For Performance Measurement

ZIMBABWE SCHOOL EXAMINATIONS COUNCIL

General Certificate of Education Advanced Level

STATISTICS 6046/1

PAPER 1

NOVEMBER 2018 SESSION 3 hours

Additional materials:
- Answer paper
- Graph paper
- List of Formula
- Scientific calculator

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 correct 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.

Questions are printed in the order of their mark allocations.

The use of a 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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1 A group of twenty people played a game. The table below shows the frequency distribution of their scores.

score (X)	1	2	4	x
number of people	2	5	7	6

The mean score is 5.

Find

(a) the value of x, [2]

(b) the variance of the distribution. [2]

2 The head of a school wishes to contact parents of learners. She could use e-mail, letter or cellphone with probabilities 0.4, 0.1 and 0.5 respectively. She uses only one of the methods. The probabilities of the parents receiving the message if the head uses e-mail, letter or cellphone are 0,6; 0,8 and 1 respectively.

(a) Find the probability that the parents receive the message. [2]

(b) Given that the parents received the message, find the probability that they received it via email. [3]

3 (a) List the four components of time series. [4]

(b) State the effect on the pattern of plot, of using a 4 point moving average compared to a 3-point moving average. [2]

4 (a) Julius Caesar is one of the novels in a collection of 20 novels. A learner is going to choose 5 of these novels to take for the holiday.

Find the

(i) number of ways the learner can choose the 5 books, [2]

(ii) number of choices that will include Julius Caesar. [2]

(b) Find the number of ways in which 3 boys and 4 girls can stand in a line if

(i) there are no restrictions, [1]

(ii) the boys stand next to each other. [2]

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5 The random variable X has probability density function given by

$$f(x) = \begin{cases} \frac{3}{32}(4 - x^2), -2 \leq x \leq 2 \\ 0 \qquad \text{otherwise} \end{cases}$$

Find **(a)** E(X), [3]

(b) Var(X) [4]

6 **(a)** State the conditions under which the Poisson distribution can be used to approximate the Binomial distribution. [2]

(b) Potato seeds are packed in packets each containing 200 seeds. On average 2 % of the seeds in a packet are rotten. A packet containing 5 or more rotten potato seeds is said to be substandard.

(i) Calculate the probability that a packet of potato seeds is substandard. [3]

(ii) A load consists of 20 randomly chosen packets of potato seeds.

Find the probability that the load will consist of exactly 2 packets which are substandard. [3]

7 **(a)** Given that E(X) = 1,2 and Var(X) = 0,6 and that the random variable Y is defined by $Y = 10X + 50$,

find

(i) E(Y). [1]

(ii) Var(Y). [2]

(b) A random sample consists of 160 independent observations of Y.

Find the probability that the sample mean $(\overline{Y})$ lies between 61 and 62,5. [5]

8 In a normal distribution with mean μ and standard deviation σ, $P(X > 5,6) = 0,5$ and $P(X > 4,8) = 0,6554$.

(a) Calculate the value of μ and the value of σ. [4]

(b) If 4 observations of X are taken at random from this distribution, find the probability that at least 2 observations are greater than 4,8. [4]

9 The mass, x kg, of each pocket in a random sample of 80 pockets filled with manure was measured and the results summarised by

$$\sum X = 79.53 \quad , \quad \sum X^2 = 100.4621$$

Test at the 5 % level of significance, the claim that the pockets contain less than 1,10 kg of manure. [8]

10 The heights (cm) of 15 children were measured and the results shown below.

115	120	158	132	125
104	142	160	145	104
162	117	107	124	134

(a) Draw a stem-and-leaf diagram to represent the heights.

(b) Find the

(i) median, [3]

(ii) quartiles of the heights. [3]

(c) (i) Using a scale of 2 cm to represent a height of 10 cm, draw a box and whisker plot for the data. [2]

(ii) Comment on the distribution of these heights. [1]

11 (a) Events A and B are such that $P(A \cup B) = 0.9$, $P(A \cap B) = 0.2$ and $P(A/B) = 0.8$.

Find

(i) $P(B)$ [3]

(ii) $P(A')$ where A' is the complement of A. [4]

(b) An unbiased die is thrown until a six appears. Find the expected number of tosses. [3]

12 (a) Define the following terms

(i) population, [1]

(ii) sample, [1]

(iii) census. [1]

(b) State any **two** methods of obtaining an unbiased sample. [2]

(c) The amount of pocket money ($X) received by 120 learners on visiting day was noted. The results were summarised by

$$\Sigma(X-50) = -221 \quad , \quad \Sigma(X-50)^2 = 4\,708$$

Find

(i) unbiased estimates of the population mean and standard deviation. [3]

(ii) a 95 % confidence interval for the population mean of the amount of money given to learners. [4]

13 The number of calls per hour to a Hotline during 9 am to 4 pm on weekdays was recorded with the results below.

period	9 -10 am	10-11 am	11-12 am	12 am -1 pm	1 – 2pm	2 – 3 pm	3 – 4 pm
number of calls	132	151	143	129	117	134	125

Test at the 10% level of significance the claim that the number of calls per hour follow a uniform distribution. [12]

14 (a) Define, with the aid of diagrams, the term *correlation*. [4]

(b) Sales representatives make calls to potential customers in order to boost sales. The table below shows the number of calls to potential customers made by each of 6 sales representatives and the sales turnover.

Sales representative	A	B	C	D	E	F
Number of calls	7	6	8	6	1	2
Sales turnover ($1000)	11	10	14	12	8	9

Calculate the

(i) product moment correlation coefficient and comment on the relationship between number of calls and sales turn over. [4]

(ii) least squares regression equation of sales turnover on number of calls made. [4]

(c) Use the equation to find where possible the turnover for a sales representative who made

(i) 4 calls [3]

(ii) 10 calls [1]