"Investing in Africa's Future"

COLLEGE OF BUSINESS, PEACE, LEADERSHIP, AND GOVERNANCE

NMEC 104: STATISTICS FOR ECONOMISTS 11

END OF SECOND SEMESTER EXAMINATIONS

MAY 2023

LECTURER: MR MANDEWO

INSTRUCTIONS

Answer **Question number 1 and Any other THREE questions.** Total possible mark is **100.**

Start **each** question on a new page in your answer booklet.

The marks allocated to **each** question are shown at the end of the question.

Credit will be awarded for logical, systematic and neat presentations

QUESTION 1

(a) A recent study showed that 53% of college applications were submitted online. Assume that this result is based on a simple random sample of 1,000 college applications, with 530 submitted online. Use a 0.01 significance level to test the claim that among all college applications, the percentage submitted online is equal to 50%.

(i) State the claim in symbolic form. **[2 Marks]**
(ii) State the null and alternative hypotheses **[2 Marks]**
(iii) What type of hypothesis test is this? **[2 Marks]**
(iv) What is the value of the test statistic? **[3 Marks]**
(v) What is the P-value? **[3 Marks]**
(vi) What is your conclusion? **[3 Marks]**

(b) Make a clear distinction of the following terms and show application in statistics

(i) Parameter and statistic **[5 Marks]**
(ii) Degrees of freedom and Level of Significance **[5 Marks]**
(iii) Null hypothesis and Alternative hypothesis **[5 Marks]**
(iv) Type 1 and Type 11 errors **[5 Marks]**
(v) Regression analysis and correlation analysis **[5 Marks]**

QUESTION 2

(a) One-sample t-test. To test the hypothesis that eating fish makes one smarter, a random sample of 12 persons take a fish oil supplement for one year and then are given an IQ test. Here are the results:

116 111 101 120 99 94 106 115 107 101 110 92

Test using the following hypotheses, report the test statistic with the P-value, then summarize your conclusion. **[5 Marks]**

(b) For each part of this question say whether the given statement is TRUE or FALSE giving an explanation for your choice. No marks will be awarded if the explanation is either invalid or not given.

(i) If a null hypothesis is rejected at a 5% level of significance, then it will also be rejected at a 1% level of significance. **[2 Marks]**

(ii) If the null hypothesis in a hypothesis test is true but is rejected, then a Type II error has been made. **[4 Marks]**

(iii) The probability of a Type I error in a hypothesis test is always bigger than 5%. **[4 Marks]**

(c) Use the confidence level and sample data to find a confidence interval for estimating the population m. A group of 56 randomly selected students has a mean score of 30.8 with a standard deviation of 4.5 on a placement test. What is the 90 percent confidence interval for the mean score of all students taking the test? **[5 Marks]**

QUESTION 3

You have collected data from the Fortune 500 companies regarding their top 5 highest-paid employees (such as CEOs, president, etc.) You have the following information on these 2,500 workers: demographics (gender, age, and education), time in months at the company, and salary. Your research question is whether gender makes a difference in salary. In detail, explain what descriptive and inferential statistics you would use to answer this question. Also, specify the type of variables that you are using in the analysis. You may provide an outline of tables or graphs that you would use in your analysis. Also, provide a discussion of the limitations and strengths of the research design. **[15 Marks]**

Two-sample t procedure. Two different alloys are being considered for making lead-free solder used in the wave soldering process for printed circuit boards. A crucial characteristic of solder is its melting point, which is known to follow a Normal distribution. A study was conducted using a random sample of 21 pieces of solder made from each of the two alloys. In each sample, the temperature at which each of the 21 pieces melted was determined. The mean and standard deviation of the sample for

Alloy 1 were $x1 = 218.9^{o}C$ and $s1 = 2.7^{o}C$;

for Alloy 2 the results were $x2 = 215.5^{o}C$ and $s2 = 3.6^{o}C$.

If we were to test H0: $\mu 1 = \mu 2$ against Ha: $\mu 1 \neq \mu 2$, what would be the value of the test statistic? **[5 Marks]**

QUESTION 4

b. After harvesting the soya bean, only eight farmers took some of their produce to the grain marketing board. The number of tonnes sold and the revenue received by farmers is shown in table 1 below:

Farmer	Soya beans sold (tonnes)	Revenue received (ZWL, 000)
1	10	12
2	12	16
3	8	10
4	15	20
5	9	11
6	10	9
7	7	8
8	14	17

(i) Present the information graphically and comment **[5 marks]**

(ii) Estimate the regression equation that explains the relationship between soya beans sold and revenue received. **[5 marks]**

(iii) Using Pearson's correlation coefficient, determine the nature of the relationship between soya beans sold and revenue. **[5 marks]**

(iv) Estimate the possible amount of revenue that can be received by the farmer after selling 35 tonnes of soya beans. **[5 marks]**

QUESTION 5

Explain the following concepts in detail and demonstrate the procedures for each

(a) One way ANOVA **[5 Marks]**
(b) Two way ANOVA **[5 Marks]**
(c) Testing the equality of means **[5 Marks]**
(d) Procedure for hypothesis testing **[5 Marks]**

QUESTION 6

Using examples of your own choice make a clear distinction of the following

(a) Chi square test and a t test **[5 marks]**
(b) A sample and a population **[5 marks]**
(c) A parameter and a statistic **[5 marks]**
(d) Confidence interval and P-value test **[5 marks]**

QUESTION 7

(a) The works department is estimating the cost of constructing a perimeter wall. The works manager believes that the standard perimeter wall should be 25 metres high. To avoid confusion, the director of the work requested the section to carry

out research, and 30 walls were sampled for the study. The average wall height was found to be 22 metres with a sample standard deviation of 8 metres.

i. Explain the difference between the null hypothesis and the alternative hypothesis **[5 marks]**

ii. Under what circumstances can Z distribution tables be used instead of t distribution tables? **[5 marks]**

iii. Test the works manager's hypothesis at 1% level of significance. **[5 marks]**

iv. Can we come up with the same conclusion at 5% level of significance? **[5 marks]**

END OF EXAMINATION