IYGB GCE

Mathematics FS1

Advanced Level

Practice Paper O

Difficulty Rating: 2.9000/1.2903

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

The probability distribution of a discrete random variable X is given by

$$\mathrm{P}(X=x)=\begin{cases} kx^2 & x=3,4,5 \\ 0 & \text{otherwise} \end{cases}$$

a) Determine the value of the constant k. **(2)**

b) Find the value of …

i. … $\mathrm{E}(X)$. **(2)**

ii. … $\mathrm{Var}(X)$. **(3)**

c) Determine …

i. … $\mathrm{E}(5X-4)$. **(2)**

ii. … $\mathrm{Var}(5X-4)$. **(2)**

Question 2

Justin is playing "*Alien Shooter*" on the internet. It is a game where you battle against randomly drawn opponents where the reward of a battle is a "*game ticket*".

The probability of Justin winning a battle is thought to be 0.4.

a) Showing detailed workings where appropriate, calculate the probability of Justin …

i. … winning his first battle on his third attempt. **(2)**

ii. … winning his first battle after his third attempt. **(2)**

In Alien Shooter when you collect 7 game tickets you can upgrade your spaceship. Justin has already collected 2 game tickets from the previous day's play. He starts playing today, hoping to upgrade his spaceship.

b) Determine the probability he will have to have 10 battles by the time he is able to upgrade his spaceship. **(3)**

c) State two conditions that must be satisfied in this scenario if the calculations are to be valid. **(2)**

Question 3

A random sample of 250 employees of a certain town were classified by their level of education and their eventual average annual earnings.

	Non Graduates	**Graduates**	**Post Graduates**
Up to £10000	17	6	3
£10001 to £25000	97	16	3
£25001 to £40000	42	21	8
Over £40000	24	10	6

Use the sample to investigate whether there is any association between level of education and the eventual average annual earnings of the employees.

Use a χ^2 test, at the 1% level of significance. **(12)**

Question 4

The discrete random variable X has probability generating function

$$G_X(t) = k\left(1 + 3t + 3t^2 + t^3\right)^3,$$

where k is a positive constant.

a) State the name of the distribution, fully specifying any parameters. **(5)**

b) Use $G_X(t)$ to calculate the mean and variance of X. **(4)**

No credit will be given if the mean and variance of X are obtained by alternative methods.

Question 5

From a Poisson distribution with parameter λ, a single observation w is taken and is to be used to test, at the 5% level of significance,

$$H_0 : \lambda = k \qquad \text{against} \qquad H_1 : \lambda \neq k,$$

where k is a positive integer.

Find the actual significance for the test if the critical region is

$$W \leq 1 \ \cup \ W \geq 12. \qquad \textbf{(6)}$$

Question 6

Steve is filming and uploading videos on the internet, and **every week** he plans to upload 5 videos.

The probability that a video has no significant faults and so it is deemed to be suitable for uploading to the internet, is 0.25. Once Steve has uploaded 5 videos he stops filming for that week.

a) Find the probability that, in a given week, Steve will have to film 11 videos. **(2)**

b) Determine the number of videos Steve will be expected to film in a given week in order to meet his weekly uploading target of 5 videos. **(2)**

In a season Steve plans to film for 40 weeks.

c) Estimate the probability that the **mean** number of videos Steve has to film per week, is greater than 18. **(6)**

Question 7

Bags of flour have a nominal weight of 2 kg.

It is known from past records that the weights of these bags are Normally distributed with a standard deviation of 50 grams.

A random sample of 4 bags are weighed, in order to carry out a test at the 5% level of significance for the following hypotheses.

$$H_0 : \mu = 2 \text{ kg} \qquad \text{versus} \qquad H_1 : \mu < 2 \text{ kg},$$

Given further that the mean weight has in fact changed to 1.94 kg, calculate the power of this test. **(8)**

Question 8

A large office block is illuminated by light tubes which when they fail they are replaced by the block's caretaker.

The mean number of tubes that fail on a particular weekday, Monday to Friday, is 1.

The mean number of tubes that fail on a random two day weekend, is 0.5.

a) Find the probability that …

i. … exactly 4 light tubes fail on a particular Wednesday. **(2)**

ii. … more than 2 light tubes fail on a particular weekend. **(2)**

iii. … less than 4 light tubes fail on a particular complete, 7 day week. **(2)**

The caretaker looks at his stock one Monday morning.

He wants to have the probability of running out of light tubes before the next Monday morning, less than 1%.

b) Calculate the smallest number of tubes he must have in stock. **(4)**