Detyra 2

Analize Numerike

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(Per Ekzekutimin e kodit detyra2.java mjafton te hiqet komenti para metodes qe therritet tek metoda main)

Ekuacioni Ax=b

$10 x_1 – x_2 + 2 x_3 = 6$

$–x_1 + 11 x_2 – x_3 + 3 x_4 = 25$

$2x_1 – x_2 +10 x_3 –x_4 = –11$

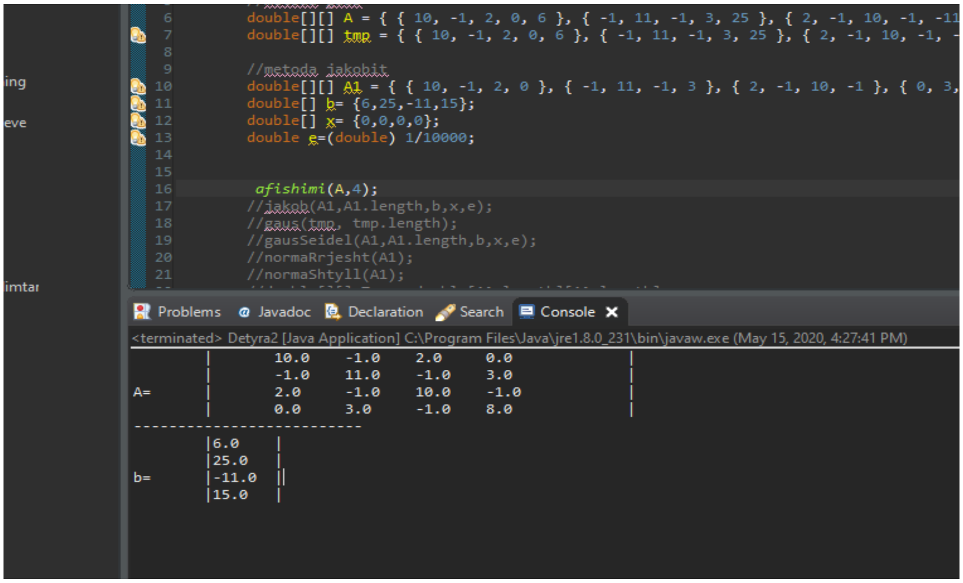
$3 x_2 – x_3 + 8 x_4 = 15$

a)Algoritmi afishimit te matrices A dhe vektorit b.Matrica ka permasat n me n+1, ku n+1 eshte kolona e vektorit b.

```
public static void afishimi(double[][] A, int n) {


        for (int i = 0; i < n; i++) {
            if (i == 2) {
                System.out.print("A=");
            }
            System.out.print("\t|\t");
            for (int j = 0; j < n; j++) {
                System.out.print(A[i][j] + "\t");
            }
            System.out.println("\t|");
        }
```

```
          System.out.println("--------------------------");
          for (int i = 0; i < n; i++) {
                    if (i == 2) {
                              System.out.print("b=");
                    }
                    System.out.println("\t|" + A[i][n] + "\t|");
          }
}
```

Pas afishimit :



```
double[][] A = { { 10, -1, 2, 0, 6 }, { -1, 11, -1, 3, 25 }, { 2, -1, 10, -1, -11
double[][] tmp = { { 10, -1, 2, 0, 6 }, { -1, 11, -1, 3, 25 }, { 2, -1, 10, -1, -

//metoda jakobit
double[][] A1 = { { 10, -1, 2, 0 }, { -1, 11, -1, 3 }, { 2, -1, 10, -1 }, { 0, 3,
double[] b= {6,25,-11,15};
double[] x= {0,0,0,0};
double e=(double) 1/10000;


 afishimi(A,4);
//jakob(A1,A1.length,b,x,e);
//gaus(tmp, tmp.length);
//gausSeidel(A1,A1.length,b,x,e);
//normaRrjesht(A1);
//normaShtyll(A1);
```

```
<terminated> Detyra2 [Java Application] C:\Program Files\Java\jre1.8.0_231\bin\javaw.exe (May 15, 2020, 4:27:41 PM)
        |       10.0    -1.0    2.0     0.0             |
        |       -1.0    11.0    -1.0    3.0             |
A=      |       2.0     -1.0    10.0    -1.0            |
        |       0.0     3.0     -1.0    8.0             |
--------------------------
        |6.0    |
        |25.0   |
b=      |-11.0  ||
        |15.0   |
```

