

**BIRLA INSTITUTE OF TECHNOLOGY, MESRA, RANCHI
(END SEMESTER EXAMINATION)**

CLASS: IMSc
BRANCH: QEDS

SEMESTER : I
SESSION : MO/2025

SUBJECT: ED25103, STATISTICAL METHODS-I

TIME: 3 Hours

FULL MARKS: 50

INSTRUCTIONS:

1. The question paper contains 5 questions each of 10 marks and total 50 marks.
 2. Attempt all questions.
 3. The missing data, if any, may be assumed suitably.
 4. Before attempting the question paper, be sure that you have got the correct question paper.
 5. Tables/Data hand book/Graph paper etc. to be supplied to the candidates in the examination hall.
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| Q.1(a) The following are 30 daily rainfall amounts (in mm) over a month: 2, 5, 0, 8, 12, 4, 10, 7, 3, 6, 9, 15, 11, 5, 2, 0, 13, 18, 21, 16, 4, 6, 8, 14, 20, 12, 10, 5, 1, 7. Construct a grouped frequency distribution with class width 5 starting at 0, draw a histogram for the distribution, and comment on the shape | [5] | 1 | | | | | | | | | | | | | | | | | | |
| Q.1(b) In a survey of preferred transport mode among 120 students, the counts are: Bus: 45, Bike: 30, Car: 18, Walk: 15, Others: 12. Compute the sector angles for a pie chart, sketch the pie chart, and draw a bar graph of the category counts. | [5] | 1 | | | | | | | | | | | | | | | | | | |
| Q.2(a) For the ungrouped data: 6, 7, 9, 9, 10, 12, 13, 14, 14, 16, compute the mean, median, and mode. Interpret the relationship among these measures in terms of distribution shape. | [5] | 2 | | | | | | | | | | | | | | | | | | |
| Q.2(b) Using the following grouped table of ages (years), estimate the mean and median age, and identify the modal class: | [5] | 2 | | | | | | | | | | | | | | | | | | |
| <table border="1" style="margin-left: auto; margin-right: auto; border-collapse: collapse;"> <tr> <td style="padding: 2px;">Age group</td> <td style="padding: 2px;">18-22</td> <td style="padding: 2px;">23-27</td> <td style="padding: 2px;">28-32</td> <td style="padding: 2px;">33-37</td> <td style="padding: 2px;">38-42</td> </tr> <tr> <td style="padding: 2px;">frequency</td> <td style="padding: 2px;">8</td> <td style="padding: 2px;">16</td> <td style="padding: 2px;">22</td> <td style="padding: 2px;">12</td> <td style="padding: 2px;">7</td> </tr> </table> | | | Age group | 18-22 | 23-27 | 28-32 | 33-37 | 38-42 | frequency | 8 | 16 | 22 | 12 | 7 | | | | | | |
| Age group | 18-22 | 23-27 | 28-32 | 33-37 | 38-42 | | | | | | | | | | | | | | | |
| frequency | 8 | 16 | 22 | 12 | 7 | | | | | | | | | | | | | | | |
| Q.3(a) Given the sample of test scores: 52, 55, 57, 60, 62, 65, 67, 70, 73, 78, compute the range, sample variance, sample standard deviation, and interquartile range (IQR). Use appropriate sample formulas. | [5] | 3 | | | | | | | | | | | | | | | | | | |
| Q.3(b) Using the same scores in Q.3(a), compute the sample skewness (Fisher-Pearson coefficient) and the sample excess kurtosis. Comment on whether the distribution is symmetric, light or heavy-tailed. | [5] | 3 | | | | | | | | | | | | | | | | | | |
| Q.4(a) For the bivariate data (study hours x, score y): (2, 58), (3, 62), (4, 67), (5, 72), (6, 76), (7, 80), compute the sample covariance and the Pearson correlation coefficient r. | [5] | 4 | | | | | | | | | | | | | | | | | | |
| Q.4(b) Explain why correlation is a standardized measure (unitless) while covariance is not. Illustrate with a brief example. | [5] | 4 | | | | | | | | | | | | | | | | | | |
| Q.5(a) For the points (1, 2.2), (2, 2.8), (3, 3.6), (4, 3.9), (5, 4.4), obtain the least square estimates of intercept and slope for simple linear regression $y = \omega_0 + \omega_1 x + \epsilon$ and write the fitted line, interpret the slope. | [5] | 5 | | | | | | | | | | | | | | | | | | |
| Q.5(b) Perform the multiple linear regression with the following data: | [5] | 5 | | | | | | | | | | | | | | | | | | |
| <table border="1" style="margin-left: auto; margin-right: auto; border-collapse: collapse;"> <tr> <td style="padding: 2px;">x_1</td> <td style="padding: 2px;">2.0</td> <td style="padding: 2px;">2.5</td> <td style="padding: 2px;">3.0</td> <td style="padding: 2px;">3.5</td> <td style="padding: 2px;">4.0</td> </tr> <tr> <td style="padding: 2px;">x_2</td> <td style="padding: 2px;">10</td> <td style="padding: 2px;">12</td> <td style="padding: 2px;">13</td> <td style="padding: 2px;">15</td> <td style="padding: 2px;">16</td> </tr> <tr> <td style="padding: 2px;">y</td> <td style="padding: 2px;">20</td> <td style="padding: 2px;">23</td> <td style="padding: 2px;">25</td> <td style="padding: 2px;">28</td> <td style="padding: 2px;">30</td> </tr> </table> | | | x_1 | 2.0 | 2.5 | 3.0 | 3.5 | 4.0 | x_2 | 10 | 12 | 13 | 15 | 16 | y | 20 | 23 | 25 | 28 | 30 |
| x_1 | 2.0 | 2.5 | 3.0 | 3.5 | 4.0 | | | | | | | | | | | | | | | |
| x_2 | 10 | 12 | 13 | 15 | 16 | | | | | | | | | | | | | | | |
| y | 20 | 23 | 25 | 28 | 30 | | | | | | | | | | | | | | | |