Pure Maths With Stats 3
770/3

CAMEROON GENERAL CERTIFICATE OF EDUCATION BOARD

General Certificate of Education Examination

JUNE 2015 ADVANCED LEVEL

Subject Title	**Pure Mathematics With Statistics**
Paper No.	**Paper 3**
Subject Code No.	**770**

Two and a half Hours

Full marks may be obtained for answers to ALL questions. All questions carry equal marks.

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) Three events A, B and C are such that $P(A) = \frac{1}{3}$, $P(C) = \frac{5}{7}$ and $P(A \cup B) = \frac{1}{2}$.
Find (a) $P(B)$ if A and B are mutually exclusive,
(b) $P(B)$ if A and B are independent,
(c) $P(A \cap C)$ if A and C are exhaustive.
(ii) Two cards are drawn at random one at a time without replacement from a pack of 52 playing cards. **Find the probability that**
(d) the two cards drawn are picture cards,
(e) the two cards are of the same suit.

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2. The lengths, y, to the nearest cm, of some 8 rods and their corresponding masses, x kg, produced from a certain factory are shown in the table below.

Rod	A	B	C	D	E	F	G	H
Mass, x	44	79	72	67	64	52	58	76
Length, y	51	73	65	68	62	64	67	75

(a) Calculate, to three decimal places, the product-moment correlation coefficient between the masses and the lengths of the rods. Interpret your result.
(b) Determine the least square regression line of the masses on the lengths of these rods.
(c) Hence, estimate the mass to the nearest kg, of the rod whose length was measured as 70cm.

(You may use $\sum x^2 = 33790$, $\sum y^2 = 34833$, $\sum xy = 34129$)

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3. The probability distribution of a discrete random variable X, is as shown below,

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

Given that $E(X) = \frac{14}{5}$, find
(a) the values of the probabilities a and b,
(b) $P(3 \leq X \leq 5)$,
(c) $P(X \leq 3)$,
(d) $Var(X)$.
(e) Given that $Y = 3X - 4$, find $Var(Y)$.

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4. (i) A firm manufactures radios and the probability that any radio fails a quality control is 0.2. Find the probability that in a sample of 15 radios,
(a) all will pass the quality control,
(b) exactly one fails the quality control,
(c) at least 13 pass the quality control.

(ii) A building has an automatic telephone exchange and the number of wrong connections in any one day follows a Poisson distribution with mean λ. Given that $\lambda = 1.5$, find, to 3 decimal places, the probability that in any one day,
(d) there will be exactly 3 wrong connections,
(e) there will be three or more wrong connections.

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5. The probability density function of continuous random variable X is given by

$$f(x) = \begin{cases} \frac{x+1}{4}, & 0 \leq x \leq c, \\ 0, & \text{otherwise.} \end{cases}$$

Find
(a) the value of the constant c,
(b) the mean and variance of X,
(c) the median of X,
(d) $P\left(X < \frac{1}{2}\right)$.

6. A variable X is normally distributed with mean 24 and variance 144. Find, correct to 4 significant figures,
(a) $P(X < 0)$,
(b) $P(6 < x < 42)$,
(c) $P(|X| < 12)$,
(d) the value of y, for which $P(3 < X < y) = 0.6299$.

7. (i) Explain briefly, the following as used in hypothesis testing.
(a) a Type I and a Type II error,
(b) the Null and the Alternative Hypothesis.

(ii) In a competition to grow the tallest orange plant, samples of plants were taken from two farms and their heights measured. Let X denote the heights of plants from one farm and Y denote the heights of plants from the another farm, n_1 and n_2 the number of plants taken from the two farms, respectively.

Given that $n_1 = 35$, $E(X) = 206.5$ cm, $Var(X) = 40.4$ cm^2,
$n_2 = 40$, $E(Y) = 211.4$ cm, $Var(Y) = 43.3$ cm^2,

(c) Find to one decimal place, an estimate of the population variance from the two samples.
(d) Assuming that the heights of the plants are normally distributed with a common variance, test at 2% level of significance whether there is a difference in the growth rate of plants from the two farms.

8. A factory has 50 workers, 30 females and 20 males. The ages of the female workers, to the nearest year, are shown in the table below

Age	21 - 25	26 - 30	31 - 35	36 - 40	41 - 45
Female	6	12	8	2	2

(a) Find, to 2 decimal places, the mean and standard deviation of the ages of the female workers.
(b) Given that the mean of the ages of the male workers is 31.75, find the mean of the ages of all the workers in the factory.
(c) Estimate, the modal age of the female workers in this factory.