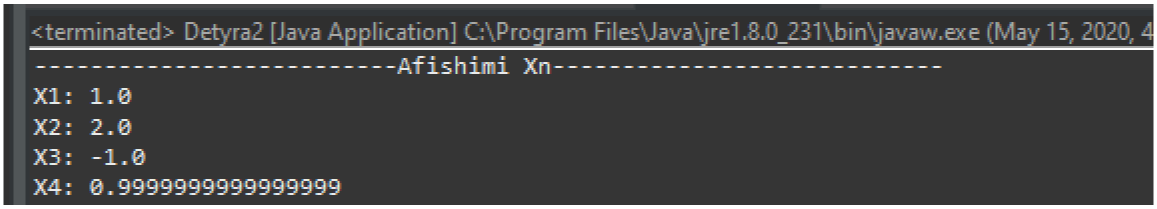
b)Zgjidhja e sistemit me metoden e Gausit

```
public static void gaus(double[][] A, int n) {
          double[][] g = new double[n][n];
          for (int k = 0; k < n - 1; k++) {
                    for (int i = k + 1; i < n; i++) {
                              g[i][k] = A[i][k] / A[k][k];
```

```
        for (int j = k; j < n + 1; j++) {
            A[i][j] = A[i][j] - g[i][k] * A[k][j];
        }
    }

}
double[] x = new double[n];
x[n - 1] = A[n - 1][n] / A[n - 1][n - 1];
for (int i = n - 2; i >= 0; i--) {
    double S = A[i][n];
    for (int j = i + 1; j < n; j++) {
        S = S - A[i][j] * x[j];
    }
    x[i] = S / A[i][i];
}
System.out.println("--------------------------Afishimi Xn----------------------------");
for (int i = 0; i < n; i++) {
    System.out.println("X" + (i + 1) + ": " + x[i]);
}
System.out.println("--------------------------Afishimi L----------------------------");
for (int i = 0; i < n; i++) {
    g[i][i] = 1;
}
for (int i = 0; i < n; i++) {
        for (int j = 0; j < n; j++) {

            System.out.print(g[i][j] + " ");

        }

        System.out.println();

    }


    System.out.println("--------------------------Afishimi U----------------------------");

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

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

            System.out.print(A[i][j] + " ");

        }

        System.out.println();

    }


}
```

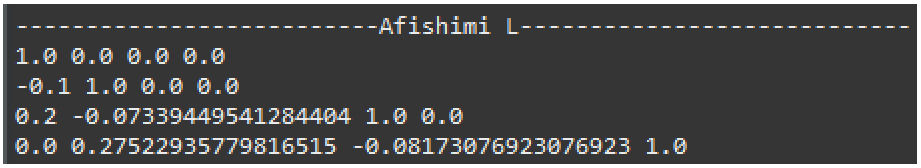
Rezultatet e metodes se Gausit:

(X4 ka dale 0.99999999999999999 pasi ne nje nga fazat A[i][j] doli me me shum shifra pas presjes se sa c eshte madhesia e ‘double’ prndj ka nje gabim shm te vogel per shkak te gabimeve te llogaaritjes kompjuterike)



```
<terminated> Detyra2 [Java Application] C:\Program Files\Java\jre1.8.0_231\bin\javaw.exe (May 15, 2020, 4
--------------------------Afishimi Xn----------------------------
X1: 1.0
X2: 2.0
X3: -1.0
X4: 0.9999999999999999
```

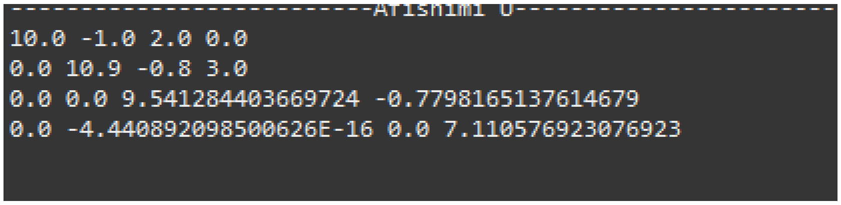
Matrica L:



```
-------------------------Afishimi L---------------------------
1.0 0.0 0.0 0.0
-0.1 1.0 0.0 0.0
0.2 -0.07339449541284404 1.0 0.0
0.0 0.27522935779816515 -0.08173076923076923 1.0
```

