

No. of Printed Pages : 8    **MSTL-011(Set-II)**

**M. SC. (APPLIED STATISTICS)**

**[M. SC. (AST)]**

**Term-End Practical Examination**

**June, 2025**

**MSTL-011(Set-II) : STATISTICAL COMPUTING  
USING R-I**

*Time :  $2\frac{1}{2}$  Hours*

*Maximum Marks : 50*

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**Note :** (i) Attempt any **two** questions.

(ii) Solve the questions using *R* software  
and create a script file.

(iii) Symbols have their usual meanings.

(iv) Mention necessary formulae, steps,  
interpretations etc.

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1. (a) Create a scatter plot in the range  
 $-8 \leq x_1 \leq 8$  and  $-50 \leq x_2 \leq 50$  for the  
following data : 5

**P-8/MSTL-011(Set-II)**

**P. T. O.**

| $x_1$ | $x_2$ |
|-------|-------|
| -3    | 9     |
| -2    | 47    |
| -1    | 26    |
| 0     | 27    |
| 1     | 49    |
| 2     | 45    |
| 3     | 41    |
| 4     | 12    |

Also perform the following tasks :

- (i) Draw  $x$ -axis and  $y$ -axis at  $x = 0$  and  $y = 0$  by showing all four quadrants.
  - (ii) Add a line  $y = 4x - 2$  to the above plot.
- (b) In a single plot, draw the density function and distribution function of a Normal Distribution with the following parameters, using different line styles, and colours. Add the requisite Legend and Labels to the plot : 10
- (i)  $(\mu = 1, \sigma = 2)$

(ii)  $(\mu = 1, \sigma = 9)$

(iii)  $(\mu = 2, \sigma = 16)$

Also, find  $P(X \leq 10)$  and  $P(5 \leq X \leq 10)$

for each of the above cases.

- (c) Consider the following data in which each column represents a systematic sample :

| $S_1$ | $S_2$ | $S_3$ | $S_4$ | $S_5$ | $S_6$ | $S_7$ |
|-------|-------|-------|-------|-------|-------|-------|
| 11    | 23    | 24    | 15    | 26    | 27    | 38    |
| 15    | 27    | 38    | 27    | 22    | 12    | 13    |
| 19    | 22    | 11    | 12    | 14    | 14    | 25    |
| 11    | 29    | 12    | 13    | 41    | 28    | 49    |

Compute the mean of the  $i$ th systematic sample and population mean. Also, compute the relative efficiency of systematic sampling with respect to the simple random sampling. 10

2. (a) Evaluate the following integral : 5

$$\int_{-1}^{-2} f(x) dx, \text{ where}$$

$$f(n) = \begin{cases} 4 - 3x, & -1 \leq x < 1 \\ 2x + 1, & 1 \leq x < 2 \end{cases}$$

- (b) A Latin square design was used to compare 5 varieties of oats. The yields (in kgs per plot) are given in the following table, where  $V_1, V_2, V_3, V_4$  and  $V_5$  refer to varieties of oats : 10

|           |           |           |           |           |
|-----------|-----------|-----------|-----------|-----------|
| $V_2$ 405 | $V_1$ 526 | $V_5$ 464 | $V_4$ 442 | $V_3$ 482 |
| $V_3$ 362 | $V_4$ 447 | $V_2$ 428 | $V_1$ 412 | $V_5$ 494 |
| $V_5$ 472 | $V_2$ 493 | $V_1$ 471 | $V_3$ 380 | $V_4$ 412 |
| $V_1$ 551 | $V_3$ 430 | $V_4$ 423 | $V_5$ 570 | $V_2$ 450 |
| $V_4$ 429 | $V_5$ 468 | $V_3$ 433 | $V_2$ 466 | $V_3$ 461 |

Perform the following tasks :

- Create a 'CSV' file for the analysis purpose.
- Test for the differences between effect of varieties
- Do the pairwise comparison (if required)

(c) Consider the following data :

| Lot No. | Number Inspected | No. of Defectives |
|---------|------------------|-------------------|
| 1       | 501              | 33                |
| 2       | 410              | 41                |
| 3       | 360              | 34                |
| 4       | 301              | 28                |
| 5       | 420              | 13                |
| 6       | 440              | 34                |
| 7       | 375              | 54                |
| 8       | 404              | 79                |
| 9       | 504              | 29                |
| 10      | 451              | 34                |

Perform the following tasks using quality control package : 10

- (i) Construct control chart for number of defectives.
- (ii) Check whether the process is under statistical control or not. If not, compute revised limits and construct revised control chart.

3. (a) Plot the distribution function of standard cauchy distribution using the **curve ( )** function in the range  $[-10, 10]$ . 5
- (b) Consider the following data of annual profits (in crores rupees) of a XUV company : 10

| Year | Profit |
|------|--------|
| 2007 | 88     |
| 2008 | 92     |
| 2009 | 95     |
| 2010 | 95     |
| 2011 | 90     |
| 2012 | 85     |
| 2013 | 98     |
| 2014 | 95     |
| 2015 | 108    |
| 2016 | 118    |
| 2017 | 119    |
| 2018 | 117    |
| 2019 | 130    |

Do the following :

- (i) Fit a linear and the quadratic trend to this data and suggest the most appropriate trend out of these two.
  - (ii) Plot the original, linear trend line and quadratic curve in a single plot.
  - (iii) Project the profit for the year 2020.
- (c) The failure data for 500 electric heaters are given in the following table :

| Operating Time | No. of Failure |
|----------------|----------------|
| 0—6            | 26             |
| 6—12           | 25             |
| 12—18          | 20             |
| 18—24          | 38             |
| 24—30          | 47             |
| 30—36          | 48             |
| 36—42          | 55             |
| 42—48          | 44             |
| 48—54          | 39             |
| 54—60          | 35             |
| 60—66          | 60             |
| 66—72          | 63             |

Estimate the reliability function, cumulative failure distribution function, failure density function and hazard rate function. Place all these values as columns of a data frame. Also, plot the curves of the estimated functions. 10

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