GENERAL CERTIFICATE OF EDUCATION BOARD

General Certificate of Education Examination

JUNE 2025 **ADVANCED LEVEL**

Subject Title	**Pure Mathematics With Statistics**
Paper No.	**Paper 3**
Subject Code No.	**0770**

Duration: Three Hours

Full marks may be obtained for answers to ALL questions.

Mathematical formulae and tables produced by the GCE Board are allowed.

In calculations, you are advised to show all the steps in your working, giving the answer at each stage.

Electronic calculators may be used.

Start each question on a fresh page.

1. (i) Events A and B are such that

$P(A) = \frac{1}{3}$, $P(B) = \frac{2}{5}$ and $P(A/B) = \frac{1}{4}$

Calculate

(a) $P(A \cap B)$. **(2 marks)**

(b) $P(A \cup B)$. **(2 marks)**

(c) $P(B/A^c)$. **(3 marks)**

(ii) An animal feed store stocks feed for pigs and fowls in bags. 30% of the stock is pig feed and 70% is fowl feed. 5% of the pig feed and 10% of the fowl feed are known to have expired.

A bag of animal feed is taken out from the store at random.

(a) Sketch a tree diagram to show all possible outcomes and their respective probabilities. **(3 marks)**

(b) Find the probability that the bag of feed has expired. **(3 marks)**

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2. A sample of 60 pupils is taken from a school; their masses, in kg, are measured and recorded in a frequency table as shown below.

Mass	16 - 20	21 - 25	26 - 30	31 - 35	36 - 40	41 - 45	46 - 50
Number of pupils	5	10	18	12	8	4	3

Calculate, to one decimal place, the

(a) mean mass. **(4 marks)**

(b) median mass. **(3 marks)**

Draw a cumulative frequency curve for the data and use it to estimate the interquartile range. **(6 marks)**

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3. A discrete random variable X has the following distribution.

x	1	2	3	4	5
$P(X = x)$	$\frac{1}{5}$	c	$\frac{3}{10}$	k	$\frac{3}{20}$

(a) Given that $P(X \leq 2) = \frac{9}{11}P(X > 2)$, find the values of the probabilities c and k. **(5 marks)**

(b) Show that the expectation of X is $\frac{11}{4}$. **(3 marks)**

(c) Find $E(X^2)$ and the standard deviation of X. **(5 marks)**

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4. The probability density function f of a random variable X is given by

$$f(x) = \begin{cases} k(4x - 1), & 0 \leq x \leq 2 \\ 0, & \text{elsewhere} \end{cases}$$

Calculate

(a) the value of the constant k. **(3 marks)**

(b) $E(X)$ and $E(X^2)$. **(5 marks)**

(c) the variance of X. **(2 marks)**

Find an equation in terms of m, the median of the distribution. **(3 marks)**

5. (i) It is known that 90% of the seeds planted by a farmer will germinate. If 8 seeds are sown, find, to four decimal places, the probability that
(a) 3 seeds will not germinate. **(3 marks)**
(b) at least 7 seeds will germinate. **(4 marks)**

(ii) Averagely, a restaurant receives 4 customers every 30 minutes. Assuming that the number of customers who visit the restaurant follows the Poisson distribution,
find, to four decimal places, the probability that
(c) two customers will visit the restaurant in a 30 minutes period. **(2 marks)**
(d) at most 3 customers will visit the restaurant in a 1 hour period. **(4 marks)**

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6. In a certain church, 20% of the adults are known to use reading glasses. If on a particular Sunday there are 600 adults in the church,
(a) find the mean and the variance of the number of adults using reading glasses in the church on that Sunday. **(4 marks)**

Using the normal approximation to the Binomial distribution,
find, to four decimal places, the probability that out of the 600 adults in the church on that Sunday,
(b) exactly 130 are using reading glasses. **(5 marks)**
(c) between 100 and 140 are using reading glasses. **(4 marks)**

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7. (i) Briefly explain the meaning of the following terms as used in hypothesis testing:
(a) The null hypothesis.
(b) The alternative hypothesis.
(c) A type I error.
(d) A type II error.
(e) The level of significance. **(5 marks)**

(ii) A bulb manufacturing company claims that their bulbs have a mean life span of 270 days with a standard deviation of 12 days. The company improves the quality of production with the intention to increase the life span of its bulbs. A random sample of 64 bulbs tested gave a mean life span of 275 days.
Test, at 5% level of significance, whether this sample provides sufficient evidence for an increase in the life span of the bulbs. **(8 marks)**

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8. In an agricultural study, the heights above the ground, of 10 pepper plants and the corresponding number of fruits on the plant were recorded as in the table below.

Height , X cm	31	32	36	37	39	42	43	49	52	54
Number of fruits , Y	18	16	21	24	23	30	28	32	35	33

Given that $\sum X^2 = 17805$, $\sum Y^2 = 7148$, $\sum XY = 11245$,

(a) calculate the product-moment correlation coefficient between the height of a pepper plant and the number of fruits on the plant. **(7 marks)**
(b) find the equation of the least squares regression line of Y on X. **(4 marks)**
(c) estimate the number of fruits on a pepper plant whose height is 38cm. **(2 marks)**
