# Indian Statistical Institute

## Documentation Research and Training Centre
### M.S. (Library and Information Science)
### 2nd Semester Mid-term Examination (2023-2025)

### Paper 09: Elements of Mathematics and Statistics

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**Time: 11:30 AM - 1:00 PM**            **Max. Marks: 40**            **Date: 22-02-2024**

**[Instruction**: Read the question before you attempt. Only question no. 15 has two options, attempt any one. Rest all questions are mandatory. ]

## Section A                                                       [1x10 = 10]

1) Let R be the relation in the set N given by R = {(a, b): a = b - 2, b > 6}. Choose the correct answer

    (a) $(2,4) \in R$              (b) $(3,8) \in R$

    (c) $(6,8) \in R$             (d) $(8,7) \in R$

2) If set A contains 5 elements and the set B contains 6 elements, then the number of one-one and onto mappings from A to B is:

    a) 720                       (b) 120

    (c) 0                        (d) None of these

3) Let $f : R \to R$ be given by $f(x) = \tan x$. Then $f^{-1}(1)$ is:

    (a) $\pi/4$                   (b) $\{n\pi + \pi/4 : n \in Z\}$

    (c) does not exist           (d) none of these

4) Which of the following statements is true about the mode?

    a) There can be multiple modes in a dataset

    b) Mode is always equal to the median

    c) Mode is sensitive to extreme values

    d) Mode is the most commonly used measure of central tendency

5) If a dataset is perfectly normally distributed, what should be the value of skewness?

    a) 0                         b) 1

    c) -1                        d) It depends on the mean and median

6) Which of the following best describes the concept of variance?

    a) The average absolute deviation from the mean

    b) The square root of the mean absolute deviation

    c) The average squared deviation from the mean

    d) The difference between the maximum and minimum values

7) Which of the following types of graphs is best suited for showing the distribution of a continuous variable?

        a) Scatter plot        b) Bar chart

        c) Histogram        d) Pie chart

8) In a box plot, what does box represent?

        a) Range of the data

        b) Interquartile range

        c) Mean of the dataset

        d) Standard deviation of the dataset

9) What is the purpose of a frequency polygon?

        a) To represent the distribution of a continuous variable

        b) To show the relationship between two continuous variables

        c) To display the frequency of each category in a dataset

        d) To display the frequency of a continuous variable in a dataset

10) What is the complement of the empty set?

        a) The empty set        b) Universal set

        c) Null set        d) Undefined

## Section B

11) With the imaginary datasets create suitable visualisation    [5]

    a) Create a visualisation to display the sales performance of three different products (A, B, and C) over the past year. Describe the type of graph you would choose and justify your choice. Additionally, explain the key elements that would be included in your visualisation to effectively communicate the sales trends of these products.

    b) Create a graphical representation of the population distribution across different age groups in a city. Describe the type of chart or graph you would use for this purpose and justify your choice. Then, outline the steps you would take to ensure that the visualisation is clear and informative, including any labelling or formatting considerations.

12) Give an example of a relation. Which is    [5]

    a) Symmetric but neither reflexive nor transitive

    b) Equivalence relation

13) State with reason whether following functions have inverse:    [5]

    a) $h : \{2, 3, 4, 5\} \rightarrow \{7, 9, 11, 13\}$ with $h = \{(2, 7), (3, 9), (4, 11), (5, 13)\}$

    b) $f : \{1, 2, 3, 4\} \rightarrow \{10\}$ with $f = \{ (1, 10), (2, 10), (3, 10), (4, 10)\}$

14) In a survey of 80 students, it was found that 35 students play football, 30 students play basketball, and 25 students play cricket. Additionally, 15 students play both football and basketball, 10 students play both basketball and cricket, 8 students play both football and cricket, and 5 students play all three sports. Find:

(i) The number of students who play at least one of the sports.

(ii) The number of students who play exactly one sport. [5]

15) Answer any one of the following

[10]

a) Explain four major types of functions (based on mapping) along with suitable examples.

OR

b)

i) Two people work in a factory making parts for cars. The table shows how many complete parts they make in one week.

| Worker | Mon | Tue | Wed | Thu | Fri |
|--------|-----|-----|-----|-----|-----|
| Rachel | 20 | 21 | 22 | 20 | 21 |
| John | 30 | 15 | 12 | 36 | 28 |

(a) Find the mean, range and standard deviation for Rachel and John.

(b) Who is more consistent?

