For Performance Measurement

ZIMBABWE SCHOOL EXAMINATIONS COUNCIL

General Certificate of Education Advanced Level

STATISTICS 6046/1

PAPER 1

NOVEMBER 2023 SESSION 3 hours

Additional materials:
- Answer paper
- Graph paper
- List of Formulae MF 7
- Scientific calculator [Non-programmable]
- Mathematical Instruments

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.

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-programmable scientific 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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[Turn over

1 (a) (i) Describe how direct observation can be used to collect data for the annual rainfall pattern at a particular weather station. [2]

(ii) State any **one** advantage and **one** disadvantage of using direct observation as a method of data collection. [2]

2 (a) Define the terms

(i) Mutually Exclusive events

(ii) Independent events [2]

(b) An electronic display is equally likely to show any one of the digits 1, 2, 3 ….9. Determine the probability that

(i) it shows a prime number, [1]

(ii) it shows an odd number given that it is a prime number. [2]

3 The prices ($) of a pair of a certain type of male shoes in an informal market of a particular country are as follows:

34.95	44.95	49.95	69.95
54.95	64.95	64.95	54.95
24.95	14.95	19.95	39.95
29.95	74.95	79.95	

Calculate the mean and standard deviation for the sample. [5]

4 From a standard pack of 52 playing cards, 6 cards are chosen without replacement. Find the probability that exactly 4 out of the 6 cards chosen are spades. [5]

5 (a) Distinguish between a permutation and a combination. [2]

(b) A librarian has to arrange 9 books on the bookshelf of which four are from the same author. Find the number of arrangements of the books if

(i) there are no restrictions on the order of arrangement, [1]

(ii) books of the same author are to stay together. [2]

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6 **(a)** State Bayes theorem. [2]

(b) A manufacturer makes writing pens using two machines. His bigger machine manufactures 75% of the pens and his smaller machine manufactures the remaining 25%. From the bigger machine 5% of the pens are defective and from the smaller machine 8% of the pens are defective. A pen is selected at random.
Find the probability that the pen came from the bigger machine given that it is defective. [3]

7 In a certain country the proportion of drivers for passenger vehicles who pay a fine at a particular police road block for miscellaneous offences is 24%

If 15 drivers for passenger vehicles pass by the police road block, find the probability that

(i) exactly three pay a fine, [3]

(ii) three or more pay a fine. [3]

8 A boy is thinking of playing a game. To play the game he has to pay \$4 and he will toss three fair coins. He will be awarded in dollars twice the number of heads obtained.

(a) Find the boy's expected win or loss in the game. [4]

(b) With regards to winning or losing would you advise him to play the game? Justify your answer. [2]

9 The table below shows the marks obtained by 12 students in recent Mathematics and Physics tests.

Maths (x%)	68	90	42	50	86	84	78	80	49	50	78	83
Physics (y%)	60	85	40	41	65	89	65	78	59	80	48	80

(a) Calculate $\bar{x}$ and $\bar{y}$. [2]

(b) Draw a scatter diagram to illustrate the marks in the two tests. [3]

(c) Draw a line of best, fit [2]

10 **(a)** State conditions under which a normal distribution can be used as an approximation to the Binomial distribution. [3]

(b) In a class of 50 students, 20% of them enjoy basketball as their favourite sport. Use a suitable approximation to find the probability that more than 15 out of the 50 students enjoy basketball as their favourite sport. [4]

11 The random variable X has probability distribution table given below.

X	1	2	5	6
$P(X = x)$	k	$2k$	$3k$	$4k$

Find

(a) the value of k. [2]

(b) $E(x)$ [2]

(c) $Var(x)$ [3]

12 **(a)** Define a time series. [3]

(b) State the **three** types of variations in a time series. [4]

(c) State the number of 4-point moving averages that are there for the following set of time series values.

20, 34, 40, 23, 27, 32 [1]

13 A cement manufacturer claims that the newly introduced special type of cement has a 0,95% success rate in producing strong walls.

A construction company buys the cement and uses it to build 20 houses for their clients. After one year 16 of the clients said that their houses were strong because of the cement.

(a) Test the cement manufacturer's claims at 5% significance level. [5]

(b) Should the construction company recommend the cement to other construction companies? [1]

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14 **(a)** The random variable X has a Bernoulli distribution with standard deviation $\frac{3}{10}$. Find the possible values of the expectation of X. [4]

(b) $X \sim$ Geo (0,7)

Find the

(i) mode, [1]

(ii) mean of X, [2]

(iii) standard deviation of X. [2]

15 **(a)** State any **two** conditions necessary for a random variable to be modelled using a Poisson distribution. [2]

(b) If $X \sim Po(4{,}5)$

(i) State the mean and standard deviation. [2]

(ii) Find $P(X \geq 6)$. [2]

(iii) If $P(X < a) = 0{,}5321$, find a [2]

16 The following table shows the results of a survey to find the average daily time, in minutes, that a group of school children spent in an internet café.

TIME PER DAY (t minutes)	FREQUENCY
$0 \leq t < 10$	2
$10 \leq t < 20$	f
$20 \leq t < 40$	11
$40 \leq t < 80$	4

The mean time was calculated to be 27,5 minutes.

Calculate the

(a) value of f, [3]

(b) median time taken by the group on internet and comment on your answer, [3]

(c) standard deviation. [3]

[Turn over

17 The data below are the times in seconds that fifteen students took to run an 800m race.

139	148	151	140	162
182	154	171	157	162
145	178	132	148	166

(a) **(i)** Construct a stem and leaf diagram of the data. [3]

(ii) State any **one** advantage of a stem and leaf diagram. [1]

(b) **(i)** Draw a box and whisker plot of the data. [3]

(ii) State any **one** disadvantaged of the box and whisker plot. [1]

18 A continuous random variable X has the probability density function given by

$$f(x) = \begin{cases} \frac{1}{4}, & 0 \leq x < 1 \\ k(3-x), & 1 \leq x \leq 3 \\ 0, & otherwise \end{cases}$$

where k is a constant.

(a) Find the value of k. [2]

(b) Calculate the value of $E(X)$ [3]

(c) Find **(i)** $P(0{,}8 < X < 2)$ [2]

(ii) $P(X > E(X))$ [3]

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