Shivaji University, Kolhapur

Question Bank for Mar 2022 (summer) Examination

M.Sc.(Statistics/Applied Statistics and Informatics)

Subject Code: 83442 Subject Name: Statistical Computing

Common subject Code (if any): 74911/83408/74978

Short answer questions (2 marks)

1 Discuss the use of 'sort and filter' menu in MSEXCEL.

2 Which functions are used to obtain mean, median, coefficient of skewness in MSEXCEL?

3 Discuss the FREQUENCY( ) function in MSEXCEL

4 Discuss the TDIST( ) function in MSEXCEL

5 Discuss 'vlookup( )' function in MSEXCEL with suitable example.

6 Discuss UPPER( ) and PROPER( ) functions in MSEXCEL

7 Discuss DATE( ) and DATEVALUE( ) functions in MSEXCEL

8 Write down the syntax of MSEXCEL function to compute probabilities of Poisson distribution

9 Write down the syntax of MSEXCEL function to compute probabilities of Normal distribution

10 Write down the syntax of MSEXCEL function to compute Binomial probabilities.

11 Illustrate 'while' statement in R.

12 Write down the procedure to import '.txt' type file in R.

13 Write a user defined function in R to compute factorial of a given non-negative integer.

14 Discuss *summary( )* function in R

15 Explain *rep( )* function in R.

16 Discuss *list* data structure in R.

17 Explain *seq( )* function in R.

18 Discuss *data frame* data structure in R.

19 Suppose gender of 10 student (M, M, F, F, M, F, F, M, M, M) is provided to you. How will you count number of males and females using R software?

20 Let X~ N(11,4). How to compute P(X>8) and P(5<X<15) using R software?

21 Let X~ B(10,0.4). How to compute P(X≥8) and P(X=5) using R software?

22 What is simulation?

23 Discuss the inversion method to generate random numbers from any continuous distribution.

24 What is random number generator? Give two examples.

25 Write down the procedure to generate random numbers from B(10,5/8) distribution using single coin?

26 Discuss the procedure for generating true random numbers from B(10, 0.75) distribution using single coin.

27 Discuss the procedure for generating true random numbers from G(0.25) distribution using single coin.

28 How do you generate random numbers from B(0.25) using ten unbiased coins.

29 Write an algorithm to generate random number from G(0.4) distribution.

30 Write an algorithm to generate random numbers from following distribution

X=x	10	20	100
P(X=x)	0.2	0.3	0.5

32 State an iterative formula for finding the root of a nonlinear equation using Regula Falsi method. Write down the same for finding the root of the equation $x^3 - 8 = 0$

33 Write an algorithm to find the root of the equation $x^2 - x - 6 = 0$ using bisection method.

34 What is numerical integration? State Simpson's $1/3^{rd}$ rule for numerical integration

35 What is numerical integration? State Trapezoidal rule of numerical integration

36 State Trapezoidal rule of numerical integration. Using the same evaluate $I = \int_0^5 (x+1)\,dx$

37 State the sufficient condition for the convergence of the Jacobi method for solving system of linear equation.

38 Comment on "Gauss Seidel method always converges to real solution"

39 Define diagonally dominant matrix? State the result based on this about the convergence of Jacobi method.

40 Explain the purpose of bootstrap method.

Long answer questions (8 marks)

1 Explain following functions in MSEXCEL
i) STDEV( ) ii) EXPONDIST ( ) iii) LOG( ) iv) RAND( )

2 Explain following functions in MSEXCEL
i) BINOMDIST( ) ii) CHIINV( ) iii) LOG( ) iv) RAND( )

3 Explain following functions in MSEXCEL
i) TDIST( ) ii) IF( ) iii) VLOOKUP( ) iv) DAVERAGE( )

4 Explain following functions in MSEXCEL
i) TRIM( ) ii) AND( ) iii) CONCATENATE( ) iv) LEFT( )

5 Explain following functions in MSEXCEL
i) DAY ii) TIME iii) OR( ) iv) EXACT( )

6 Explain functions/procedure in MSEXCEL for the following
   i. To compute correlation coefficient between two variables
   ii. To generate random numbers from U(1,10) distribution
   i. To compute quantile of normal distribution
   iii. To compute mean deviation about mean

