AFRICA UNIVERSITY
A United Methodist-Related Institution

"Investing in Africa's future"

COLLEGE OF ENGINEERING AND APPLIED SCIENCES (CEAS)

APPLIED STATISTICS – NCIS208

END OF FIRST SEMESTER EXAMINATIONS

NOVEMBER 2023

LECTURER: Dr. Weston D Govere

DURATION: 3 HOURS

INSTRUCTIONS

1. *This paper consists of **SIX questions***
2. *Answer **ANY FOUR** questions*
3. *Each whole Question carries **[25 marks].***

Question 1

a. Define the two (2) branches of statistics **[5 Marks]**

b. The questionnaire below has been prepared by a student carrying out research to extract perceptions of AU academic staff on services offered by CIMAS Medical Aid. Analyse the questionnaire and complete the table below by proving variable name, datatype, measurement scale, and variable type for each question:

QUESTION NUMBER	VARIABLE NAME	DATA TYPE	MEASUREMENT SCALE	VARIABLE TYPE

[20 Marks]

Section A: Demographics

1. What is your gender?

   Male: ☐ Female: ☐

2. What is your home language?

   English: ☐ Shona: ☐ Ndebele: ☐ Other: ☐

3. Which of the following best describes your position at AU?

   Assistant Lecturer: ☐ Lecturer: ☐ Senior Lecturer: ☐ Assistant Professor: ☐

   Professor: ☐

4. When did you join Bonvie?

   Before 2018: ☐ 2019: ☐ 2020: ☐ 2021: ☐ 2022: ☐

5. What is your medical aid membership status?

   Blue: ☐ Silver: ☐ Gold: ☐ Platinum: ☐

Section B: Voyager usage level

6. Have you ever claimed Bonvie Awards?

   Yes: ☐ No: ☐

7. (*a*) Did you come across any problems in claiming Bonvie Awards?

   Yes: ☐ No: ☐

   (*b*) If 'yes', specify the kind of problems encountered

   .....

   .....

8. How often have you used services by a Bonvie Partner in the following categories?

	Never	Rarely	Sometimes	Often	Always
Security	1	2	3	4	5
Essential	1	2	3	4	5
Tertiary Care	1	2	3	4	5
Link	1	2	3	4	5
Maxima	1	2	3	4	5

Section C: Bonivie service quality perceptions

9. The following statements relate to your feelings about services offered by Bonvie. For each statement, indicate your level of support by circling the appropriate number.

	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
Receive my statements regularly.	1	2	3	4	5
The Bonvie Guide is user friendly.	1	2	3	4	5
Bonvie Centers are conveniently situated.	1	2	3	4	5
Bonvie staff have good communication skills.	1	2	3	4	5
Queries are always dealt with effectively.	1	2	3	4	5
Bonvie staff are knowledgeable about their product.	1	2	3	4	5

Thank you for completing this questionnaire.

Question 2

a. Discuss the following sampling methods

i. Quota sampling **[6 Marks]**

ii. Convenience of accidental sampling **[6 Marks]**

iii. Multistage **[6 Marks]**

b. A weekly production company has a mean production capacity of 150 tones and a standard deviation of 5 tones. Evaluate the probability that in any given week, the company produces:

i. Less than 142 tones **[3 Marks]**

ii. Between 148 tonnes and 158 tonnes **[4 Marks]**

Question 3

a. Below are weights of a random sample of 40 AU students attending an Applied Statistics module which were recorded to the nearest kilogram:

50	**58**	**56**	**60**	**53**	**65**	**57**	**67**
51	**66**	**62**	**66**	**63**	**51**	**74**	**59**
64	**52**	**59**	**73**	**73**	**55**	**67**	**69**
68	**67**	**68**	**64**	**74**	**61**	**79**	**62**
55	**65**	**70**	**54**	**69**	**77**	**64**	**63**

i. Using the above data, construct a grouped frequency distribution table using a class interval of 5Kgs. The first class should start from 50kg **[3 Marks]**

ii. Using the table obtained in (i) above, draw a less than Ogive and use it to determine all the quartiles and estimate the quartile deviation **[10 Marks]**

iii. Estimate the mean and standard deviation for the grouped frequencies **[7 Marks]**

b. The number of comments that a Newspaper Company receives entertainment articles per day is a random variable with an expectation of four (4). What is the probability that, the Company will receive: -

i. Exactly three (3) comments on a given day. **[2 Marks]**

ii. Between one (1) and four (4) comments on a half day **[3 Marks]**

Question 4

a. Based on past experience, 10% of the accounts of a large wholesale are incorrect. If a random sample of 5 accounts is selected what is the probability that:

i. We have exactly one account being incorrect. **[2 Marks]**

ii. At least 2 accounts being incorrect. **[4 Marks]**

iii. At most 4 accounts being incorrect. **[4 Marks]**

b. A sample of students from an introductory Information Systems class was polled regarding the number of hours they spent studying for the last exam. All students anonymously submitted the number of hours. There were 24 individuals in the section of the course that polled. The data was used to make inferences regarding the other students taking the course. There data are below:

4.5	**22**	**7**	**14.5**	**9**	**9**	**3.5**	**8**	**11**	**7.5**	**18**	**20**
7.5	**9**	**10.5**	**15**	**19**	**2.5**	**5**	**9**	**8.5**	**14**	**20**	**8**

Set up a 95 percent confidence interval for the mean of the number of students who polled. **[15 Marks]**

Question 5

a. The relationship between the sales and costs of a company that is reported to be making a loss is being investigated. The sales and costs for the company were recorded in thousand USD for a couple of months.

Costs	30	40	70	40	60	30	50	78	20	19
Sales	80	90	160	85	120	75	88	180	70	65

i. Obtain the least squares regression equation of sales and cost. **[6 Marks]**

ii. What does the equation suggest about the sales? **[1 Mark]**

iii. Calculate the Pearson's correlation coefficient and comment on the losses being made by the company. **[5 Marks]**

iv. Calculate the expected sales if costs are amounting to $100 000 **[3 Marks]**

b. A Midlands province motor vehicle supplier desires to ascertain if the ***size of a car*** bought is in any way related to the ***buyer's age.*** From sales transactions done over the last two consecutive trading years, a random sample of 300 buyers was classified by size of car bought and buyer's age and the following cross-tabulation table was constructed.

PURCHASER'S AGE	**CAR SIZE PURCHASED**		
	Small	**Medium**	**Large**
Below 30 years	10	22	34
Between 30 and 45 years	24	42	48
Above 45 years	45	35	40

i. Construct a *row percentage* table and interpret these percentages. **[3 Marks]**

ii. Test, at the 5% level of significance, whether the *size of the car bought* and the age of the *purchaser* are statistically independent using the chi-square test procedure.

[7 Marks]

Question 6

a. Discuss any two (2) data collection methods **[10 Marks]**

b. A monetarist studied the annual returns of three different groups of products. The monetarist wanted to know whether the average annual returns per group varied across product groups. A random sample of unit trusts from each of three groups A, B and C were selected and their annual returns were recorded as shown in Table below:

UNIT TRUSTS		
A	**B**	**C**
11	7	14
9	10	13
6	8	11
12	13	16
14		10
11		

Can the financial analyst settle on the conclusion that the average annual returns from the three groups of products are the equal? Conduct a hypothesis test at the 5% significance level.

[15 Marks]

END OF EXAMINATION