



MACHAKOS UNIVERSITY

University Examinations 2021/2022 Academic Year

SCHOOL OF BUSINESS AND ECONOMICS

DEPARTMENT OF BUSINESS ADMINISTRATION

FIRST YEAR FIRST SEMESTER EXAMINATION FOR

MASTER OF BUSINESS ADMINISTRATION

BMS 840: QUANTITATIVE TECHNIQUES

DATE: 17/12/2021

TIME: 9.00-12.00 PM

INSTRUCTIONS

Answer Question ONE and any other THREE questions

QUESTION ONE (COMPULSORY 15 MARKS)

- a) Statisticians always seek to use estimators that are likely to take on numeric values close to parameters of interest. Discuss four properties of good estimators. (4 marks)
- b) A researcher wanted to investigate the employees' earnings in a certain company. He sampled 40 employees and recorded their monthly earnings in thousands of Kenya Shillings as follows.

| | | | | | | | | | |
|----|----|----|----|----|----|----|----|----|----|
| 30 | 50 | 86 | 10 | 70 | 35 | 45 | 65 | 78 | 98 |
| 59 | 90 | 40 | 40 | 18 | 30 | 67 | 44 | 84 | 10 |
| 56 | 20 | 35 | 90 | 90 | 82 | 50 | 32 | 86 | 48 |
| 89 | 50 | 80 | 90 | 70 | 90 | 29 | 30 | 50 | 26 |

Construct a 97.5 % confidence interval estimate for the mean of the sampled population.

(4 marks)

- c) A medical doctor observed that recovery period of many of his patients suffering from COVID-19 followed a normal distribution with a mean of 18 days and a standard deviation of 4.8. He noted that 32 of his clients during a certain period had an average recovery period of 23 days. Perform the necessary hypothesis test at 5% level of significance to find out if this group had a higher recovery period. (5 marks)
- d) A research firm conducted a household survey and recorded the monthly incomes and consumption in thousands of Kenya Shillings for ten households

| Household | A | B | C | D | E | F | G | H | I | J |
|-------------|----|----|----|----|----|----|----|----|----|----|
| Income | 34 | 44 | 53 | 28 | 37 | 56 | 25 | 48 | 50 | 20 |
| Consumption | 22 | 25 | 33 | 24 | 23 | 34 | 20 | 30 | 29 | 18 |

Estimate a consumption function for the households and interpret it (2 marks)

QUESTION TWO (15 MARKS)

- a) Three types of juices with different flavors were tested to determine if the content of sugar was the same for all of them. Samples of each type of juice were taken and their sugar content in milligrams of sugar per liter were taken and recorded in the table below.

| Orange | Pineapple | Mango |
|--------|-----------|-------|
| 4.3 | 3.4 | 6.2 |
| 5.5 | 5.2 | 5.6 |
| 5.9 | 4.4 | 4.4 |
| 4.6 | 3.3 | 6.0 |
| 5.0 | 4.7 | 4.8 |
| 6.4 | 6.9 | 7.0 |

Perform the Kruskal Wallis test at the 5% level to determine if mean sugar contents for the three types of juices are the same (7 marks)

- b) A motor vehicle company intends to introduce a new brand of cars into the market. Past experience indicates that a new brand would only be profitable if it can attract at least 35 % of the sales. The company conducted a study to test the new brand in the market. During the study 60 out of 200 potential clients indicated that they would buy the new brand. Carry out a hypothesis test at 5% level of significance and advise whether the brand should be introduced. (8 marks)

QUESTION THREE (15 MARKS)

- a) Explain five reasons why researchers would prefer to use samples rather than population while carrying an inquiry (5 marks)
- b) A parent seeking to transfer his son to a top performing school in the country is torn between two good schools. To make a well-informed decision he sought to establish whether the difference in 2020 KCSE performance of the two secondary schools was statistically significant. He felt that if it was not significant then he would consider other characteristics of the schools that contribute to wholistic development of a child. He sampled 15 candidates in each school and recorded their KCSE performance as follows.

| School | Sample size | Mean score | Standard Deviation |
|-------------|-------------|------------|--------------------|
| Mako School | 14 | 9.62 | 1.82 |
| Bema School | 14 | 8.96 | 2.36 |

Show whether there was a statistically significant difference in performance between the two schools at 5% level of significance and advise the parent accordingly.

(10 marks)

QUESTION FOUR (15 MARKS)

- a) In a certain dispensary one of every 20 patients is normally diagnosed with airborne diseases. A medical officer selected a sample of 10 patients who were treated in the dispensary in one week. Find the probability that;
- i. Five of them had airborne diseases (2 marks)
 - ii. At most two of them had airborne diseases (3 marks)
- b) A researcher wanted to know whether there was a significant relationship between the income levels of employees and the sectors they were working for. He took a sample of some employees from the three sectors and classified them on basis their income brackets as follows.

| Sector | Income bracket | | |
|---------------|----------------|--------|------|
| | Low | Middle | High |
| Agricultural | 100 | 100 | 400 |
| Manufacturing | 200 | 200 | 300 |
| Tertiary | 200 | 300 | 200 |

Perform the Chi-square test of independence at 1% level. (10 marks)

QUESTION FIVE (15 MARKS)

- a) Ten students indicated their preferences for mangoes and oranges by scoring them out of five marks as follows.

| Students | A | B | C | D | E | F | G | H | I | J |
|----------|---|---|---|---|---|---|---|---|---|---|
| Oranges | 4 | 2 | 3 | 5 | 4 | 3 | 4 | 3 | 2 | 1 |
| Mangoes | 2 | 4 | 1 | 3 | 2 | 1 | 1 | 3 | 4 | 5 |

Determine the Spearman’s rank correlation coefficient and interpret it. (5 marks)

- b) The management of a commercial bank sought to know whether the profits posted by various regions in the country were statistically equal. The research department of the bank sampled five branches in four regions and recorded their annual profits in millions of Kenya Shillings as follows.

| Eastern | Western | Coast | Central |
|---------|---------|-------|---------|
| 118 | 150 | 92 | 122 |
| 146 | 128 | 106 | 136 |
| 140 | 136 | 118 | 118 |
| 126 | 156 | 112 | 112 |
| 150 | 150 | 122 | 102 |

Perform an ANOVA test at 1% level to determine whether the mean annual profits for regions were equal. (10 marks)