not be accepted.

(a) Write down suitable hypotheses to carry out this test.

(2)

(b) Find the probability of making a Type I error.

(3)

The table below gives the value of the probability of the Type II error, to 4 decimal places, for different values of p where p is the probability of the drug curing a person with the disease.

P(cure)	0.2	0.3	0.4	0.5
P(Type II error)	0.5880	r	0.8565	s

(c) Calculate the value of r and the value of s.

(3)

(d) Calculate the power of the test for $p = 0.2$ and $p = 0.4$

(2)

(e) Comment, giving your reasons, on the suitability of this test procedure.

(2)

(Total 12 marks)

6. The number of goals scored by a football team is recorded for 100 games. The results are summarised in Table 1 below.

Number of goals	**Frequency**
0	40
1	33
2	14
3	8
4	5

Table 1

(a) Calculate the mean number of goals scored per game.

(2)

The manager claimed that the number of goals scored per match follows a Poisson distribution. He used the answer in part (*a*) to calculate the expected frequencies given in Table 2.

Number of goals	**Expected Frequency**
0	34.994
1	r
2	s
3	6.752
≥ 4	2.221

Table 2

(b) Find the value of r and the value of s giving your answers to 3 decimal places.

(3)

(c) Stating your hypotheses clearly, use a 5% level of significance to test the manager's claim.

(7)

(Total 12 marks)

7. Four torpedoes are fired independently from a ship at a target. Each one has a probability of $\frac{1}{3}$ of hitting the target. The random variable X represents the number of hits and has probability generating function

$$G_X(t) = k(2 + t)^4.$$

(a) Show that $k = \dfrac{1}{81}$.

(3)

(b) Find the mean and the variance of X.

(2)

A second ship fires at the same target and the random variable Y, representing its number of hits, has probability generating function

$$G_Y(\mathrm{t}) = \frac{1}{243}(2 + t)^5.$$

Given that X and Y are independent,

(c) find the probability generating function of $Z = X + Y$.

(2)

(d) Calculate the mean and the variance of Z.

(6)

(Total 13 marks)

TOTAL FOR PAPER: 75 MARKS