

QP CODE: 25050660



Reg No : .....

Name : .....

**MSc DEGREE (CSS) EXAMINATION, DECEMBER 2025**

**First Semester**

**M Sc STATISTICS**

**Core Courses - ST010102 - STATISTICAL COMPUTING I USING R**

2019 Admission Onwards

CC522852

Time: 3 Hours

Weightage: 30

( Answer any **THREE** questions. Each question carries a weight of **10**)

1. (A) Write a R program to create an array, passing in a vector of values and a vector of dimensions. Also provide names for each dimension.

Write a R program to combine three arrays so that the first row of the first array is followed by the first row of the second array and then first row of the third array.

(B) Explain different control loops and statements in R.

Write a program in R to find factorial of a number using while loop.

2. (A) Using R functions, write a program to generate random sample of size 100 from a normal population with mean 2 and variance 9.

Then construct P-P plot of the generated sample.

(B) The failure times of 50 batteries of a certain kind in hours are as follows:

13.8, 41.2, 39.7, 42.6, 15.9, 12.8, 28.7, 12.6, 13.8, 16.7, 26.8, 24.7, 21.4, 32.6, 16.8,  
39.3, 19.6, 18.7, 16.8, 15.9, 20.4, 41.2, 33.7, 34.8, 39.6, 43.4, 28.6, 18.8, 21.4, 16.3,  
30.6, 19.3, 18.7, 31.4, 38.7, 34.2, 29.6, 24.6, 20.2, 21.3, 28.7, 18.7, 14.6, 16.3, 29.9,  
17.6, 33.7, 31.9, 29.1, 28.2

Fit an exponential distribution to the above data.

Also test the adequacy of model using goodness of fit in R.

3. (A) Describe different types of data objects/structures and their operations in R.

Explain the difference between data frame and a matrix in R with examples.

(B) Write down the spectral decomposition of  $A = \begin{bmatrix} 3 & 5 & 1 \\ 2 & 1 & 4 \\ 3 & 7 & 2 \end{bmatrix}$  and obtain  $A^{64}$ .





4. (A) Reduce the following quadratic form to a sum of squares by a linear transformation. Deduce whether the form is positive definite. Write down the index and signature.

$$39.64 x_1^2 + 64.97 x_2^2 + 1133.33 x_3^2 - 1.63 x_1 x_2 + 155 x_1 x_3 - 13.33 x_2 x_3$$

$$A = \begin{bmatrix} 1 & -1 & -1 & 2 \\ 4 & 2 & 2 & -1 \\ 2 & 2 & 0 & 2 \end{bmatrix}$$

(B) Obtain Moore-Penrose g-inverse of

5. (A) The following data gives the geographical area (in acres) under paddy for 58 villages. Draw a SRSWR sample of 8 villages. Using R, find the estimated average area per village under paddy, an estimate of its variance and its 95% confidence interval.

98, 270, 79, 273, 130, 158, 110, 194, 41, 33, 78, 56, 58, 19, 64, 81, 141, 58, 29, 46, 93, 27, 114, 88, 108, 57, 47, 69, 44, 56, 102, 87, 161, 177, 76, 133, 137, 127, 104, 117, 170, 210, 101, 222, 228, 96, 114, 318, 272, 152, 292, 240, 201, 262, 189, 39, 154, 230.

(B) Given below are the number of pepper standards for the selected villages in each of the three strata of Cochin zone.

| Stratum | Total no. of villages in the stratum | No. of villages selected from the stratum | No. of pepper standards in each of the selected village |
|---------|--------------------------------------|-------------------------------------------|---------------------------------------------------------|
| 1       | 401                                  | 11                                        | 41, 116, 19, 15, 144, 159, 212, 57, 28, 76, 119         |
| 2       | 403                                  | 12                                        | 170, 38, 37, 161, 38, 27, 119, 36, 128, 30, 208, 125    |
| 3       | 103                                  | 7                                         | 252, 385, 192, 296, 115, 159, 12                        |

Using R, (1) Estimate total number of pepper standards in Cochin Zone. (2) Give an estimate of standard error of your estimator. (3) Estimate relative gain in precision due to stratification.

6. (A) The following table shows the number of inhabitants (in 1000's) in each of a simple random sample of 49 cities drawn from the population of 196 large cities. Using R, estimate the total number of inhabitants in 196 cities in the year 1930. In 1920, the total (x) is assumed to be 22919.

Also, estimate the variance and standard error of the ratio estimate of the population total.

$X_i$  (1920) - 76, 138, 67, 29, 381, 23, 37, 120, 61, 887, 192, 98, 66, 60, 46, 2, 507, 179, 121, 150,

44, 77, 64, 64, 93, 56, 40, 38, 40, 36, 116, 46, 243, 87, 20, 71, 256, 43, 28, 94, 43,

228, 26, 161, 74, 45, 38, 50, 48

$Y_i$  (1930) - 80, 143, 67, 50, 464, 48, 63, 115, 69, 449, 104, 183, 106, 86, 57, 65, 56, 634, 130, 64,

58, 89, 63, 77, 142, 60, 64, 52, 139, 130, 53, 291, 105, 111, 79, 288, 61, 57, 85, 50,

317, 46, 232, 93, 53, 54, 58, 75, 70

(B) For the above data, obtain the estimate of the population total by regression estimate and also find the standard error using R. Comment on the efficiencies of the estimates made by ratio method and regression method.