Matrica U:

(A[3][1] ka vleren -4.44089 *10^{-16} qe esht nje vlere shum e vogel afer 0 qe teorikisht duhet te ishte 0 por per shkak te gebimit kompjuterik ne llogaritje ka dal nje vlere shm e vogel afer 0)



```
------------------------Afishimi U---------------------
10.0 -1.0 2.0 0.0
0.0 10.9 -0.8 3.0
0.0 0.0 9.541284403669724 -0.7798165137614679
0.0 -4.440892098500626E-16 0.0 7.110576923076923
```

c) Ekuacioni Ax=b

10 x1 – x2 + 2 x3 = 6

–x1 + 11 x2 – x3 + 3 x4 = 25

2x1 – x2 +10 x3 –x4 = –11

3 x2 – x3 + 8 x4 = 15

Ekuacioni X=Tx+d;

X_1=(6-2X_3+X_2)/10

X_2=(25-3X_4+X_3+X_1)/11

X_3=(-11+X_4+X_2-2X_1)/10

X_4=(15+X_3-3X_2)/8

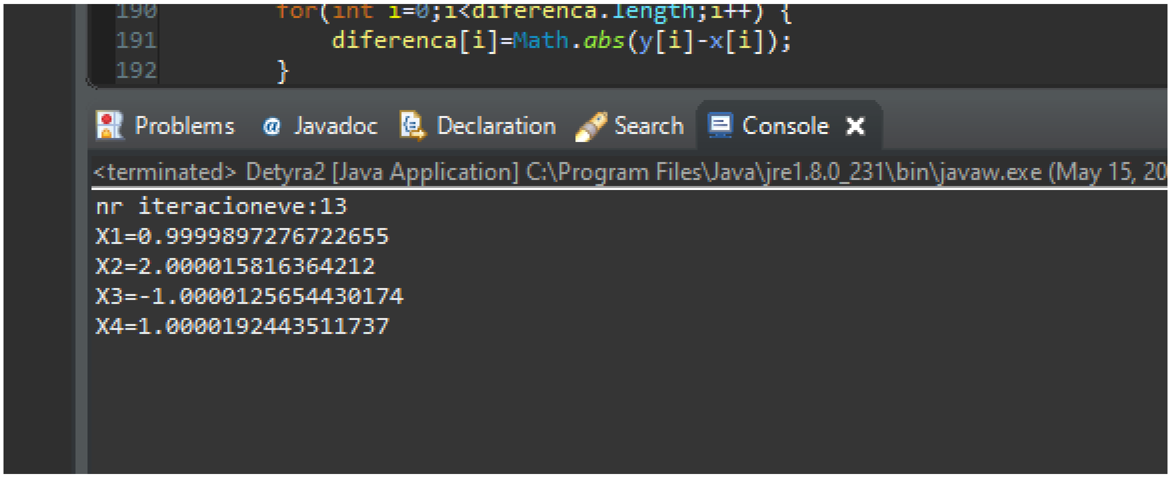
d) Metoda Jakobit:

```
public static void jakob(double[][] A,int n,double[] b,double[] x,double e) {
            double[] y= {0,0,0,0};
            int k=0;
            boolean finished=false;
```

```
    while(!finished) {
        k++;
        for(int i=0;i<n;i++) {
            double S=b[i];
            for(int j=0;j<i;j++) {
                S=S-A[i][j]*x[j];
            }
            for(int j=i+1;j<n;j++) {
                S=S-A[i][j]*x[j];
            }
            y[i]=S/A[i][i];
        }
        if(kontrolloKushtin(x,y,e)) {
            finished=true;
        }
        else {
            for(int i=0;i<n;i++) {
                x[i]=y[i];
            }
        }

    }
    System.out.println("nr iteracioneve:"+k);
    for(int i=0;i<y.length;i++) {
        System.out.println(y[i]);
    }
}
```

```
public static boolean kontrolloKushtin(double[] x,double[] y,double e){
    double[] diferenca=new double[x.length];
    for(int i=0;i<diferenca.length;i++) {
        diferenca[i]=Math.abs(y[i]-x[i]);
    }
    double max=-99999;
    for(int i=0;i<diferenca.length;i++) {
        if(diferenca[i]>max) {
            max=diferenca[i];
        }
    }
    if(max<e) {
        return true;
    }
    else {
        return false;
    }
}
```

