Total number of printed pages–11

3 (Sem–4/CBCS) MAT SE1/2

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.*

Contd.

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 দৈর্ঘ্য ফলনৰ ব্যৱহাৰ ক'ত কৰিব পাৰি ?

(b) How are impossible values represented in R ?

R-ত অসম্ভব মানবোৰ কেনেদৰে প্ৰদৰ্শন কৰা হয় ?

(c) What do you understand by CRAN ?

CRAN ৰ অর্থ লিখা।

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

তলৰ ফলনটোৰ ফলাফল কি হব ?

```
> 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-সম্পর্ক আৰু সহ-বিচৰণ কেনেকৈ প্ৰস্তুত কৰা হয় ?

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

R-ত "%%" আৰু "%/%" ৰ মাজৰ পার্থক্য 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 $\mu_x=\sum_{i=1}^{n}\frac{x_i}{n}$ আৰু

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

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

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

R-প্ৰগ্ৰামত ব্যৱহাৰ হোৱা *পাচটা* সাধাৰণ বাক্যবিন্যাস বর্ণনা 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-প্ৰগ্ৰাম 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-ষ্টুডিঅ'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-প্ৰগ্ৰামটো লিখা।

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

100 তকৈ সৰু আটাইবোৰ মৌলিক সংখ্যা নির্ণয় কৰিবলৈ R-প্ৰগ্ৰামটো 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 হ'ল

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

$n!$ ৰ পূনৰাবৃত্তিমূলক 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.

পুনৰাবৃত্তি ঘটা ঘটনা ব্যৱহাৰ কৰি nটা স্বাভাবিক সংখ্যাৰ যোগফল উলিওৱা R-প্ৰগ্ৰামটো লিখা।

OPTION – B

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 :

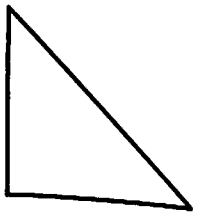
$$\prod_p \left(1-\frac{1}{p^2}\right)=\prod_p \frac{1}{1+\frac{1}{p^2}+\frac{1}{p^3}+\cdots}$$

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

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

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

(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)($\theta$)
\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

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

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)