7 Explain functions/procedure in MSEXCEL for the following
   i. To compute mean deviation about mean
   ii. To generate integer random numbers between 1 to 100
   iii. To compute CDF of Chi-square distribution
   iv. To perform F-test for equality of variance

8 Explain functions in MSEXCEL for the following
   i. To count the number of cells that are nonempty
   ii. To find the average of all the cells in a range that meet a given criteria
   iii. To compute coefficient of skewness.
   iv. To compute CDF of normal distribution

9 Explain functions/procedure in MSEXCEL for the following
   i. To compute geometric mean of numbers
   ii. To compute CDF of Exponential distribution
   ii. To compute quantile of Chi-square distribution
   iii. To compute median of given numbers

10 Discuss what if analysis menu in MSEXCEL in detail.

11 Discuss database functions in MSEXCEL

12 Discuss the analysis tool pack in MSEXCEL

13 Explain functions in R for the following
   i. To compute Spearman's rank correlation coefficient between two variables
   ii. To sort given vector by descending order
   iii. To generate random sample from given vector
   iv. To obtain inverse of a matrix

14 Suppose we have recorded Roll_Num, Gender, Marks1, Marks2 of the 50 students and data is stored on EXCEL file "data.xlsx" on D drive of the computer. Explain functions/procedure in

R for the following

i. To import data in R.
ii. To find mean and variance of the *Marks1* variable
iii. To compute Spearman's rank correlation coefficient between *Marks1* and *Marks2*
iv. To get the boxplots of Marks1 for each level of the variable Gender in single graph.

15 Explain functions/procedure in R for the following

i. To compute covariance between two series
ii. To compute PDF and CDF of lognormal distribution
iii. To compute population variance and standard deviation
iv. To represent given data using pie chart

16 Explain functions/procedure in R for the following

i. To compute covariance between two series
ii. To generate random numbers from U(1,10) distribution
iii. To compute quantile of t-distribution
iv. To compute population variance

17 Explain functions in R for the following

i) To draw pie chart
ii) To import '.txt' type file
iii) To compute Spearman's rank correlation coefficient
iv) To convert 'data.frame' type object to 'matrix' type object

18 Discuss t.test( ) and prop.test( ) functions in R.

19 Explain following functions in R

i) aov( ) ii) var.test( ) iii) matrix( ) iv) sample( )

20 Discuss *plot( )* function in R.

21 Discuss *if, for* and *while* control statements in R. Write an R-program to check whether given number is multiple of 4 or not.

22 Discuss vector data structure in R. Suppose you are provided with the a vector of 10 observations, say $x_1, x_2, ..., x_{10}$. The statistic T is defined as follows:

$$T = \begin{cases} 1 & \text{if } x_7 < 23 \\ 2 & \text{if } x_7 \geq 23 \text{ and } x_8 > 14 \\ \sum_{i=1}^{10} \frac{x_i}{i} & \text{otherwise} \end{cases}$$

How will you define function T in R using user defined function?

23 Suppose entrance marks of the students are stored in a vector X in R and gender is stored in vector Y. Write an R program

i) To compute average marks of the students having marks greater than median marks.
ii) To compute average marks of female students and male students separately

24 What is random number generator? Distinguish between true random number generator and pseudo random number generator. Explain the procedure to generate random numbers from H(N=50, M=20, n=15) distribution using uniform random numbers.

25 Explain Linear Congruential Random Number Generator. Write an R program to generate uniform random numbers using the same. Also discuss about the choice of parameters involved in it in order to achieve maximum possible cycle length.

26 Discuss Acceptance-Rejection Technique for generating random numbers from continuous distributions. Write an algorithm to generate random numbers from gamma distribution by rejection technique with exponential random variable.

27 State the result used to generate random observations from Poisson and Geometric distribution using uniform random numbers. Also write down the algorithms.

