******************** **BISECTION METHOD** *********************

PROBLEM NO : 11 **DATE : 15/03/2023**

ROLL NO : 1153

❖ STATEMENT OF THE PROBLEM :

Write a c program to find a positive root of a following equation correct upto 5 decimal places by BISECTION METHOD.

$$3(2-px)^2 + x*\cos(2+px)=2$$

Where $p=1.5+\frac{R}{20}$ [Here R is the last digit of your roll no.]

❖ WORKING FORMULA :

We select a sufficiently small interval $[a_0, b_0]$ such that $f(a_0)*f(b_0)<0$ and $f'(x)$ has the same sign in (a_0,b_0) and $(0,a_0]$ does not contain any root.
We then proceed to generate a sequence $\{x_n\}$ where x_n gives the n^{th} approximation of the actual root of $f(x)=0$ in $[a_0, b_0]$. Take $x_1=\frac{a_0+b_0}{2}$
if $f(x_1)=0$ then x_1 is the actual root of $f(x)=0$, otherwise we obtain,
$a_1=a_0$, $b_0=x_1$ if $f(a_0)*f(x_1)<0$
or , $a_1=x_1$, $b_1=b_0$ if $f(x_1)*f(b_0)<0$

Therefore the root lies in the interval $(a_1,b1)$.
In this way we obtain , $x_k=1,2,3,\ldots,n,\ldots\ldots$ and

Set $a_{+1}=a_k$, $b_{k+1} = x_{k+1}$ if $f(a_k)*f(x_{k+1})<0$

Or $a_{+1}=x_{k+1}$, $b_{k+1}=b_k$ if $f(b_k)*f(x_{k+1})<0$

This process continue until the latest interval $[a_n,b_n]$ containing the root is as small as we desired.

❖ RESULTS :

SIGNATURE OF THE TEACHER

***************** **REGULA FALSI METHOD** ******************

PROBLEM NO : 12 **DATE : 17/03/2023**

ROLL NO : 1153

❖ STATEMENT OF THE PROBLEM :

Write a c program to find a smallest positive root of a following equation correct upto 5 decimal places by Regula Falsi Method.

$$2x^{p+x} + \cos(px) - p = 0$$

Where $p=1+\frac{R+25}{50}$ [Here R is the last digit of your roll no.]

❖ WORKING FORMULA :

We select by tabulation method a sufficiently small interval $[a_o, b_o]$ We select by tabulation method a sufficiently small interval $[a_o,b_o]$ such that $f(a_o) * f(b_o) < 0$ and $f'(x)$ has the same sign in (a_o, b_o) and confirm that $(0,a_o]$ does not contain any root. We then proceed to generate a sequence $\{x_n\}$ where x_n gives the n^{th} approximation of the actual root of $f(x) = 0$ in $[a_o,b_o]$. Then having obtained x_n we get,

$x_{n+1} = x_n - \frac{f(x_n)}{f(x_n) - f(x_{n-1})}(b_n - a_n)$ and $a_{n+1}=a_n$, $b_{n+1} = x_{n+1}$ if $f(a_n)*f(x_{n+1})<0$
$a_{n+1}=x_{n+1}$, $b_{n+1}=b_n$ if $f(x_{n+1})*f(b_n)<0$

so that $[a_{n+1},b_{n+1}]$ contains the smallest positive root. Taking initially $x_0 = a_0$ or b_0 continues this process for n=0,1,2,...until $|x_{n+1} - x_n|$ as small as we desired.

❖ RESULTS :

SIGNATURE OF THE TEACHER

********************* SECANT METHOD **********************

PROBLEM NO : 13 **DATE : 20/03/2023**

ROLL NO : 1153

❖ STATEMENT OF THE PROBLEM :

Write a c program to find a positive root of a following equation correct upto 5 decimal places by BISECTION METHOD.

$$3(2-px)^2 + x*\cos(2+px)=2$$

Where $p=1.5+\frac{R}{20}$ [Here R is the last digit of your roll no.]

❖ WORKING RULE :

Let x_0 and x_2 be the first approximation of the equation f(x) = 0. We then proceed to generate a sequence $\{x_n\}$ where x_n gives the nth approximation of the actual root of f(x) = 0. Then having obtained x_n, we get

$$x_{n+1} = x_n - \frac{f(x_n)}{f(x_n) - f(x_{n-1})}(x_n - x_{n-1})$$

Continues this process for n=0,1,2,..until $|x_{n+1} - x_n|$ as small as we desired.

❖ RESULT :

SIGNATURE OF THE TEACHER

************** GAUSSELIMINATION METHOD ****************

PROBLEM NO : 15 **DATE : 04/04/2023**

ROLL NO : 1153

❖ STATEMENT OF THE PROBLEM :

Write a C-programming to solve the following system of linear equation by Gausselimination Method correct upto five decimal places.

