

BINDURA UNIVERSITY OF SCIENCE EDUCATION
DIPLOMA IN SCIENCE EDUCATION

NOV 2023

MT002: Statistics 1/

DM002: Introduction to probability and descriptive statistics

Time: 2 hours

Candidates may attempt ALL questions in Section A and at most TWO questions in Section B. Each question should start on a fresh page.

SECTION A (40 marks)

Candidates may attempt ALL questions being careful to number them A1 to A4.

A1. Define the following terms

- (a) Independent event [2]
- (b) Parameter [2]
- (c) Mutually exclusive events [2]
- (d) Possibility space [2]
- (e) Statistic [2]

A2. Draw a sketch diagram for each of the following, indicating the position of the mean, mode and median;

- (a) normal distribution [3]
- (b) positively skewed-distribution [3]
- (c) negatively skewed distribution [3]

A3. A scientist tested cholesterol levels of 20 students. The readings are presented below:

210, 209, 212, 208, 217, 207, 210, 203, 208, 210, 210, 199, 215, 221, 213, 218, 200, 214, 200, 121

- (a) Construct a stem and leaf diagram for the above data [4]
- (b) Explain any **three** advantages and any **two** disadvantages of the stem and leaf diagram. [5]
- (c) Calculate the mean [2]

A4. In an experiment the heights of 5 seedlings in a sample were as follows:

Seedlings	A	B	C	D	E
Height/cm	30	43	17	47	60

- (a) Calculate sample variance [4]
 (b) Calculate standard deviation for the sample [3]
 (c) Describe the meaning of standard deviation using the sample above. [3]

SECTION B (60 marks)

Candidates may attempt TWO questions being careful to number them B5 to B7

B5. Two ordinary fair dice, one red and one blue are to be rolled once.

- (a) Find the probability of the following events:
 (i) Event A: the number showing on the red die will be a 5 or a 6. [2]
 (ii) Event B: the total of the numbers showing on the two dice will be 7. [2]
 (iii) Event C: the total of the numbers showing on the two dice will be 8. [1]
 (iv) State with a reason which two of the events A, B and C are mutually exclusive. [2]
 (v) Show that the events A and B are independent. [3]
 (b) When a tetrahedral die is thrown, the number on the face on which it lands, X , has probability as shown, with $E(X) = 2.5$ and $\text{Var}(X) = 1.25$.

X	1	2	3	4
$P(X=x)$	0.25	0.25	0.25	0.25

- (i) Find the probability distribution of S , the sum of two numbers obtained when the die is thrown twice, where $S = X_1 + X_2$ and illustrate it by drawing a vertical line graph. Find $E(S)$ and $\text{Var}(S)$. [4]
 (ii) Find the probability distribution of D , where D is double the number on which the die lands when it is thrown once. Illustrate by drawing a vertical line graph. Find $E(D)$ and $\text{Var}(D)$. [6]
 (c) The random variable X is distributed $B(7, 0.2)$. Find correct to three decimal places,
 (i) $P(X = 3)$ [4]
 (ii) $P(1 < X \leq 4)$ [3]
 (iii) $P(X > 1)$. [3]

B6.(a) At Bindura University of Science Education, 65 % of the students are full time students, 55% are female, 35% are of the students are male full- time students

Find the probability that

- (i) a student chosen at random from all the students in the college is a part time student [4]
- (ii) a student chosen at random from all the students in the college is female and part time student [3]
- (iii) a student chosen at random from all female students in the college is a part time student [3]
- (b) The letters of the word MATHEMATICS are written, one on each of the separate cards. The cards are laid out each in a line.
- (i) Calculate the number of different arrangement of these [5]
- (ii) Determine the probability that the vowels are all placed together. [5]
- (c) The random variable X is $Geo(0, 5)$. Find
- (i) mean of X [3]
- (ii) mode [3]
- (iii) The standard deviation [4]

B7. (a) The random variable X has p.d.f. $P(X=x)$ for $x= 1, 2, 3$ as shown

X	1	2	3
$P(X=x)$	0,1	0,6	0,3

Find

- (i) $E(X)$ [3]
- (ii) $E(3)$ [3]
- (iii) $E(5X)$ [3]
- (iv) $E(5X+3)$ [3]

b) The speed to the nearest km/hr of 125 bicycles passing a check point were recorded in the table below.

speed in km/hr	$40 \leq v < 60$	$60 \leq v < 70$	$70 \leq v < 80$	$80 \leq v < 100$
Frequency	60	45	10	10

Estimate

- (i) the mean of this distribution. [3]
- (ii) the variance [3]

- (iii) the standard deviation [2]
- (iv) the modal class [2]
- (c) Show the information on
- (i) a histogram [4]
 - (ii) frequency polygon [4]

END OF PAPER