ZCAS UNIVERSITY

FIRST YEAR PROGRAMMES UNDER SCHOOL OF BUSINESS AND SOCIAL SCIENCES

CAS1282 – INTRODUCTION TO QUANTITATIVE METHODS

MID SEMESTER EXAMINATION

20TH OCTOBER 2023

08:30 HRS-11:30HRS

TIME ALLOWED FOR WRITING: THREE (3) HOURS

READING: FIVE (5) MINUTES

INSTRUCTIONS:

1. Section A: this section has one question and is **compulsory.**

2. Sections B: Answer **THREE (3)** questions from this section.

3. This examination paper carries a total of **100 marks.**

4. Candidates must **not turn this page** until the invigilator tells them to do so.

QUESTION 1 [Compulsory]

In October 2021, to spur economic development, Zambia took measures to promote local development in its ambitious 2022 national budget. The Government announced an unprecedented constituency development fund (CDF) increment from ZMW 1.6 million (U$91,000) to ZMW 25.7 million (U$1.5million) for each constituency taking the total development fund injection into the local communities from ZMW 250 million (U$14.2 million) to ZMW 4 billion (U$228.4 million). After winning a crucial Staff-Level IMF Deal, in early December 2021, Zambia went on to cut fuel subsidies later that month as a key step in seeking U$1.4 billion from the IMF. A similar decision was done in 2013 by the government to remove fuel subsidies. A consortium of organizations including Consumer Unity & Trust Society (CUTS) International Lusaka, Agriculture Consultative Forum (ACF), Economics Association of Zambia (EAZ), and Zambian Voice (ZV) conducted research to better assist informing the present discourse on the fuel subsidy removal. Critics have mentioned that fuel prices are kept constant in other countries and not based on monthly reviews as the case of Zambia. Their argument is that monthly reviews have ruinous effect on the economy as planning is affected. However, other countries such as the USA follow monthly fuel price reviews.

(a) Consider the two sample datasets for some monthly pump prices per Litre of Petrol in Zambia (in Kwacha) and USA (in US Dollar), for the year 2022/2023:

Petrol Pump Prices in Zambia [in Kwacha]

21.16	19.84	21.96	26.50	24.15	25.57	29.98

Petrol Pump Prices in USA [in US Dollar]

0.87	0.93	1.17	1.30	1.20	0.95	1.01

    i) Calculate the standard deviation and coefficient of variation of the Petrol pump prices in Zambia. **[8+2=10 marks]**

    ii) Calculate the standard deviation and coefficient of variation of the Petrol pump prices in USA. **[8+2=10 marks]**

    iii) Which country has the more unstable Petrol pump? Justify your answer using the most appropriate measure of one of the measures calculated from (i) and (ii). **[1+3=4 marks]**

(b) Consider the fictitious sample dataset below showing disbursement of CDF in 'million kwacha over the period of fifteen (15) months.

12	22	13	13.8	6	9	12	14	12	15	7	25	12.5	17	14.6

    i) Determine the median and mode of CDF disbursement. **[2+2=4 marks]**

    ii) Calculate Interquartile Range of the CDF disbursement. **[6 marks]**

    iii) Are there months which can be considered as outliers in the disbursement of CDF? Give reasons. **[6 marks]**

[Total marks = 40]

SECTION TWO: Answer THREE (3) questions from this section.

QUESTION 2

The data set below shows the Temperatures (in °C) with their corresponding Ice Cream sales for a given week.

Temperature (in °C)	28	30	32	35	25	29	31
Ice Cream Sales	110	120	130	150	90	105	125

    a) Determine the relationship between temperature and Ice Cream Sales using Pearson's correlation coefficient.   **[18 marks]**

    b) What is the implication of your finding in a)   **[2 marks]**

[Total marks = 20]

QUESTION 3: Short answer [2 marks each].

a) Read each of the following statements and state whether it is TRUE or FALSE.

i) When the data set contains outliers, median is a more representative measure of central tendency than the arithmetic mean.

ii) In a skewed right (positively skewed) data set, the mean is typically greater than the median.

iii) If a data set has no repeated values, it is impossible to calculate the mode. In a bimodal data set, there are always two medians, one for each mode.

iv) The mean is always equal to or greater than the median in a data set.

v) A higher variance indicates that the data points in a data set are more closely clustered around the mean.

vi) Variance is less affected by outliers compared to standard deviation.

vii) The correlation coefficient can be used to make about the dependent variable based on values of the independent variable.

b) Consider the following question and provide a short answer for each:

i) Give one example of a sample statistic and one of a population parameter.

ii) Describe the shape of the distribution of the data set with a Skewness = -1.30.

iii) A data analyst calculated 0.89 correlation coefficient between alcohol consumption and death. Using another data set, he calculated 0.75 correlation coefficient between smoking and death rate. Between alcohol consumption and smoking, which may be the major cause of high death rate? Justify your answer.

[Total marks = 20]

QUESTION 4

A real number in mathematics refers to a quantity that can be expressed as an infinite decimal expansion. Real numbers are used in measurements of continuously varying quantities such as size and time, in contrast to the natural numbers 1, 2, 3, ..., arising from counting. The real numbers include the positive and negative integers and the fractions made from those integers (or rational numbers) and also the irrational numbers. The irrational numbers have decimal expansions that do not repeat themselves, in contrast to the rational numbers, the expansions of which always contain a digit or group of digits that repeats itself.

Based on the description above, classify each of the following numbers as either rational or irrational. If the number is rational determine if its terminating or repeating decimal. *Show your work.*

a)
$$\dfrac{(5-3.5*2)^3-\left[4+(5-3)*2+\sqrt{24+2*(23 \ \sqrt{4})}\right]}{2+(4*4+4)}$$
[5 marks]

b)
$$\dfrac{\left[26-\left(4*3^2\right)\right]*\sqrt{3^4}}{\sqrt[4]{625}-7}$$
[5 marks]

c)
$$\dfrac{\left[46-\left(4*3^2\right)+(8*\frac{2}{\sqrt[3]{64}}\right]+\sqrt{3^2+4^2+5^2+14}}{\sqrt[3]{(4+11*2)-5^2}+10}$$
[5 marks]

d)
$$\dfrac{[6+(4*3)]*\sqrt{6^2-5^2}}{\sqrt[5]{101-(4^3+6^6)}+17}$$
[5 marks]

[Total marks = 20]

QUESTION 5

The manager of Lusaka Auto Repair shop would like to have a better understanding of the cost of parts used in the engine tune-ups performed in the shop. She examines 50 customer invoices for tune-ups. The costs of parts, rounded to the nearest kwacha, are listed below.

91	78	93	57	75	52	99	80	97	62
71	69	72	89	66	75	79	75	72	76
104	74	62	68	97	105	77	65	80	109
85	97	88	68	83	68	71	69	67	74
62	82	98	101	79	105	79	69	62	73

For Lusaka Auto Repair, determine the following.

    a) Approximate the class width if we choose six classes.   **[2 marks]**
    b) Determine the frequency distribution for each class based on the data above.   **[6 marks]**
    c) Determine the relative frequency distribution for each class.   **[6 marks]**
    d) Determine the cumulative frequency for each class.   **[6 marks]**

[Total marks = 20]

END OF MID TERM EXAMINATION