ZIMBABWE SCHOOL EXAMINATIONS COUNCIL

General Certificate of Education Advanced Level

STATISTICS 6046/2

PAPER 2

NOVEMBER 2021 SESSION 3 hours

Additional materials:
Answer paper
Graph paper
List of Formulae MF 7
Scientific calculator [non – programmed]

TIME 3 hours

INSTRUCTIONS TO CANDIDATES

Write your Name, Centre number and Candidate number in the spaces provided on the answer paper/answer booklet.

Answer **all** questions in **Section A** and any **five** from **Section B**.

If a numerical answer cannot be given exactly, and the accuracy required is not specified in the question, then in the case of an angle it should be given to the nearest degree, and in other cases it should be given correct to 2 significant figures.

INFORMATION FOR CANDIDATES

The number of marks is given in brackets [ ] at the end of each question or part question.

The total number of marks for this paper is 120.

The use of a non – programmed scientific calculator is expected, where appropriate.

You are reminded of the need for clear presentation in your answers.

This question paper consists of 7 printed pages and 1 blank page.

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Section A (40 marks)

Answer all questions in this section.

1 When a school needs cleaning material, it calls one of the three companies A, B or C. 50% of the calls are to company A, 30% to company B whilst 20% are to Company C. The probability that a delivery is late from A is 4%, from B is 6% and from C is 17% of the required time.

(a) Find the probability that the school calls for an order and it arrives late. [3]

(b) Given that the school's order arrives late, find the conditional probability that it called company B. [3]

2 A certain school has a total of 16 prefects, 8 boys and 8 girls. A committee of 6 prefects is to be chosen such that it has at least 4 boys and at least one girl.

(a) Find the number of possible ways of choosing the six prefects. [4]

(b) Among the six prefects are 4 boys and 2 girls. When they are introduced during assembly they stand in a line. Find the number of ways in which the prefects should stand such that the girls are not next each other. [3]

3 **(a)** State any **three** methods of collecting data. [3]

(b) A school uses one brand of light bulbs inside the buildings. The life times of a sample of 100 bulbs were recorded as follows:

Time in months	1	2	3	4	5	6	7	8	9	10	11
Number of bulbs	16	21	17	14	12	5	5	4	3	2	1

(i) State median life time of a bulb. [1]

(ii) Calculate the mean and variance of the life times of the bulbs. [4]

4 A salesman sells a radio by calling potential customers. The probability that any particular call achieves a sale is $\frac{1}{12}$, independently of all other calls. The salesman continues to make calls until one call achieves a sale.

(a) Name an appropriate distribution which models this situation. [1]

(b) Calculate the probability that the call that achieves a sale

(i) is the fifth, [2]

(ii) does not occur in the first five calls. [2]

(c) Find for the number of calls made by the salesman, the

(i) mean,

(ii) variance. [3]

5 A random variable X has a Normal distribution with mean μ and variance σ^2. It is known that $P(X > 9) = 0{,}9192$ and $P(X < 11) = 0{,}7580$.
Calculate

(a) the mean μ and the variance σ^2, [8]

(b) $P(X > 10)$. [3]

Section B (80 marks)

Answer any **five** questions from this section.

Each question carries 16 marks.

6 A continuous random variable X has probability density function f given by

$$f(x) = \begin{cases} a(x+3) & -3 \leq x \leq 3, \\ 0 & otherwise \end{cases} \qquad a \text{ is constant}$$

(a) Find

(i) the value of a, [2]

(ii) $E(X)$ and Var (X), [4]

(iii) the lower quartile of X. [4]

(b) If $Y = mX + h$, where m and h are constants with $m > 0$, find the values of m and h for which $E(Y) = 0$ and Var $(Y) = 1$ [6]

7 The table below shows the age, x, (in years) and the height, y, (in centimetres) of eleven girls.

Age in years	8	9	10	11	12	14	15	16	17	18	19
Height (in cm)	128	140	150	150	147	160	163	173	166	162	180

(a) Draw a scatter plot to illustrate the data. [3]

(b) Describe the trend shown on the scatter plot. [1]

(c) Calculate the equation of the regression line of y on x. [4]

(d) Draw a line of best fit on the scatter plot. [2]

(e) Use the equation of the line to estimate the height of a 13 year old girl. [2]

(f) **(i)** Calculate the product moment correlation coefficient. [2]

(ii) Comment on the relationship between age and height of girls. [2]

10 (a) Distinguish between a one tailed test and a two tailed test. [2]

(b) The bank manager claims that clients are served within 20 minutes upon arrival. The time x minutes spent by a random sample of 150 clients in a bank was measured. The results were summarised as

$\sum x = 2871 \qquad \sum x^2 = 60029.$

Test at 5% level of significance the bank manager's claim. [9]

(c) A large number of customers were consulted over a new product on the market. A sample of 2156 customers were given questionnaires. 1734 customers were for the new product.
Calculate the 99,9% Confidence Interval for the proportion p. [5]

11 (a) Give any **one** use of Chi-squared test. [1]

(b) A survey was carried out on 200 'A' level learners studying two science learning areas including Mathematics.
This was conducted to determine the relationship between the science learning area preferred. The results are as follows:

	Mathematics learning area		
Science learning areas	Pure Mathematics	Statistics	Mechanical Mathematics
Physics	21	28	32
Chemistry	25	23	50
Biology	6	11	4

Test at 1% level of significance whether there is any association between the Science and Mathematics learning areas. [15]

12 The demand for water in kilolitres over a period of 3 years was as follows:

	1980	1981	1982
Term 1	20	38	40
Term 2	41	56	85
Term 3	62	90	120
Term 4	10	12	30

(a) Plot the water demand for each term through the years 1980 to 1982 and comment on the trend. [6]

(b) By use of a 3 point moving average, insert the trend. [5]

(c) Estimate the demand for water in 1983, term 1. [5]