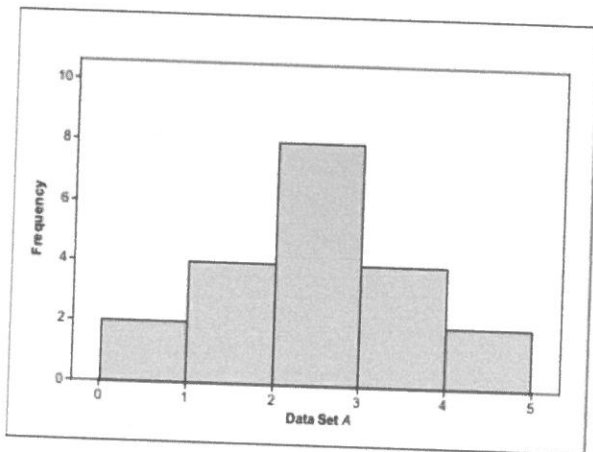(c) Who makes the most parts in a week?

ii) Figures 1.1 – 1.5 show histograms of five data sets.
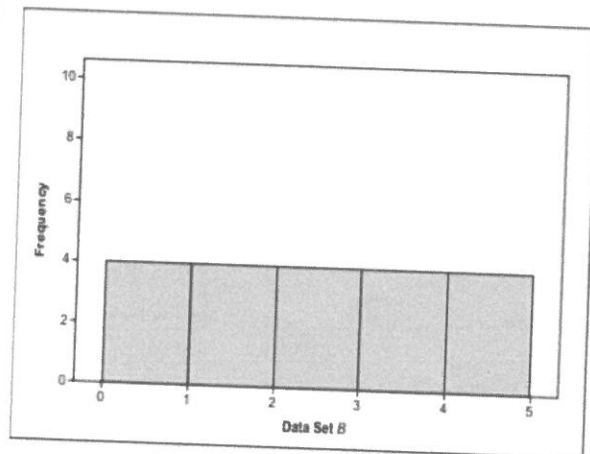


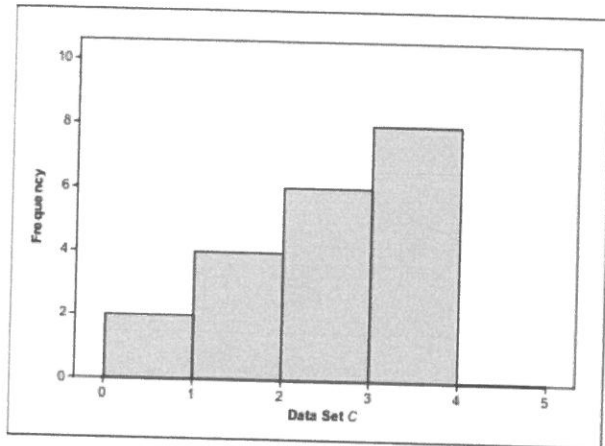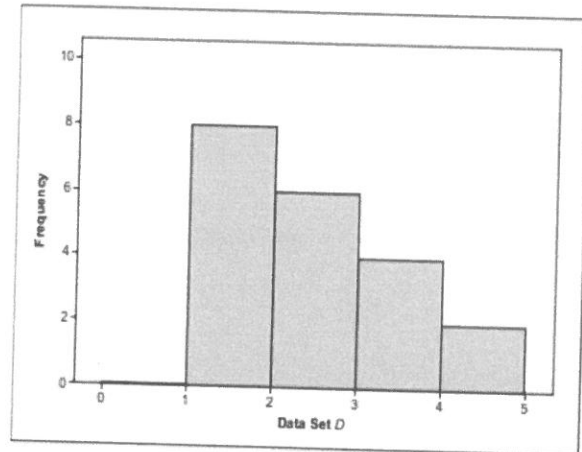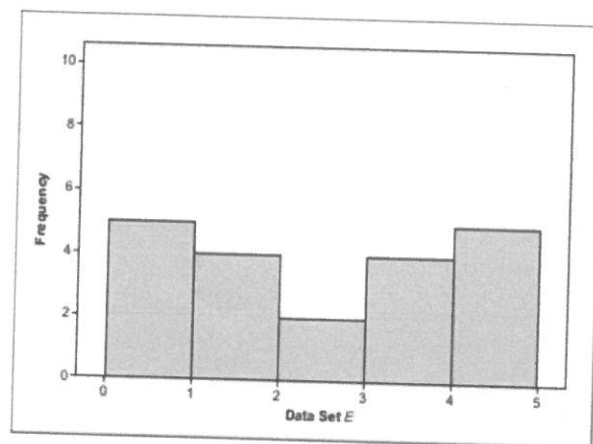Figure 1.1



Figure 1.2

Figure 1.3



Figure 1.4



Figure 1.5

In parts (a) – (c), determine from the histograms which of the two data sets has the larger standard deviation, or if the standard deviations are about the same. In each case, give a justification of your answer.

     a. Data Set A and Data Set B.

     b. Data Set C and Data Set D.

     c. Data Set D and Data Set E.