

CHUKA



UNIVERSITY

**UNIVERSITY EXAMINATIONS**

**EXAMINATION FOR THE AWARD OF DEGREE OF BACHELOR OF SOCIOLOGY**

**SOCI 353: SOCIAL STATISTICS 1**

**STREAMS: B. SOCI**

**TIME: 2 HOURS**

**DAY/DATE: THURSDAY 23/09/2021**

**2.30 P.M – 4.30 P.M.**

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**INSTRUCTIONS:**

- **Answer question ONE and any other TWO questions.**
- **Use illustrations where appropriate.**

1. (a) Briefly describe the following concepts:
  - (i) Variable (2 marks)
  - (ii) Surveys (2 marks)
  - (iii) Z-score (2 marks)
- (b) Distinguish between:
  - (i) Class boundary and class interval (2 marks)
  - (ii) Histogram and bar graph (2 marks)
  - (iii) Classical approach and Empirical approach to probability (4 marks)
  - (iv) Skewness and kurtosis (4 marks)
- (c) Describe how to approximate the class width of a frequency distribution for quantitative data. (2 marks)
- (d) Identify the properties of a binomial experiment. (4 marks)
- (e) The body style of an automobile (sedan, coupe, wagon, etc) is an example of which type of variable? (2 marks)
- (f) What is the appropriate way of representing an evaluation of two categorical variables at the same time? (2 marks)

- (g) If the random variable  $X$  follows a Poisson distribution with mean of 3.4, find  $P(X=6)$ . (2 marks)

2. (a) Here are some data from Demographic Health Survey of Kenya for the year 2016.

Tribe of respondent: Kikuyu, Meru or Kamba  
 Respondent's highest education level  
 Number of children in respondent's family

**Data from Demographic Health Survey 2016**

| Respondent ID Number | Tribe  | Highest Education Level | Number of Children |
|----------------------|--------|-------------------------|--------------------|
| 1433                 | Meru   | Some years of college   | 2                  |
| 2344                 | Kikuyu | Bachelor                | 0                  |
| 878                  | Kamba  | Completed high school   | 1                  |
| 337                  | Kikuyu | Tertiary college        | 2                  |
| 431                  | Kikuyu | Completed high school   | 1                  |
| 181                  | Kikuyu | Completed high school   | 1                  |
| 2408                 | Kikuyu | Completed high school   | 4                  |
| 2302                 | Kikuyu | Completed high school   | 0                  |
| 2799                 | Kamba  | Completed high school   | 0                  |
| 601                  | Meru   | Completed high school   | 0                  |
| 657                  | Kikuyu | Completed high school   | 1                  |
| 1605                 | Kikuyu | Completed high school   | 0                  |
| 671                  | Kikuyu | Tertiary school         | 4                  |
| 1655                 | Kikuyu | Completed high school   | 3                  |
| 2795                 | Kikuyu | Masters                 | 2                  |
| 391                  | Kikuyu | Completed high school   | 0                  |
| 2045                 | Kikuyu | Tertiary college        | 5                  |
| 146                  | Kikuyu | Tertiary college        | 2                  |
| 2727                 | Kikuyu | Completed high school   | 2                  |
| 1920                 | Kikuyu | Completed high school   | 0                  |

For each variable:

- (i) Create a frequency chart that includes relative frequencies and cumulative relative frequencies. (6 marks)
- (ii) Prepare a pie chart to display the distribution. (6 marks)
- (b) A company that sells annuities must base the annual pay out on the probability distribution of the length of life of the participants in the plan. Suppose the lifetimes of the participants are approximately normally distributed with a mean of 72 years and a standard deviation of 5 years. What proportion of the plan recipients die before they reach the standard retirement age of 65? (4 marks)

- (c) If the accident rate at a certain factory is 7.0 and this is a poisson process. Find the probability that fewer than 3 accidents occur in a year. (4 marks)

3. (a) From the data below

| Age in years | No. of persons |
|--------------|----------------|
| 0-10         | 20             |
| 10-20        | 25             |
| 20-30        | 32             |
| 30-40        | 40             |
| 40-50        | 42             |
| 50-60        | 35             |
| 60-70        | 10             |
| 70-80        | 8              |

- (i) Find the mean deviation from mean and median. (8 marks)

- (ii) Compute co-efficient of mean deviation of the mean. (2 marks)

- (iii) Compute co-efficient of mean deviation of the median. (2 marks)

- (b) The number of misprints on a page of the Daily Nation Newspaper has a Poisson process with a mean of 1.2. Find the probability that the number of errors.