AX=B ,

Where A $= \begin{bmatrix} 3.91 + a & 1.13 & 0.15 & 0.85 \\ 1.13 & -3.81 + a & -0.39 & 0.97 \\ 0.15 & -0.39 & -5.01 + a & 1.03 \\ 0.85 & 0.97 & 1.03 & 4.11 + a \end{bmatrix}$

a = 0.5+ $\frac{R}{10}$ [Here R is the last digit of your roll no.]

$X=[\ x_1\ \ x_2\ \ x_3\ \ x_4\ ]^T$

$B=[\ 1.11\ \ -2.12\ \ 3.13\ \ 1.23\ ]^T$

❖ WORKING RULE:

By this method the the solution of the following system of equation is given by

$$x_i = \frac{1}{a_{ii}^{(i)}}\left[b_i^{(i)} - \sum_{j=i+1}^{n} a_{ij}^{(i)} x_j\right]$$

Where, i,j=1,2,3,4,....n and j=n-1,n-2,...

❖ RESULT :

SIGNATURE OF THE TEACHER

*******CROUT'S LU DECOMPOSITION METHOD***********

PROBLEM NO : 16 **DATE : 06/04/2023**

ROLL NO : 1153

❖ STATEMENT OF THE PROBLEM :

Write a C-programming to solve the following system of linear equation by LU Decomposition Method correct upto four decimal places.

AX=B ,

Where A $= \begin{bmatrix} 5.11+a & 1.32 & 0.91 & -1.81 \\ 2.31 & 6.45+a & 1.11 & 0.45 \\ 1.69 & -0.45 & 5.27+a & 1.06 \\ 2.08 & 1.19 & -2.18 & 7.15+a \end{bmatrix}$

a $= \frac{R}{2}$ [Here R is the last digit of your roll no.]

$X=[\ x_1\ \ x_2\ \ x_3\ \ x_4\ ]^T$

$B=[\ -1.49\ \ 8.19\ \ -8.54\ \ 30.95\ ]^T$

❖ WORKING RULE:

SIGNATURE OF THE TEACHER

****************** GAUSS JACOBI METHOD *****************

PROBLEM NO : 17 **DATE : 11/04/2023**

ROLL NO : 1153

❖ STATEMENT OF THE PROBLEM :

Write a C-programming to solve the following system of linear equation by LU Decomposition Method correct upto five decimal places.

AX=B ,

Where A $=\begin{bmatrix} 4.49+a & 1.41 & 1.28 & 1.35 \\ 1.19 & -7.31+a & -3.14 & 2.23 \\ 1.88 & -2.74 & 7.55+a & 1.85 \\ 1.85 & 2.23 & 1.65 & 6.41+a \end{bmatrix}$

a = 1+0.1*R [Here R is the last digit of your roll no.]

X=[x_1 x_2 x_3 x_4 $]^T$

B= [4.41 5.14 -4.27 3.76 $]^T$

❖ WORKING RULE:

The (r+1)th approximation is given by

$$x_i^{(r+1)} = \frac{b_i}{a_{ij}} - \sum_{\substack{j=1 \\ j \neq i}}^{n} \frac{a_{ij}}{a_{ii}} x_j^{(r)}$$

Where,i=1,2,3,...n and r=0,1,2,...

❖ RESULTS :

SIGNATURE OF THE TEACHER

****************** GAUSS SEIDAL METHOD *****************

PROBLEM NO : 18 **DATE : 13/04/2023**

ROLL NO : 1153

❖ STATEMENT OF THE PROBLEM :

Write a C-programming to solve the following system of linear equation by LU Decomposition Method correct upto four decimal places.

AX=B ,

Where A $=\begin{bmatrix} 8.12+a & 1.54 & 1.36 & 1.41 \\ 2.74 & 9.65+a & 2.65 & 2.23 \\ 1.14 & -0.57 & 8.45+a & 2.07 \\ -0.23 & -2.04 & -1.59 & 7.24+a \end{bmatrix}$

a $=1.2+\frac{R}{4}$ [Here R is the last digit of your roll no.]

$X=[\ x_1\ x_2\ x_3\ x_4\ ]^T$

$B=[\ 1.74\text{-}a\ \ 10.56\text{-}a\ \ 11.63\text{-}a\ \ 2.87\text{-}a\ ]^T$

❖ WORKING RULE:

Rearrange the given equation such that the coefficient matrix A of the new system becomes diagonally dominant. In this method (r+1)th approximation is given by

$$x_i^{(r+1)} = \frac{b_i}{a_{ij}} - \sum_{j<i} \frac{a_{ij}}{a_{ii}} x_j^{(r+1)} - \sum_{j>i} \frac{a_{ij}}{a_{ii}} x_j^{(r)}$$

i,j=1,2,3,4 and r =0,1,2,...

