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**Practical 09: Guass Seidel’s Iteration Method**

**Objective:**To find root of the system equation using Guass Seidel’s Iteration method.

**2. Algorithm:**

1. Start

2. Input the matrix of equations in arr[n][n+1] where n is number of unknown variables

3. Check the validity of the equations, if valid we can apply iterative methods !!!

1. Matrix X[n] , for unknown variables.
2. Take x0=y0=z0=0
3. Convert the variables as a function of other variables.
4. Apply iteration method in loop with immediate updation:

x=f(y0,z0)

y=f(z0,x)

z=f(x,y)

x=x0

y=y0

z=z0

if((z-z0)>allowed Error AND (y-y0)>allowed Error AND (x-x0)>allowed Error )

Terminate Loop

8. Solution:

for(i= n-1; i>=0; i--){

X[i]= (arr[i][n])/arr[i][i];

}

9. Print X

10. Stop

**Code:**

#include <stdio.h>

#include <math.h>

#include <stdlib.h>

float arr[3][4],x[3];

int n=3;

/\*

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8x-3y+2z=20

4x+11y-z=33

6x+3y+12z=35

\*/

#define x(y0, z0) (arr[0][3] - (arr[0][2]\*z0 + arr[0][1]\*y0)) / arr[0][0]

#define y(x0, z0) (arr[1][3] - (arr[1][2]\*z0 + arr[1][0]\*x0)) / arr[1][1]

#define z(y0, x0) (arr[2][3] - (arr[2][0]\*x0 + arr[2][1]\*y0)) / arr[2][2]

void checkValidity(){

for (int i = 0; i < n; i++)

{

float sum=0;

for(int j=0; j<n; j++){

if(i!=j){

sum+=fabs(arr[i][j]);

}

}

if((fabs(arr[i][i])-sum)<0){

printf("Can't apply iteration method !!!!\n\n");

exit(1);

}

}

printf("Can apply iteration method !!!!\n\n");

}

int main()

{

printf("Enter coefficients of Augmented Matrix:\n");

for (int i = 0; i < n; i++)

{

for (int j = 0; j < n + 1; j++)

{

printf("a[%d][%d] = ", i, j);

scanf("%f", &arr[i][j]);

}

}

checkValidity();

int iter = 1;

float allErr, fabx, faby, fabz, deltaX, deltaY, deltaZ;

float x0 = 0.0, y0 = 0.0, z0 = 0.0;

printf("Enter the allowed error: ");

scanf(" %f", &allErr);

printf("\n\nIteration\t\tx0\t\ty0\t\tz0\t\t\tx1\t\ty1\t\tz1\n\n");

do

{

/\* code \*/

float xTemp=x0;

float yTemp=y0;

float zTemp=z0;

fabx = fabs(x(y0, z0));

deltaX = fabs(x0 - fabx);

x0 = fabx; // Immediate Updation

faby = fabs(y(x0, z0));

deltaY = fabs(y0 - faby);

y0 = faby; // Immediate Updation

fabz = fabs(z(y0, x0));

deltaZ = fabs(z0 - fabz);

z0 = fabz; // Immediate Updation

printf("%d\t\t\t%f\t%f\t%f\t\t%f\t%f\t%f\n", iter, xTemp, yTemp, zTemp, fabx, faby, fabz);

iter++;

// } while (iter<15);

} while ((deltaX > allErr) || (deltaY > allErr) || (deltaZ > allErr));

printf("\n\nThe roots are: \n");

printf("x= %f\n", fabx);

printf("y= %f\n", faby);

printf("z= %f\n", fabz);

return 0;

}

**Output:**

PS D:\01\_Java\Deepankar\CCpp\CBNST\Practical-09-GuassSeidel> cd "d:\01\_Java\Deepankar\CCpp\CBNST\Practical-09-GuassSeidel\" ; if ($?) { g++ \_10\_guassSeidel.cpp -o \_10\_guassSeidel } ; if

($?) { .\\_10\_guassSeidel }

Enter coefficients of Augmented Matrix:

a[0][0] = 8

a[0][1] = -3

a[0][2] = 2

a[0][3] = 20

a[1][0] = 4

a[1][1] = 11

a[1][2] = -1

a[1][3] = 33

a[2][0] = 6

a[2][1] = 3

a[2][2] = 12

a[2][3] = 35

Can apply iteration method !!!!

Enter the allowed error: 0.0001

Iteration x0 y0 z0 x1 y1 z1

1 0.000000 0.000000 0.000000 2.500000 2.090909 1.143939

2 2.500000 2.090909 1.143939 2.998106 2.013774 0.914170

3 2.998106 2.013774 0.914170 3.026623 1.982516 0.907726

4 3.026623 1.982516 0.907726 3.016512 1.985607 0.912009

5 3.016512 1.985607 0.912009 3.016600 1.985964 0.911875

6 3.016600 1.985964 0.911875 3.016768 1.985891 0.911810

7 3.016768 1.985891 0.911810 3.016757 1.985889 0.911816

The roots are:

x= 3.016757

y= 1.985889

z= 0.911816