BINDURA UNIVERSITY OF SCIENCE EDUCATION

FACULTY OF SCIENCE EDUCATION

DEPARTMENT: SCIENCE AND MATHEMATICS

PROGRAMME: BACHELOR OF SCIENCE EDUCATION HONOURS DEGREE IN MATHEMATICS (HBSCEDMT)

COURSE CODE MT313: INFERENTIAL STATISTICS

DURATION: 3HOURS TOTAL MARKS:100 JAN 2025

INSTRUCTIONS TO CANDIDATES

i. This Examination has TWO sections, Section A and Section B.

ii. Candidates may attempt ALL questions in Section A and any THREE questions in Section B Full marks can be obtained for complete solutions to ALL the questions.

iii. The answer to each question should start on a fresh page.

SECTION A: [40 Marks]

Answer all questions in this section

A1. (a) Define a random sample? [3 Marks]

(b) Why is a representative sample of statistical consideration in statistical inference? [2 Marks]

(c) A random sample of 50 students was taken from Bindura University of Science Education. The average height of the students in the sample was 165cm with a standard deviation of 8cm. Calculate the 95% confidence interval for the population mean height? [5 Marks]

A2. A researcher wants to investigate whether there is a significant difference in the average scores of two groups (Group A and Group B) in a Mathematics test. The summary statistics were as follows:

Group A: n = 30, Mean Score = 75 and Standard deviation =10

Group B: n = 35, Mean Score = 80 and Standard deviation =12

Perform an independent sample t-test at 1% level to determine if there is a significant difference between the means of the two groups. [10 Marks]

A3. A manufacturing company produces light bulbs. The lifetime (in hours) of a random sample of 20 bulbs is recorded. The sample mean lifetime is 1200 hours with a sample standard deviation of 100 hours. Test at the 5% significant level the hypothesis that the population mean lifetime is greater than 1100 hours. [10 Marks]

A4. The new Africa Lotto Daily Number is a state lottery where a 3-digit number is constructed by drawing a digit between 0 and 9 at random from each of 3 different containers. Assume a local official is concerned about recent draws because 4 draws in the past week started with the number 9. Focusing on the first container, he collects 500 draws. (Data below are the starting values for the actual lottery numbers drawn from January 19, 2024 to November 29, 2024.)

If the draws from the container are random, what proportion of draws should be 9s? What hypotheses would you test to see if the container was drawing numbers between 0 and 9 at random?

The following table summarizes the 500 draws obtained by the official.

Number	0	1	2	3	4	5	6	7	8	9	Total
Observed	47	50	55	46	53	39	55	55	44	56	500

What are the values of the missing expected counts? [10 Marks]

SECTION B: [60 Marks]

Attempt any THREE questions in this section. Each question carries 20 marks

B1. (a) The University intends to produce ball point pens for a supplier. The ball point pens are supposed to weigh at most 12g each. A reliable user of such ball point pens tells the University management that the ball point pens' standard deviation of their weight was 4.5g. The University decides to test a consignment of 45 ball point pens for the user before they make a massive production. Carry out the hypothesis testing for the user 's claim at 10% level given the sample mean weight of the ball point pens was 13,1g. [10 Marks]

(b) Given two independent samples with the following statistics:

Sample sizes $n_1 = 40$ and $n_2 = 32$ standard deviations $\sigma_1 = 1.65$ $\sigma_2 = 1.58$ and sample means 5.56 and 5.21. Test at the 5% level if the population means are different. [10 Marks]

B2. The table below gives the distribution of grades awarded independently by three examiners for a students' research projects in the Department of Science and Mathematics Education.

Grade	Examiner 1	Examiner 2	Examiner 3
Distinction	36	18	20
Merit	44	25	15
Pass	73	85	82
Fail	12	17	8

Using the 1% level of significance test whether there was an association between the grades and the examiner. [20 Marks]

B3. The assignment and test scores of 10 MT313 students were recorded in the following table.

Assignment	50	68	70	81	92	56	74	90	85	45
Test	59	74	64	80	86	60	60	82	90	50

By making the assumption of equality of variance, carry out an independent paired T-test at the 5% level of significance to check whether the scores of assignments were different from those of the tests. [20 Marks]

B4. Suppose the number of traffic accidents at the corner of Mt Darwin Road and the Mazowe-Harare Road in Bindura were investigated by Bindura Traffic Police unit. They discovered that the numbers of accidents per week occur over a period of 114 weeks as in a table below.

Number of accidents	Frequency
0	14
1	28
2	32
3 or more	40

Using a 5% level of significance, test the hypothesis that the number of traffic accidents per week is Poisson distributed random variable with mean of 3. [20 Marks]

END OF EXAMINATION