

No. of Printed Pages : 5 **MSTL–011(Set-I)**

M. Sc. (APPLIED STATISTICS)
(MSCAST)

Term-End Practical Examination

December, 2024

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

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

Maximum Marks : 50

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

(ii) Solve the questions using R software.

(iii) Symbols have their usual meanings.

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

1. (a) Find $f''(x)$, the second derivative of the function $f(x) = e^{-x}x^5$. Also, compute $f''(2)$.
- (b) Plot the density and distribution functions of the exponential distribution in the range 0 to 15 with rate as 2.5. Also, find q , such that $P(X \leq q) = 0.75$, where X follows the exponential distribution with rate 2.5.

- (c) Fifteen samples of 100 televisions are drawn from the output of a process that produces several thousand units daily. Television samples are inspected for quality and the number of defective televisions are noted. The data on 15 samples are given below :

Sample No.	No. of Defective Televisions
1	9
2	11
3	14
4	10
5	9
6	11
7	15
8	7
9	11
10	14
11	23
12	16
13	13
14	15
15	10

On the basis of the information given above construct the control chart for number of defectives using formulae, to check the process of televisions manufacturing and state whether the process is under statistical control ? If not, compute the revised control limits and plot the revised control chart. Verify your answer by using a suitable package.

5+5+15

2. (a) Create the graph of :

$$f(x) = 3x^5 - 40x^3 + 3x - 20$$

in the range $-2 < x < 0$, using `plot( )` and `curve( )` functions. Check whether the function is convex or concave.

- (b) A cold drink manufacturing company supplies cold drink cans in lots of size 1100 to the customers. A double sampling inspection plan with $n_1 = 25$, $c_1 = 3$, $n_2 = 20$ and $c_2 = 4$ is used for the lot inspection. By taking different acceptable values for the proportion of defectives, plot the OC and AOQ curves of this double sampling plan.

- (c) Consider the R built in ‘chickwts’ data set available in the datasets package, of an experiment, that was conducted to measure and compare the effectiveness of various feed supplements on the growth rate of chickens. Create a box plot of the weight data according to the feeds. Also, check whether the feeds supplements differ significantly at 5% significance level ?

5+10+10

3. (a) Create a three-dimensional graph of the beta function for different values of its parameters.
- (b) Consider a population of size four with observations 15, 20, 35 and 40. Enumerate all possible samples of size 2, with replacement from the above population. Verify the following :

(i) $E(\bar{x}) = \bar{X}$

(ii) $E(s^2) = \sigma^2$

Also, compute s^2 and $\text{Var}(\bar{x})_{\text{SRSWR}}$.

- (c) The failure data for 220 electric fans is given in the following table :

Operating Time (in months)	Number of Failures
0—5	20
5—10	15
10—15	10
15—20	25
20—25	30
25—30	35
30—35	45
35—40	40

Estimate the reliability function, cumulative failure distribution function and failure density function. Put them all as columns of a data frame. Also, plot the curves of the estimated functions. 5+10+10

× × × × × × ×