Rezultati:



```
        for(int i=0;i<diferenca.length;i++) {
            diferenca[i]=Math.abs(y[i]-x[i]);
        }
```

<terminated> Detyra2 [Java Application] C:\Program Files\Java\jre1.8.0_231\bin\javaw.exe (May 15, 20

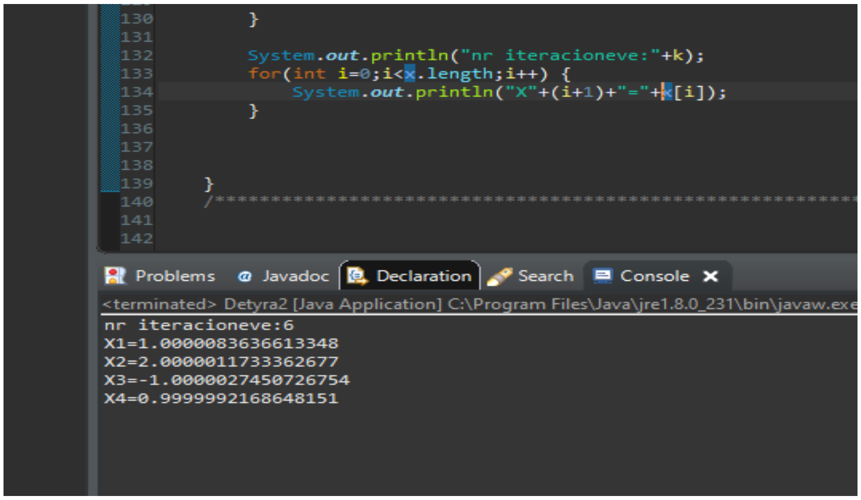
```
nr iteracioneve:13
X1=0.9999897276722655
X2=2.000015816364212
X3=-1.0000125654430174
X4=1.0000192443511737
```

Metoda:Gaus-Seidel

```
public static void gausSeidel(double[][] A,int n,double[] b,double[] x,double e) {
        double[] y= {0,0,0,0};
        int k=0;
        boolean finished=false;
        while(!finished) {
                k++;
                for(int i=0;i<n;i++) {
                        double S=b[i];
                        for(int j=0;j<i;j++) {
                                S=S-A[i][j]*x[j];
                        }
                        for(int j=i+1;j<n;j++) {
                                S=S-A[i][j]*x[j];
                        }
                        x[i]=S/A[i][i];
                }
```

```
            if(kontrolloKushtin(y,x,e)) {
                finished=true;
            }
            else {
                for(int i=0;i<n;i++) {
                    y[i]=x[i];
                }
            }
        }



        System.out.println("nr iteracioneve:"+k);
        for(int i=0;i<x.length;i++) {
            System.out.println("X"+(i+1)+"="+x[i]);
        }




    }
```

Rezultatet:



```
        }

        System.out.println("nr iteracioneve:"+k);
        for(int i=0;i<x.length;i++) {
            System.out.println("X"+(i+1)+"="+x[i]);
        }



    }
    /*************************************************************
```

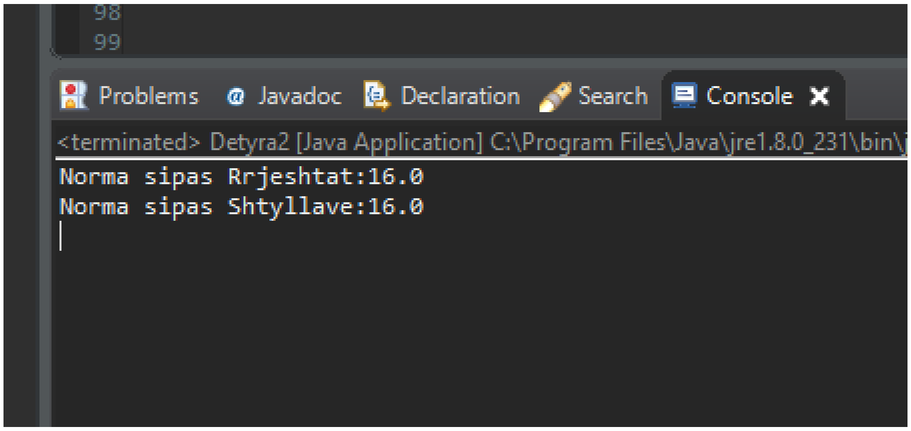
```
<terminated> Detyra2 [Java Application] C:\Program Files\Java\jre1.8.0_231\bin\javaw.exe
nr iteracioneve:6
X1=1.0000083636613348
X2=2.0000011733362677
X3=-1.0000027450726754
X4=0.9999992168648151
```

