3 (Sem–4/CBCS) MAT SE 1/2

2023

MATHEMATICS

(Skill Enhancement Course)

Answer the Questions from any one Option.

OPTION – A

(R–Programming)

Paper : MAT–SE–4014

OPTION – B

(LaTeX and HTML)

Paper : MAT–SE–4024

Full Marks : 50

Time : Two hours

The figures in the margin indicate full marks for the questions.

*Answer **either** in English **or** in Assamese.*

OPTION – A

(R–Programming)

Paper : MAT–SE–4014

1. Answer the following questions :   1×4=4

তলৰ প্ৰশ্নবোৰৰ উত্তৰ কৰা ঃ

(a) What is the use of length ( ) function in R ?

R-প্ৰগ্ৰামৰ দৈৰ্ঘ্য ফলনৰ ব্যৱহাৰ ক'ত কৰিব পাৰি ?

(b) How are impossible values represented in R ?

R-ত অসম্ভৱ মানবোৰ কেনেদৰে প্ৰদৰ্শন কৰা হয় ?

(c) What do you understand by CRAN ?

CRAN ৰ অৰ্থ লিখা।

(d) What is the output of the following function ?

তলৰ ফলনটোৰ ফলাফল কি হ'ব ?

> Seq(1, 3, by=0.2)

2. Answer the following questions :   2×3=6

তলৰ প্ৰশ্নবোৰৰ উত্তৰ কৰা ঃ

(a) Write down *two* advantages of R comparing to MS-Excel.

MS-Excel তুলনাত R-ৰ *দুটা* সুবিধা উল্লেখ কৰা।

(b) Mention how you can produce co-relations and covariances in R.

R-ৰ সহ-সম্পৰ্ক আৰু সহ-বিচৰণ কেনেকৈ প্ৰস্তুত কৰা হয় ?

(c) Differentiate between "%%" and "%/%" in R.

R-ত "%%" আৰু "%/%" ৰ মাজৰ পাৰ্থক্য লিখা।

3. Answer *any two* questions from the following :   5×2=10

তলৰ *যিকোনো দুটা* প্ৰশ্নৰ উত্তৰ কৰা ঃ

(a) The sample mean of a vector $x = [x_i]_{i=1}^n$ is defined as $\mu_x = \sum_{i=1}^n \frac{x_i}{n}$ and the unbiased sample variance is defined as $\sigma_x^2 = \frac{1}{n}\sum_{i=1}^n (x_i - mn_x)^2$. Write an R script which will compute the mean and variance of the vector $x <- 1:100$.

যদি $x = [x_i]_{i=1}^{n}$ ৰ গড় সদিশৰাশি $\mu_x = \sum_{i=1}^{n} \dfrac{x_i}{n}$ আৰু

নিদৰ্শক বিচৰণ $\sigma_x^2 = \dfrac{1}{n} \sum_{i=1}^{n} (x_i - mn_x)^2$ হয়, তেন্তে

সদিশৰাশি $x < -1 : 100$ ৰ গড় আৰু বিচৰণ উলিওৱা
R-ৰ লিপি নিৰ্ণয় কৰা।

(b) Explain *five* of the common syntax in R-Programming language.

R-প্রগ্রামত ব্যৱহাৰ হোৱা *পাঁচটা* সাধাৰণ বাক্যবিন্যাস বৰ্ণনা কৰা।

(c) What is a factor ? How would you create a factor in R ?

উৎপাদক কি? R-ত কেনেদৰে উৎপাদক প্ৰস্তুত কৰিব পাৰি?

(d) Write R-Program to create a list containing strings, numbers, vectors and logical values.

Strings, numbers, vectors আৰু logical values উৎপন্ন কৰা R-প্রগ্রাম লিখা।

4. Answer *any three* questions from the following :   10×3=30

তলৰ *যিকোনো তিনিটা* প্ৰশ্নৰ উত্তৰ কৰা ঃ

(a) Discuss about the components of R-studio.

R-স্টুডিঅ'ৰ উপাদান বোৰৰ বিষয়ে আলোচনা কৰা।

(b) Write a R-programming to find the multiplication table (from 1 to 10).

1 ৰ পৰা 10 লৈ পূৰণৰ তালিকা উলিওৱা R-প্রগ্রামটো লিখা।

(c) Write a R-programming to find all primes smaller than 100.

100 তকৈ সৰু আটাইবোৰ মৌলিক সংখ্যা নিৰ্ণয় কৰিবলৈ R-প্রগ্রামটো লিখা।

(d) The factorial of a non-negative integer n, noted $n!$, can be algebraically defined as

$$n! = \prod_{i=0}^{n-1} (n - i)$$
$$= n(n-1)(n-2)\ldots 3.2.1$$

Write a R-Program of the function which recursively computes the factorial.

$n!$ ৰ বীজগণিতীয় প্ৰকাশ হল

$$n! = \prod_{i=0}^{n-1}(n-1)$$
$$= n(n-1)(n-2)\ldots 3.2.1$$

$n!$ ৰ পুনৰায় গুণিতক নিৰ্ণয় প্ৰয়োজনীয় ফলনৰ R-প্ৰগ্ৰামটো লিখা।

(e) Write a R-programming to create a two-dimensional 5×3 array of sequence of even integers greater than 50.

