

**Ph.D. IN STATISTICS
(PHDSTAT)**

00035 Term-End Examination

June, 2018

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

Time : 3 hours

Maximum Marks : 100

Note : Question no. 1 is compulsory. Attempt any four questions from questions no. 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.

4×2=8

(i) The R-command for generating 10000 observations from $U(0, 1)$ is `runif(0, 1, 10000)`.

(ii) If vector x is such that

$$x <- c(9, 4, 2, NA, 5)$$

then 'sum(x)' command in R gives the output [1] 20.

- (iii) Gibbs sampling involves sampling from the conditional distribution for each parameter given the previous values of all parameters.
- (iv) For calculating p-value corresponding to t-distribution, the function 'TINV()' is used in MS-Excel.
- (b) Differentiate between the following, with suitable examples : 3×4=12
- (i) Matrix and Dataframe in R
 - (ii) Word processing and PowerPoint
 - (iii) Lottery method and Middle square method.
2. (a) Describe the congruential method of generating random numbers. Also generate the sequence of random numbers for $m = 8$, $a = 5$, $c = 7$ and $x_0 = 4$.
- (b) Describe the test for Rectangularity. 12+8
3. Describe Accept-Reject method. Write R-program to draw a random sample of size 5000 from Beta distribution with parameters $a = 4$ and $b = 6$, using proposal density $U(0, 1)$. 20
4. Explain Metropolis-Hastings Algorithm and using it, write R-program to (i) simulate $N(\mu, \sigma^2)$ distribution by taking Cauchy (0, 1) as proposal density; and (ii) Draw histogram and compute mean of the generated random numbers. 8+8+4

5. (a) What is simulation ? Write its advantages and disadvantages.

(b) Write R-program to generate 5000 random numbers from exponential distribution with parameter $\theta = 5$ and draw graph of generated random numbers.

14+6

6. The data on 10 mobile users saved in Excel file in CSV format in 'D' drive with folder name 'Survey' and file name 'Mobile_data' is as follows :

Name	Gender	Age	Mobile Type	Mobile Internet	Mobile Bill (in ₹)
Tinku	M	25	Android	Yes	350
Ram	M	62	Simple	No	100
Rinki	F	30	Android	Yes	250
Rahul	M	18	Android	Yes	560
Neeraj	M	40	Android	No	240
Preeti	F	26	Android	Yes	430
Ankit	M	65	Simple	No	150
Salman	M	60	Android	No	250
Lavnik	M	20	Simple	Yes	150
Neha	F	34	Android	Yes	350

Write R-commands for the following : 10×2=20

- (a) To set the working directory to read this file.
- (b) To import the data and store it in dataframe with name 'Mobile'.
- (c) To see the names of all the variables.
- (d) To see the status of each variable in the dataframe.
- (e) To find the mean age of the mobile users.
- (f) To find the average mobile bill for females.
- (g) To find the average mobile bill for Android users.
- (h) To access the data whose ages are less than 45 years.
- (i) To sort the data from low to high according to 'Mobile bill'.
- (j) To extract the data for Mobile Internet users.

7. Write short notes on any *four* of the following : 4×5=20

- (a) Features of Excel
- (b) Validity of Accept-Reject Method
- (c) Detailed Balance Equation
- (d) Type of data objects in R
- (e) Monte Carlo Integration