e)Normat sipas rrjeshtave dhe shtyllave per matricen A;

```
public static void normaRrjesht(double[][] A) {
        double max=-999999999;
        for(int i=0;i<A.length;i++) {
            double S=0;
            for(int j=0;j<A[0].length;j++) {
                S=S+Math.abs(A[i][j]);
            }
            if(S>max) {
                max=S;
            }

        }

        System.out.println("Norma sipas Rrjeshtat:"+max);

    }
```

```
/**********************norma sipas shtyllave***************/

public static void normaShtyll(double[][] A) {
        double max=-999999999;
        for(int i=0;i<A[0].length;i++) {
                double S=0;
                for(int j=0;j<A.length;j++) {
                        S=S+Math.abs(A[j][i]);
                }
                if(S>max) {
                        max=S;
                }

        }
        System.out.println("Norma sipas Shtyllave:"+max);

}
```

Rezultatet per matricen A:

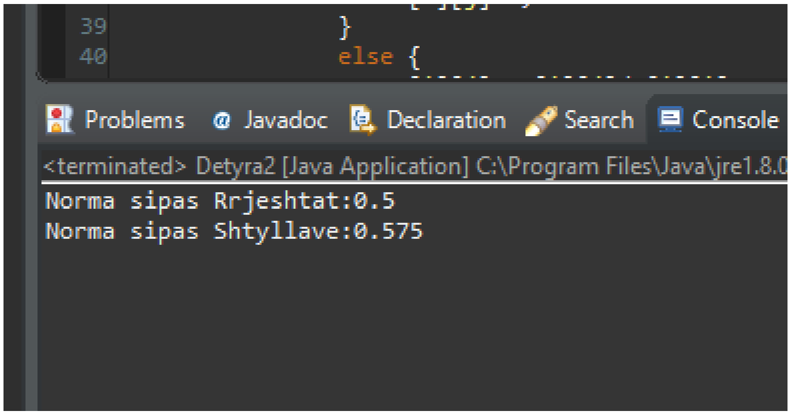


```
<terminated> Detyra2 [Java Application] C:\Program Files\Java\jre1.8.0_231\bin\j
Norma sipas Rrjeshtat:16.0
Norma sipas Shtyllave:16.0
```

Gjetja e matrices T dhe me pas afishimi I normave te saj:

```
public static double[][] gjetjaT(double[][] A,int n) {
                double[][] T=new double[n][n];
                for(int i=0;i<n;i++) {
                        for(int j=0;j<n;j++) {
                                if(i==j) {
                                        T[i][j]=0;
                                }
                                else {
                                        T[i][j]=-A[i][j]/A[i][i];
                                }
                        }
                }
                return T;

        }
```

Rezultati normave per matricen T:



```
                }
                else {
```

```
<terminated> Detyra2 [Java Application] C:\Program Files\Java\jre1.8.0
Norma sipas Rrjeshtat:0.5
Norma sipas Shtyllave:0.575
```

f)Permbledhja e rezultateve:

Algoritmi	Rezultati	Nr_iteracioneve	Gabimi

Jakobi	X1=0.9999897276722655
	X2=2.000015816364212
	X3=-1.0000125654430174
	X4=1.0000192443511737
		13	10^{-4}

Gaus-Seidel	X1=1.0000083636613348
	X2=2.0000011733362677
	X3=-1.0000027450726754
	X4=0.9999992168648151
		6	10^{-4}

Duke shqyrtuar rezultatet vihet re se metoda me e sakte eshte e Gausit.Por ajo metode nk eshte e vlefshme per n te medha prandaj duhen perdorur metodat iterative te Jakobit dhe Gaus-Seidelit.

Nr me te vogel te iteracioneve e kerkon Gaus-Seidel per te njejtin gabim,pra metoda e Gaus-Seidel konvergjon me shpejt se ajo e Jakobit.