28 Discuss the procedure to generate random vectors from Marshal Olkin Bivariate exponential distribution. If (X, Y) follows Marshal Olkin Bivariate exponential distribution, then write an algorithm to estimate $P(X>3, 1<Y<2)$ by using random vectors.

29 What are pseudo random numbers? Discuss Linear Congruential Random Number Generator.

30 State the transformation used to generate random numbers from Poisson distribution. Write an R program to generate random numbers from P(3) using U(0,1) random numbers.

31 Write an algorithm to generate random numbers from B(n, p) and NB(r, p) distributions

32 Discuss the procedure to generate random vectors from Multinomial distribution. If (X, Y, Z) ~ MN(10, 0.2 0.3, 0.5), then write an algorithm to estimate P(X<2, 1 ≤ Y≤ 3) by using random vectors.

33 Explain the procedure to generate random numbers from mixture of several distributions. Illustrate with example.

34 State the Box-Muller transformation for generating random numbers from standard normal distribution. Also explain the procedure to generate random vectors from bivariate distribution.

35 Write an algorithm to generate random numbers from Exponential and Weibull distribution.

36 How the generated random numbers can be used to evaluate integrals? Discuss in detail giving illustrations.

37 Explain Newton-Rahpson method for approximating root of a nonlinear equation. Hence write an algorithm to approximate the root of the equation $e^{-x} - x = 0$

38 Explain bisection method for approximating root of a nonlinear equation. Hence write an algorithm to approximate the root of the equation $x - e^{-x} = 0$

39 Explain Regula Falsi method for approximating root of a nonlinear equation. Write an algorithm to approximate the root of the equation $x^2 + x - 2 = 0$ using the same.

40 Explain Simpsons 1/3rd rule of numerical integration. Also write an algorithm to numerically compute P(1<Y<2) if Y ~ W(scale=1, shape=2) using the same.

41 Explain Simpsons 3/8rd rule of numerical integration. Also write an algorithm to numerically compute P(1<X<2) if X ~ G(2,3) using the same.

42 Explain Trapezoidal rule of numerical integration. Also write an algorithm to numerically compute P(X>1) if X ~ G(1,1) using the same.

43 Explain Simpsons 1/3rd rule of numerical integration. Write an R-program to evaluate $I = \int_1^5 (x^2 - x + 2)dx$ using the same.

44 Write an algorithm and program in 'R' to compute $\int_0^1 e^{-\frac{x^2}{2}}\, dx$ using Simpson's 1/3rd rule.

45 Explain Jacobi method for approximating solution of a system of linear equation.

46 Explain Gauss Seidel method for approximating solutions of a system of equation. Also discuss about its convergence.

47 Discuss the Gauss Seidel method for approximating the solution to the system of linear equations. Write an R program to solve the following system of equations

$$3x + 2y = 5$$
$$4x - 6y = -2$$

48 Discuss the Bootstrap technique in detail.

49 Let $X_1, X_2, \ldots, X_n$ be random sample from displaced exponential distribution p.d.f. $e^{-(x-\theta)} I_{[\theta,\infty)}(x)$. Suppose $\hat{\theta} = X_{(1)}$ an estimator of θ. Obtain the Jackknife estimator $J(\hat{\theta})$ of θ.

50 Discuss Jackknife technique for estimating bias and standard error of the estimator.

Short notes (4 Marks each)

1 Analysis tool pack in MSEXCEL

2 Formula errors in MSEXCEL

3 Excel macros

4 Pivot tables in MSEXCEL

5 Matrix operations in MSEXCEL

6 Graphics in R
7 R-packages
8 *apply* family of functions in R
9 User defined functions in R
10 Building web applications using shiny package.
11 Hypothesis testing using R
12 Use of random numbers to evaluate definite integrals
13 Random numbers and statistical inference
14 Acceptance-Rejection technique
15 Application of Simulation
16 Jackknife technique for estimation of bias and standard error
17 Bootstrap technique
18 Gauss-Seidel method
19 Trapezoidal rule of numerical integration
20 Numerical methods for finding root of nonlinear equations