❖ RESULTS :

SIGNATURE OF THE TEACHER

************************POWER METHOD ************************

PROBLEM NO : 19 **DATE : 20/04/2023**

ROLL NO : 1153

❖ STATEMENT OF THE PROBLEM :

Write a C-programming to compute dominant eigen pair of the following matrix correct upto four decimal places by Power Method.

AX=B ,

Where A $= \begin{bmatrix} 8.11+r & 3.24 & 1.24 & -0.18 \\ 3.24 & 9.57+r & 0.77 & -0.55 \\ 1.24 & 0.77 & 9.89+r & 2.89 \\ -0.18 & -0.55 & 2.89 & 6.66+r \end{bmatrix}$

a $= \frac{R+4}{20}$ [Here R is the last digit of your roll no.]

❖ WORKING RULE:

Let x_1 be the eigen vector corresponding to the largest eigenvalue of the matrix A.Let v_o be an initial guess for $x_{1,}$ Then the sequence $\{v_k\}$ of vectors generated recusively by, $y_k = Av_k$ and $v_{k+1} = \frac{1}{a_{k+1}}$,k=0,1,2,...

where $a_{k+1} = \max|(y_k)_r|$,$(y_k)_r$ denote the rth component of the vector , y_k,r=1(1)n.The process stops after k steps if the difference of $a_{k-1}$and a_k is within the tollerence level and we declare that a_k is the numerically largest eigen value with corresesponding eigenvector v_k of the matrix A.

❖ RESULTS :

SIGNATURE OF THE TEACHER

************************EULER METHOD ************************

PROBLEM NO : 20 **DATE : 25/04/2023**

ROLL NO : 1153

❖ STATEMENT OF THE PROBLEM :

Write a C-programming to solve the following initial value problem by EULER's METHOD and tabulate the values of y for x=0(0.1)1 round to 4D .

$$\frac{dy}{dx} = \frac{1 + \cos(0.25x^2 + 0.40y^2)}{1 + 0.25x^3 + 0.40y^2}$$

With $y(0)=1 + \frac{R}{10}$ [Here R is the last digit of your roll no.]

❖ WORKING RULE:

Let y(x) be the exact solution of the problem:

$\frac{dy}{dx} = f(x,y)$, $0 \le x \le x_n$

With initial condition $y(x_0)=y_0$.Let y_i denote the approximate value of y at $x=x_i=x_0+ih$, (i=1,2,3,….,n) where h denote the positive increment and $y(x_i) = y_i$,
i=1(1)n. We find y_{i+1} in terms of y_i by the formula $y_{i+1} = y_i + hf(x_i,y_i)$,

$$i = 0(1)n - 1$$

❖ RESULTS :

SIGNATURE OF THE TEACHER

*****************MODIFIED EULER METHOD *****************

PROBLEM NO : 21 **DATE : 27/04/2023**

ROLL NO : 1153

❖ STATEMENT OF THE PROBLEM :

Write a C-programming to solve the following initial value problem by MODIFIED EULER's METHOD and tabulate the values of y for x=0.1(0.1)1 round to 4D .

$$\frac{dy}{dx} = \frac{\sqrt[3]{1 + x^3y^3}}{\sqrt{1 + x^2y^2}}$$

With $y(0)=1.1 + \frac{R}{100}$ [Here R is the last digit of your roll n

❖ WORKING RULE:

Let y(x) be the exact solution of the problem:

$\frac{dy}{dx} = f(x,y)$, $x_o \leq x \leq x_n$

With initial condition $y(x_o)=y_o$.Let y_i denote the approximate value of y at $x=x_i=x_o+ih$, (i=1,2,3,....,n) where h denote the positive increment and $y(x_i) = y_i$,

i=1(1)n. We find y_{i+1}in terms of y_i by the formula:

$$y_{i+1}=y_i + hf(x_i + \frac{h}{2},y_i + \frac{h}{2}f(x_i,y_i))$$

❖ RESULTS :

SIGNATURE OF THE TEACHER

******************RUNGE KUTTA METHOD ******************

PROBLEM NO : 22 **DATE : 04/05/2023**

ROLL NO : 1153

❖ STATEMENT OF THE PROBLEM :

Write a C-programming to solve the following initial value problem by MODIFIED EULER's METHOD and tabulate the values of y for x=0.1(0.1)1 round to 4D .

$$\frac{dy}{dx} = \sqrt{\frac{P + xy^2 + (p-1)x^2y}{2 + 1.3x^2 + 3.1y^2}}$$

With y(0) = $1.1 + \frac{R}{50}$ and P=$\frac{28+R}{20}$ [Here R is the last digit of your roll no.]

