

Ph. D. IN STATISTICS (PHDSTAT)

Term-End Examination

December, 2024

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

Time : 3 Hours

Maximum Marks : 100

Note : *Question No. 1 is compulsory. Attempt any
four questions from Q. Nos. 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) R code to load a package dplyr in a session of R is `library.load(dplyr)`.
- (ii) R code to see first three rows of the data frame `dat` is `Head(dat, 3)`.

- (iii) Rejection sampling is used when CDF of a distribution is known.
 - (iv) Metropolis-Hastings method involves sampling from the conditional distribution for each parameter given the previous values of all parameters.
- (b) (i) Explain the meaning of different arguments of the function `rep()`. 4
- (ii) Explain the meaning of different arguments of the function `seq()`. 4
- (iii) Explain the meaning of different arguments of the function `log()`. 4
2. (a) Explain the difference of outputs of the three functions `sort()`, `order()` and `rank()`. 6
- (b) The elements of vector x are 5, 3, 7, 15, 23, -11, 18 and 20. Write R code to obtain : 8
- (i) maximum element of x
 - (ii) minimum element of x
 - (iii) average of x
 - (iv) standard deviation of x
 - (v) variance of x
 - (vi) square of each element of x
 - (vii) divide each element of x by 5
 - (viii) median of x .

- (c) Write R code to generate the sequence : 2
3, 8, 13, 18, 23, 28,....., 5003.
- (d) Explain the meaning of trim argument of the function mean(). 4
3. (a) If a bag has 8 red balls and 12 black balls, write R code to create this bag in R. Also write R code to obtain probability of getting a red ball from this bag when one ball is drawn randomly. 4
- (b) If $X \sim N(60, 36)$, then write R code to obtain value of a in each case : 4
- (i) $P[X > 62] = a$
- (ii) $P[X > a] = 0.63$
- (iii) $P[X < a] = 0.46$
- (iv) $P[X < 55] = a$
- (c) If $X \sim B(20, 0.6)$, then write R code to obtain value of a in each case : 4
- (i) $P[X = 10] = a$
- (ii) $P[X = a] = 0.1171416$
- (iii) $P[X \leq a] = 0.9999634$
- (iv) $P[X > a] = 0.993534$
- (d) Write R code to get mode of a vector x . 4
- (e) Describe “if else” statements with the help of an example. 4

4. Discuss any *five* principles of data visualization with suitable example. 20
5. Write any *ten* salient features of the package “ggplot2” for data visualization. 20
6. Explain Metropolis-Hastings algorithm. Write R-program to generate 1000 random numbers from $N(0, 1)$ distribution by taking $U(0, 1)$ as proposal density. Also draw histogram and compute mean of the generated random numbers. 20
7. Write R program to generate a random sample of 1000 observations from :
 - (i) $f(x) = \frac{1}{40}(2x + 3), 0 < x < 5$ using accept-reject method. 10
 - (ii) $f(x) = \alpha x^{\alpha-1} e^{-(x)^\alpha} \exp\left[1 - e^{(x)^\alpha}\right], x > 0$ using inversion method. 10

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