ZIMBABWE SCHOOL EXAMINATIONS COUNCIL

General Certificate of Education Advanced Level

STATISTICS 6046/1

PAPER 1

NOVEMBER 2019 SESSION 3 hours

Additional materials:
Answer paper
Graph paper
List of Formulae MF 7
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 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 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 student prepares for an examination by studying a list of 10 questions. The student can solve 6 of them. For the examination, the teacher selects 5 questions at random from the list of 10 questions.

Find the probability that the student can solve all the 5 questions in the examination. [2]

2 The times in minutes taken to travel to school by a sample of 22 students recorded to the nearest minute are shown below.

STEM	LEAF					
2	0	1	2	5	7	9
3	0	3	4	7	8	
4	2	2	5	5	8	9
5	0	1	2	3	8	

KEY: 4/5 = 45

(a) State **one** advantage of using this form of data representation. [1]

(b) Find the median and the quartiles. [3]

(c) Hence draw a box and whisker plot, for the information in the diagram. [2]

3 The following table shows the frequency distribution of the ages of 36 men in a private company.

Age (years)	20-25	26-30	31-35	36-40	41-46
Frequency	6	8	7	5	10

Calculate an estimate of the

(a) mean,

(b) standard deviation. [5]

4 Two fifths $\left(\frac{2}{5}\right)$ of the teaching staff of a college are female.

The probability that a female staff is absent on any Tuesday is 0.32 and that of a male staff is 0.08.

Find the probability that on a particular Tuesday, a

(a) member of the teaching staff is absent, [2]

(b) female staff is absent, given that one member of the teaching staff is absent. [3]

5 The height in cm of a certain type of a plant is modelled by the random variable X with mean 68 cm and standard deviation 8. A random sample of 38 plants is selected.

Find the probability that the mean height is

(a) less than 66 cm, [3]

(b) between 67 cm and 71 cm. [3]

6 A discrete random variable **X** has the following probability distribution as shown in the table below.

X	1	2	3	4
$P(X = x)$	$\frac{1}{6}$	a	$\frac{5}{18}$	b

(a) Given that the $E(X) = 2\frac{7}{9}$, find the values of a and b. [4]

(b) Hence find Var(**X**). [3]

7 The continuous random variable X is normally distributed with mean μ and variance δ^2.

Given that $P(X > 34) = 0.0238$ and $P(X < 25) = 0.0163$.

Find the values of μ and δ. [7]

8 70% of all the cellphones sold by an electrical shop have a certain application.

(a) Find the probability that out of 15 customers who buy a cellphone, less than 13 choose one with that application. [3]

(b) Use a suitable approximation to find the probability that, out of 60 customers who buy cellphones, more than 45 choose one with that application. [5]

9 The continuous random variable X has a probability density function given by

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

Find the

(a) value of k,

(b) median of X. [8]

10 The weekly distances in kilometres travelled by John and Peter are normally distributed with mean and standard deviation given in the table below.

	Mean	Standard deviation
John	106	7
Peter	32	5

Find the probability that in a randomly chosen week,

(a) John travels more than 3 times as Peter, [4]

(b) the total distance travelled by both exceeds 150 km. [4]

11 A cyclist finds that her times for completing a race are normally distributed with mean 28 minutes. After training intensively for 2 weeks the times for the next 8 races were as follows

25.8; 35; 26.3; 24; 29; 28; 23.4; 24.5

Test at 5% level of significance whether training has improved her race completion time.

[9]

12 A teacher thinks that in Mathematics there is a linear relationship between the mid-year examination mark and the final examination mark.

To investigate, the teacher looks at the results of students from past years. The results are given in the table below.

Midyear Exam (x)	18	26	28	34	36	42	48	52	54	60
Final Exam (y)	54	64	54	62	68	70	76	66	76	74

$\sum x = 398;$ $\sum x^2 = 17524;$

$\sum y = 664$ $\sum y^2 = 44680;$

$\sum xy = 27268$

(a) Draw a scatter diagram to represent the data. [3]

(b) Find the equation of the regression line of y on x. [4]

(c) **(i)** Calculate the product-moment correlation coefficient between the marks. [2]

(ii) Comment on the value of the product-moment correlation coefficient. [2]

13 An analysis of accidents was made to determine the distribution of numbers of fatal accidents for commuter omnibuses of different sizes.

The results for 346 accidents are as follows:

Size of omnibus	Small	Medium	Large
Fatal	67	26	16
Not fatal	128	63	46

Test at 1% level of significance whether the fatality of accidents depends on the size of the commuter omnibus. [12]

14 The number of buses passing a Police road block during 100 intervals each of time 5 minutes were recorded in the table below.

Number of buses (X)	0	1	2	3	4	5	6 or more
Frequency	5	23	23	25	14	10	0

Test at 5% level of significance the hypothesis that **X** follows a Poisson distribution. [13]

15 A shop manager noted the time x, taken to drive to the shop. The times over a long period have a mean of 24.5 minutes. After a new road was opened, the times on 72 randomly chosen journeys to the shop were noted and summarised by

$$\Sigma(x-20) = 215 \qquad \Sigma(x-20)^2 = 3\,234$$

(a) Calculate the unbiased estimates of the population

(i) mean. [2]

(ii) variance. [2]

(b) Calculate the 90% confidence interval for the population mean. [3]

(c) Using a 5% significance, test whether the journey now takes less time. [6]