ZIMBABWE SCHOOL EXAMINATIONS COUNCIL

General Certificate of Education Advanced Level

STATISTICS 6046/2

PAPER 2

NOVEMBER 2020 SESSION 3 hours

Additional materials:
- Answer paper
- Graph paper
- List of Formulae MF7
- Electronic calculator (Non-programmable)

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 an electronic calculator is expected, where appropriate.

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

This question paper consists of 6 printed pages and 2 blank pages.

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Section A [40 marks]

Answer all questions in this section.

1 The probability that a man goes hunting is 0.3. On a day when he goes hunting, the probability that he has rabbit meat for supper is 0.82. On a day when he does not go hunting, the probability that he has rabbit meat for supper is y. The probability that the man has rabbit meat for supper on any day is 0.6.

(a) Find y. [3]

(b) Given that the man has rabbit meat for supper, find the probability that he went hunting. [3]

2 In a bag of 13 shoes, only 4 pairs can be obtained. Find the number of ways of selecting 6 shoes among which there are exactly 2 pairs. [6]

3 The probability density function $f(x)$ of a continuous random variable X is given by

$$f(x) = \begin{cases} ae^{-2x} & x \geq 0 \\ 0 & otherwise \end{cases}$$

(a) Find,

(i) the value of a, [3]

(ii) $P(0 \leq X \leq 1)$. [2]

(b) Given that $P(X > b) = 0,3$ find the value of b correct to 2 significant figures. [3]

4 A discrete random variable X takes values 1, 2, 3, 4 and 5 only, with the probabilities shown in the table below.

X	1	2	3	4	5
$P(X = x)$	a	0,2	0,1	0,2	b

(a) Given that $E(X) = 3,9$, find the numerical value of $a + 5b$. [2]

(b) Hence or otherwise, find the

(i) values of a and b correct to **two** decimal places, [4]

(ii) variance of X. [2]

5 (a) (i) State any **two** advantages of an interview as a data collection method.

(ii) State any **two** disadvantages of an interview as a data collection method.

[4]

(b) Two types of hybrid maize A and B are planted at the same time under similar conditions. After harvesting, the masses (in grams) of seeds from each cob are measured. The following table gives the statistical values for both hybrids.

Hybrid	Lowest mass	Lower quartile	Median	Upper quartile	Greatest mass
A	340	355	360	380	388
B	345	350	360	365	390

(i) Draw on the same axes, a box and whisker plot for each type of maize hybrid. [6]

(ii) Compare the masses of the two hybrids and determine which plant is preferred. [2]

Section B [80 marks]

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

Each question carries 16 marks.

6 **(a)** In a certain survey, 20% of passenger transporters are buses, 16% are private vehicles and the remainder are mini buses.

(i) A random sample of 11 vehicles is taken. Find the probability that fewer than 3 are private vehicles. [3]

(ii) A random sample of 125 vehicles is taken. Using a suitable approximation, find the probability that more than 73 are mini buses. [4]

(b) Two unbiased coins are tossed one after the other and the random variable X is the number of heads obtained. The experiment is repeated 8 times and the random variable y represents the total number of heads obtained.

(i) Construct a probability distribution table for X. [2]

(ii) Find expectation and variance of X. [4]

(iii) Find variance of $(2y - 1)$. [3]

7 **(a)** A random variable X follows an exponential distribution with parameter $\lambda = 2$. Find

(i) $E(X)$,

(ii) $\text{Var}(X)$,

(iii) $P(X > 2)$,

(iv) $P(2 \leq X \leq 4)$.

[6]

(b) A Social Welfare organisation published that the average amount of money spent by high-income earners in a city was \$1 123 per month. A random sample of 15 high-income earners from the city gave the following results in dollars.

1351	1293	1615	1369	908
1231	1521	1254	1185	1227
1151	1350	1711	1790	1205

Test at 5% significance level whether the data indicate that, on average, the high-income earners spent more than \$1123. [10]

8 (a) Given that $X \sim N(50, 16)$ find the lower and upper quartiles. [7]

(b) The masses of heavy weight boxers have mean μ kg and standard deviation σ. A random sample of 49 heavy weight boxers is taken and a 95% confidence interval is constructed for μ.

Given that the 95% confidence interval is [94,5; 105,3], find

(i) the sample mean μ and the standard deviation σ.

(ii) a 99% confidence interval for μ.

[9]

9 (a) A life insurance salesman sells on average 3 insurance policies in a week. Calculate the probability that in any given week he will sell

(i) some policies, [3]

(ii) 2 or more but less than 5 policies. [3]

(iii) Assuming that there are 5 working days in a week, find the probability that in a given day he will sell one policy. [3]

(b) Twenty sheets of aluminium alloy were examined for surface flaws. The frequency of the number of sheets with a given number of flaws per sheet was as follows:

Number of flaws	0	1	2	3	4	5	6
Frequency	4	3	5	2	4	1	1

A sheet is chosen at random. Find the probability of finding a sheet that contains 3 or more surface flaws. [3]

(c) A company makes electric toys. The probability that an electric toy is faulty is 0,01. Using a suitable approximation, find the probability that in a sample of 300 electric toys, exactly 5 will be faulty. [4]

10 (a) Describe any one characteristic of the **Chi-square** distribution. [1]

(b) Children of three age groups were asked to indicate their preference for photographs of toys A, B and C. The information is given in the table below.

Age	A	B	C	TOTAL
5 – 6 years	18	22	20	60
7 – 8 years	2	28	40	70
9 – 10 years	20	10	40	70
Total	40	60	100	200

Test at 5% level of significance if the data suggest that there is a significant relationship between age and preference for toys? [15]

11 The table below shows two sets of data x and y.

x	22	33	38	29	40	53	51	46	32	60
y	24	32	21	30	41	34	40	35	27	51

(a) Draw a scatter diagram to represent this set of data. [2]

(b) Calculate the equation of the regression lines y on x and x on y. [8]

(c) Estimate the value of y given that $x = 44$. [2]

(d) Calculate the product moment correlation coefficient. [2]

(e) Comment on the relationship between the values of x and y. [2]

12 A certain manufacturing company released the following recorded sales in 3 termly periods for 5 years.

Year	Term	Sales($1 000)
2001	1	10
	2	9
	3	8
2002	1	11
	2	10
	3	9
2003	1	13
	2	11
	3	9
2004	1	15
	2	13
	3	11
2005	1	18
	2	14
	3	12

(a) Plot a trend graph for the 5 years. [4]

(b) Construct a 5 point moving average table for the sales and plot it on the trend graph. [6]

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

(d) Estimate the amount of sales in 2006 Term One. [2]