- (i) On page four is 2 (2 marks)

- (ii) On the first ten pages totals 5 (3 marks)

- (iii) On all forty adds up to at least 3 (3 marks)

4. (a) From the data given below, find which series is more consistent. (8 marks)

| Variable | 10-20 | 20-30 | 30-40 | 40-50 | 50-60 | 60-70 |
|----------|-------|-------|-------|-------|-------|-------|
| Series A | 10    |       |       |       |       |       |
| Series B | 22    | 18    | 32    | 34    | 18    | 16    |

- (b) Using the hypothetical data of different variables of places in Nairobi County:

| Place            | VARIABLES |      |      |      |      |      |
|------------------|-----------|------|------|------|------|------|
|                  | A         | B    | C    | D    | E    | F    |
| 1.Ngong          | 20.38     | 8.3  | ***  | ***  | ***  | 1.06 |
| 2.Kiserian       | 12.7      | 6.9  | 5.5  | 8.14 | 1.96 | 0.68 |
| 3.Kajiado        | 12.7      | 7.8  | 10.7 | 2.34 | 0.00 | 0.64 |
| 4. Ongata Rongai | 19.56     | 11.9 | 5.5  | 3.96 | 0.00 | 0.45 |
| 5.Karen          | 14.14     | 7.5  | 8.0  | 3.12 | 0.00 | 0.53 |

|                    |       |      |      |      |       |      |
|--------------------|-------|------|------|------|-------|------|
| 6.Langata          | 23.85 | 14.1 | 10   | 2.76 | 3.62  | 0.97 |
| 7.Kibera           | 13.67 | 8.9  | 11.9 | 6.78 | 0.00  | 0.41 |
| 8.Kenyatta         | 20.33 | 11.4 | 9.9  | 3.69 | 0.00  | 0.61 |
| 9.South C          | 14.13 | 7.9  | 10   | 10.6 | 28.40 | 0.99 |
| 10.Nairobi West    | 13.36 | 9.9  | 6.8  | 5.57 | 37.73 | 0.85 |
| 11.South B         | 9.46  | 6.4  | 6.5  | 3.09 | 4.41  | 0.74 |
| 12.Industrial Area | 13.71 | 5.1  | 7.1  | 1.19 | 0.00  | 0.59 |
| 13.Upper Hill      | 10.24 | 7.4  | 4.3  | 3.49 | 0.00  | 0.72 |
| 14. Community      | 12.78 | 6.00 | 10.1 | 3.56 | 0.00  | 0.51 |
| 15.Hurlingham      | 13.95 | 10.1 | 7.2  | 1.58 | 0.00  | 0.54 |
| 16. Kilimani       | 12.2  | 7.2  | 6.6  | 2.2  | 47.59 | 0.29 |
| 17.Kileleshwa      | 13.38 | 7.6  | 6.0  | 4.2  | 67.76 | 0.59 |
| 18.Lavington       | 13.65 | 9.3  | 9.1  | 2.94 | 5.88  | 0.45 |
| 19.Adams Arcade    | 13.72 | 8.8  | 9.2  | 1.1  | 0.00  | 0.61 |
| 20.Dagoreti        | 14.06 | 7.5  | 8.1  | 1.1  | 26.94 | 0.45 |
| 21.Kawangware      | 12.97 | 14.7 | 9.2  | 5.15 | 10.17 | 0.92 |
| 22.Kangemi         | 9.42  | 6.9  | 4.3  | 1.87 | 18.6  | 0.74 |
| 23.Uthiru          | 14.05 | 6.9  | 13   | 3.05 | 16.06 | 0.41 |
| 24.Kikuyu          | 15.75 | 7.7  | 14.4 | 3.46 | 0.00  | 0.34 |
| 25. Kabete         | 11.85 | 7.7  | 6.2  | 3.83 | 8.11  | 0.66 |

- (i) Calculate the standard deviation of variable **B** (5 marks)
- (ii) Calculate the skewness of variable **C**. (5 marks)
- (iii) Interpret the skewness measure obtained in (ii) above (2 marks)

5. (a) The following table gives the frequency distribution of 325 workers of a factory, according to their average monthly income in a certain year.

| Income group (in Rs) | Number of workers |
|----------------------|-------------------|
| Below 100            | 1                 |
| 100-150              | 20                |
| 150-200              | 42                |
| 200-250              | 55                |
| 250-300              | 62                |
| 300-350              | 45                |
| 350-400              | 30                |
| 400-450              | 25                |
| 450-500              | 15                |
| 500-550              | 18                |
| 550-600              | 10                |
| 600 and above        | 2                 |
|                      | 325               |

Calculate median income

(5 marks)

- (b) A factory collected data on the time for which a particular type of candle would burn. The data is summarised in the following table:

|             |                 |                  |                  |                  |                  |
|-------------|-----------------|------------------|------------------|------------------|------------------|
| Time (mins) | $0 \leq t < 10$ | $10 \leq t < 20$ | $20 \leq t < 30$ | $30 \leq t < 40$ | $40 \leq t < 50$ |
| Frequency   | 1               | 2                | 12               | 15               | 5                |

- (i) Draw an ogive and determine the median and semi-interquartile range. (9 marks)
- (ii) From the Ogive determine the frequency distribution below 27 minutes. (4 marks)
- (iii) From the Ogive determine the class limits below 50%. (2 marks)
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