❖ WORKING RULE:

For an initial value problem

$\frac{dy}{dx} = f(x,y)$ With an initial condition y(a) = o

To find the solution over the interval x ∈ [a,b]. Now we divide the interval [a,b] into n equal subintervals.

The family of explicit Runge-Kutta Method of m'th stage is given by:-

$y_{i+1} = y_i + \sum_{j=1}^{m} \lambda_j k_j$ for i = 0,1,2,…,n – 1,where

$k_1 = hf(x_i + y_i)$

$k_2 = hf\left(x_i + \frac{h}{2}, y_i + \frac{k_1}{2}\right)$

$k_3 = hf\left(x_i + \frac{h}{2}, y_i + \frac{k_2}{2}\right)$

$k_4 = hf(x_i + h, y_i + k_3)$

❖ RESULTS :

SIGNATURE OF THE TEACHER

*********************PICARD'S METHOD *********************

PROBLEM NO : 23 **DATE : 11/05/2023**

ROLL NO : 1153

❖ **STATEMENT OF THE PROBLEM :**

Write a C-programming to solve the following differential equation for x=0.4 by PICARD'S METHOD upto 3rd approximation correct to 4D .

$$\frac{\mathrm{dy}}{\mathrm{dx}} = x^2 + y^2$$

With y(0) = $\frac{\mathrm{R}}{10}$ [Here R is the last digit of your roll no.]

❖ **WORKING RULE:**

Let y be the exact solution of the problem: $\frac{dy}{dx} = f(x,y), x_0 \le x \le x_r$

With initial condition $y(x_0) = y_0$. Let $y^{(i)}(x)$ denotes the i^{th} approximate value of $y(x)$. We find $y^{(i+1)}(x)$ in terms of $y^{(i)}(x)$ by the formula

$$y^{(r)} = y_0 + \int_{x_0}^{x} f\left(x, y^{(r-1)}\right) dx, (x \ge 1)$$

The value of $y(x_i)$ at each iteration is computed directly by substituting the value of x_i=x_0 $+ ih$ for $i = 0(1)$, to a desire degree of accuracy.

❖ **RESULTS :**

SIGNATURE OF THE TEACHER

******************STRAIGHT LINE FITTING *******************

PROBLEM NO : 24 **DATE : 08/05/2023**

ROLL NO : 1153

❖ STATEMENT OF THE PROBLEM :

Fit a straight line of the form $y = ax + b$ to the following data by least square method correct to 4D:

x	1.4	2.4	3.4	4.4	5.4	6.4	7.4	8.4	9.4
y	$3.9 + k^J$	$7.4+k^J$	$9.1+k^J$	$12.5+k^J$	$15.9+k^J$	$20.1+k^J$	$24.6+k^J$	$23.6+k^J$	$29.5+k^J$

where $k^J = \frac{3R}{20}$ and R is the last digit of your Roll Number.

❖ WORKING FORMULA : STRAIGHT LINE FITTING

Suppose it is required to fit a straight line $y = ax + b$ to a given set of observations $(x_1, y_1), (x_2, y_2), \ldots, (x_n, y_n)$.

The normal equations are $\sum_{i=1}^{n} y_i = a\sum_{i=1}^{n} x_i + nb$ and $\sum_{i=1}^{n} x_i y_i = a\sum_{i=1}^{n} x_i^2 + b\sum_{i=1}^{n} x_i$

Solving these equations for a and b and using these values in the equation $y = ax + b$, we obtain the desired curve of best fit.

❖ RESULT :

The required straight line is y = x +

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***************PARABOLIC CURVE FITTING ***************

PROBLEM NO : 25 **DATE : 10/05/2023**

ROLL NO : 1153

❖ STATEMENT OF THE PROBLEM :

Fit a curve of the form $y = a + bx + cx^2$ to the following data by least square method, correct to 4D:

x	2.1	3.1	4.1	5.1	6.1	7.1	8.1	9.1
$y - \frac{R}{10}$	6.2571	8.9821	11.6305	15.8305	19.3065	22.5 247	27.8189	31.2772

where R be the last digit of your Roll Number.

❖ WORKING FORMULA : PARABOLIC CURVE FITTING

Suppose the equation to be fit is given by $y = a + bx + cx^2$.Let the data points be $(x_1, y_1), (x_2, y_2), \ldots. (x_n, y_n)$.

The normal equations are

$$\sum y_i = na + b\sum x_i + c\sum x_i^2$$
$$\sum x_i y_i = a\sum x_i + b\sum x_i^2 + c\sum x_i^3$$
$$\sum x_i^2 y_i = a\sum x_i^2 + b\sum x_i^3 + c\sum x_i^3$$

Solving these linear equations for a , b and c, and using these values in equation $y = a + bx + cx^2$, we obtain the desired curve of best fit.

❖ RESULT :

The required curve is

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