

Ph. D. IN STATISTICS

(PHDSTAT)

Term-End Examination

December, 2025

**RST-002 : COMPUTER APPLICATIONS IN
RESEARCH**

Time : 3 Hours

Maximum Marks : 100

Note : *Question number 1 is compulsory. Attempt any four questions from question numbers 2 to 7. Scientific calculator (non-programmable) is allowed. Symbols have their usual meanings.*

1. (a) State whether the following statements are TRUE or FALSE. Give reasons in support of your answers : $4 \times 2 = 8$
 - (i) To install the package 'ggplot2' R command is `install.package('ggplot2')`.

- (ii) R code to generate 100 random numbers from the distribution $N(40, 25)$ is `rnorm(100, 40, 25)`.
- (iii) R code to obtain the product of all numbers 7, 8, 9, 10, ..., 15 is `product(7 : 15)`.
- (iv) R code to extract 10th element from the vector x is `x(10)`.
- (b) (i) Write a function to obtain mode of a vector in R. 4
- (ii) Explain the procedure to write the expression :
- $$\sqrt[3]{9} + \sum_{i=1}^{10} x_i - \int_0^2 x dx$$
- in word with the help of equation 3.0 or 5.0 or 7.0. 4
- (iii) Explain three ways of creating a matrix in R with the help of an example. 4

2. Consider the following data set :

ID	Gender	Brand-of-car	Mileage	Cost-of-car (in lakh)
1	F	A	17	8.5
2	F	B	19	9
3	M	C	12	20
4	M	D	15	16
5	M	C	10	19
6	F	D	14	15
7	M	A	16	8
8	F	A	18	7.5
9	M	C	11	18
10	M	B	18	8.5
11	F	B	20	8
12	M	A	17	8

Assume that this data set is available in R with the name 'data-car.' Write R code for the following :

5×4=20

- (i) To calculate mean and standard deviation of the cost of all 12 cars.
- (ii) To obtain subset of this dataframe where gender is equal to female.

- (iii) To obtain contingency table for the variables gender and Brand-of-car.
 - (iv) To subset this dataframe where gender is equal to male and Brand-of-car is equal to A.
 - (v) To obtain average of Mileage of car of each brand.
3. Write R code for the following : $10 \times 2 = 20$
- (a) To obtain 2, 3, 7, 2, 3, 7, 2, 3, 7, 2, 3, 7 using `rep()` function.
 - (b) To obtain the sequence 6, 13, 20, 27, 34, 41, 48, 55, 62, 69, 76 using `seq()` function.
 - (c) Four values 8, - 16, 24, - 36 have been stored in the vector x . Then R code for
 - (i) getting absolute value of each member of x
 - (ii) getting cube of each member of x .
 - (d) $\log_3 100$.

- (e) To delete a column having name 'cost' from the dataframe `dat`.
- (f) To obtain 65th and 72nd percentiles simultaneously in a single line of command for the variable x_1 .
- (g) Assuming that values 4, 7, 9, 6, 5, 1, -3, -8, 13, 14, 19, 20 are stored in the variable x_2 . Write R code using x_2 to

form a matrix
$$\begin{bmatrix} 4 & 7 & 9 & 6 \\ 5 & 1 & -3 & -8 \\ 13 & 14 & 19 & 20 \end{bmatrix}.$$

- (h) To obtain Pearson correlation coefficient between variables x and y .
- (i) To extract 3rd to 6th rows and 4th to 9th columns of a matrix m simultaneously.
- (j) To research for functions whose names contain the word 'cat'.
4. (a) Write R code to obtain the probabilities : $2+2+2+2+2+2+4+4$

- (i) $P[X < 97]$
- (ii) $P[X > 101]$
- (iii) $P[98 < X < 103]$

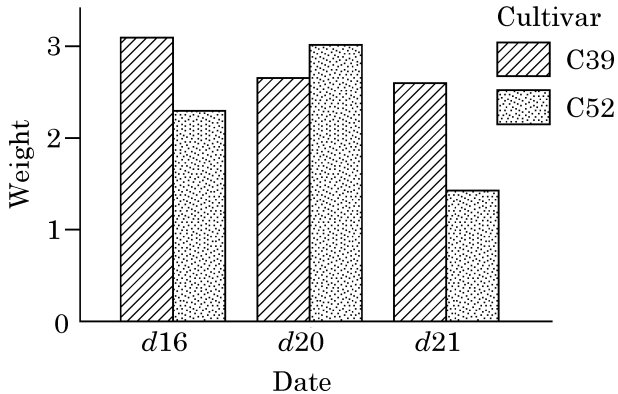
where $X \sim N(100, 25)$.

- (b) Write R code for 10000 draws from an urn having only two balls numbered 0 and 1 when sampling is done with replacement.
- (c) If $X \sim B(10, 0.5)$, then write R code to obtain the probabilities :
 - (i) $P[X = 6]$
 - (ii) $P[3 \leq X < 5]$
 - (iii) $P[X > 6]$
- (d) Solve the integral $\int_2^5 x^2 dx$ manually and also write R program to evaluate the integral.
- (e) Differentiate $x^3 - 3x + e^{x^2}$ in R with respect to x .

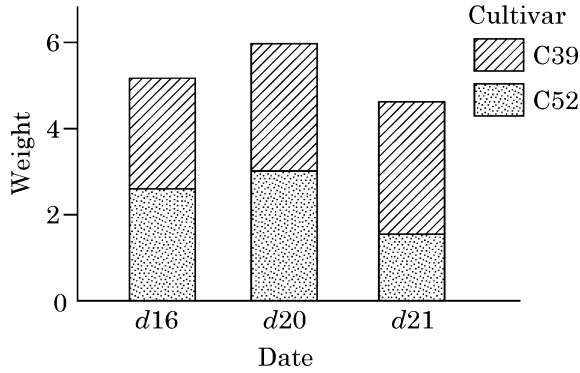
- (f) If $9^x = y$ and $\log_3(y/81) = p$, then what is the relation between x , y and p ?
- (g) Consider the data set given as follows :

Cultivar	Date	Weight	<i>sd</i>	<i>n</i>
C39	d16	3.18	0.957	10
C39	d20	2.80	0.279	10
C39	d21	2.74	0.983	10
C52	d16	2.26	0.445	10
C52	d20	3.11	0.791	10
C52	d21	1.47	0.211	10

Write R code to obtain the following graph based on this data.



- (h) For the data set given in part (g) write R code for the following graph :



5. (a) Write short note on MS-Excel statistics calculation point of view. 10
- (b) Write a short note on MS-Word. 10
6. Describe Gibbs sampling method with examples. 20
7. Write R program to generate 1000 random observations from :
- (i) $f(x) = \lambda e^{\lambda x} \exp(1 - e^{-\lambda x})$, $x > 0$ using inversion method. 10
- (ii) $f(x) = \frac{1}{\sqrt{2\pi}} e^{-\frac{x^2}{2}}$, $-\infty < x < \infty$ taking $g(x) = \frac{1}{\pi(1+x^2)}$, $-\infty < x < \infty$ as proposal distribution. 10

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