50 তকৈ ডাঙৰ যুগ্ম সংখ্যাৰ 5×3 সজ্জাৰ এটা দ্বিমাত্ৰিক অনুক্ৰম উলিওৱা R-প্ৰগ্ৰামটো লিখা।

(f) Write a R-programming to find the sum of natural numbers up to n using recursion.

পুনৰায় ঘটা ঘটনা ব্যৱহাৰ কৰি n টা স্বাভাবিক সংখ্যাৰ যোগফল উলিওৱা R-প্ৰগ্ৰামটো লিখা।

Paper : MAT-SE-4024

(LaTeX and HTML)

1. Answer the following questions :   1×4=4

   (a) What is a markup language ?

   (b) What do you mean by preamble in a LaTeX document ?

   (c) What is the purpose of the command \author in LaTeX ?

   (d) What is beamer ?

2. Answer the following questions :   2×3=6

   (a) Make the following equation in LaTeX :
   $$\lim_{\theta \to 0} \frac{\sin\theta}{\theta} = 1$$

   (b) Write the LaTeX command to produce the following matrix :
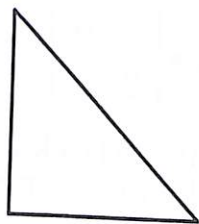 $$A = \begin{bmatrix} 1 & \alpha \\ 2 & \beta \end{bmatrix}$$

   (c) What is PSTricks ? How will you use PSTricks in a LaTeX document ?

3. Answer *any two* questions : 5×2=10

(a) Write the LaTeX command for the following :

$$\prod_p \left(1 - \frac{1}{p^2}\right) = \prod_p \frac{1}{1 + \frac{1}{p^2} + \frac{1}{p^3} + \dots}$$

$$= \left(\prod_p \left(\frac{1}{1 + \frac{1}{p^2} + \frac{1}{p^3} + \dots}\right)\right)^{-1}$$

$$= \left(1 + \frac{1}{2^2} + \frac{1}{3^2} + \frac{1}{4^2} + \dots\right)^{-1}$$

$$= \frac{6}{\pi^2}$$

(b) Use LaTeX picture environment to make a picture of a Pythagorean triangle of sides 3,4,5 as shown below and put the inscribed triangle :

(c) Write the output of the following LaTeX code :

\begin{pspicture}(4,4)
\pscircle{(2,2)(1.5)}
\pswedge[fillstyle=solid,fillcolor=lightgray](2,2){1.5}{0}{60}
\put(2.75,1.7){r}
\put(2.3,2.1)(θ)
\put(3.25,3){$A=e\theta$}
\end{pspicture}

(d) Write a simple program in LaTeX to create a presentation containing the title page and a second page containing a PSTricks picture of a square.

4. Answer *any three* questions : 10×3=30

(a) What do you mean by LaTeX ? Give examples of some LaTeX editors. Typeset the following in LaTeX :

(i) Let $\gamma, \gamma_1, \gamma_2$ piecewise smooth curves in a domain D in $\mathbb{C}$. Show that

$$\int_{\gamma_1 \cdot \gamma_2} f \, dz = \int_{\gamma_1} f \, dz + \int_{\gamma_2} f \, dz$$

and $\int_{-\gamma} f \, dz = -\int_{\gamma} f \, dz$

(ii) For $r > 0$, verify that

$$\left| \int_\gamma e^{iz^2} dz \right| \leq \frac{\pi\left(1 - e^{-r^2}\right)}{4r}$$

(b) How to create arrays and multiline expressions in LaTeX ? Give examples of each in LaTeX code as well as the corresponding outputs.

(c) Write LaTeX code to plot the cardioid given by the parametric equations :

$x = \cos t\,(1 - \cos t)$

$y = \sin t\,(1 - \cos t),\ 0 \leq t \leq 2\pi$

On the same coordinate system, plot the function $f(x) = \sin 1/t,\ 0 \leq t \leq 2\pi$ with this function shown as dotted curves.

(d) Check for mistakes in the following LaTeX codes and correct them and produce the final output :

```
\documentclass{article}
\title{My exam}
\begin{document}
\begin{frame}
\titlepage
\end{frame}
\begin{frame}
```

Let f be a function defined in a neighborhood of a point x_{0}. Then f is continuous at x_{0} if

```
\begin{enumerate}
\item $\lim_{x\rightarrow x_{0}}f$ exists and
\item $\lim_{x\rightarrow x_{0}}f(x)=f(x_{0})
\end{frame}
\end{document}
```

(e) Describe how to put an image in a webpage with the image aligned at the center. Give an example. How to use an image as a link ? Give an example.

(f) What does HTML stand for ? Write HTML code to construct the following webpage :

Here are the mathematical subjects offered :

- Differential equation
- LaTeX and HTML

The syllabus of each paper can be found at Gauhati University.

(Note : Here Gauhati University should be a link to an external website)

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