BOWEN UNIVERSITY, IWO, NIGERIA
COLLEGE OF AGRICULTURE, ENGINEERING AND SCIENCE
STATISTICS PROGRAMME

B.Sc DEGREE 2022/2023 SECOND SEMESTER EXAMINATION
COURSE CODE: STA 328 COURSE TITLE: LABORATORY/FIELD WORK ON SURVEY METHODS

DATE: 25/06/2023 **TIME ALLOWED:** 2Hours **CREDIT:** 2

INSTRUCTION: Answer **Question ONE and any other TWO** Questions

Question 1

1 (a) Show that for a Simple Random Sampling without Replacement (SRSWOR), that $\bar{x}$ is an unbiased estimator of $\bar{X}$ and that the variance of $\bar{x}$ is $V(\bar{x}) = \frac{S^2}{n}(1-f)$, where $f = \frac{n}{N}$ is the sampling fraction.

(20 marks)

(b) In a population with N =5, the values of x are 5, 2, 10, 3, and 8. Calculate the sample mean $\bar{x}$ and for all simple random sampling of size 2 without replacement, verify the following: (i) $E(\bar{x}) = \bar{X}$

(ii) $V(\bar{x}) = \frac{s^2}{n}\left(\frac{N-n}{N}\right)$ (iii) $E(s^2) = S^2$ (10 marks)

Question 2

2(a) Show that s^2 is an unbiased estimator of S^2 (14 marks)

2(b) In a population with N =6 with the values 10, 20, 30, 25, 15 and 35, show that $E(\bar{x}) = \bar{X}$. (6 marks)

Question 3

3(a) In a population with N =4, the values of y are 50, 20, 10 and 30. Calculate the sample mean $\bar{y}$ and for all simple random sampling of size 2 with replacement, verify the following: (i) $E(\bar{y}) = \bar{Y}$

(ii) $V(\bar{y}) = \frac{\sigma^2}{n} = \frac{s^2}{n}\left(\frac{N-1}{N}\right)$ (iii) $E(s^2) = \sigma^2$. (15 marks)

3(b) Show that the variance of p for $V(p) = \frac{PQ}{n}\left(\frac{N-n}{N}\right)$, where p is the sample proportion (5 marks)

Question 4

The following table gives the family size, weekly family income and their weekly food cost for a random sample of 12 families.

Family No	Family Size (x_1)	Family income (x_2)	Weekly food cost (y)
1	2	63	14.3
2	3	78	20.8
3	3	92	22.7
4	5	89	30.5
5	6	70	41.2
6	3	76	28.2
7	4	58	24.2
8	5	90	30.0
9	7	69	24.2
10	8	55	44.4
11	10	67	13.4
12	2	63	19.8

Use the data provided to compute: (i) the mean weekly expenditure on food per family (ii) the mean weekly expenditure on food per person (iii) the percentage of the income that is spent on food. **(Ensure you compute the standard error of each of these estimates).** **(20 marks)**