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Лабораторная работа № 3

Решение систем линейных алгебраических уравнений

Задание 1.1

1. Даны матрицы А и В. найти:

а) число обусловленности матрицы А в норме максимум $\|\cdot\|_\infty$;

```
f[i_, j_] := Which[i > j, 1, i == j, i + 1, i < j, 2]
A = Array[f, {7, 7}]
```

{{2, 2, 2, 2, 2, 2, 2}, {1, 3, 2, 2, 2, 2, 2},
 {1, 1, 4, 2, 2, 2, 2}, {1, 1, 1, 5, 2, 2, 2},
 {1, 1, 1, 1, 6, 2, 2}, {1, 1, 1, 1, 1, 7, 2}, {1, 1, 1, 1, 1, 1, 8}}

```
MatrixForm[A]
```

$$\begin{pmatrix} 2 & 2 & 2 & 2 & 2 & 2 & 2 \\ 1 & 3 & 2 & 2 & 2 & 2 & 2 \\ 1 & 1 & 4 & 2 & 2 & 2 & 2 \\ 1 & 1 & 1 & 5 & 2 & 2 & 2 \\ 1 & 1 & 1 & 1 & 6 & 2 & 2 \\ 1 & 1 & 1 & 1 & 1 & 7 & 2 \\ 1 & 1 & 1 & 1 & 1 & 1 & 8 \end{pmatrix}$$ (*Матрица A*)

```
g[i_] := 6 i - i^2
B = Array[g, 7]
```

{5, 8, 9, 8, 5, 0, -7}

```
MatrixForm[B]
```

$$\begin{pmatrix} 5 \\ 8 \\ 9 \\ 8 \\ 5 \\ 0 \\ -7 \end{pmatrix}$$ (*Матрица B*)

```
invA =  Inverse[A] (*Обратная матрица матрице A*)
```

$$\left\{\left\{\frac{13}{14}, -\frac{1}{2}, -\frac{1}{6}, -\frac{1}{12}, -\frac{1}{20}, -\frac{1}{30}, -\frac{1}{42}\right\}, \left\{-\frac{1}{14}, \frac{1}{2}, -\frac{1}{6}, -\frac{1}{12}, -\frac{1}{20}, -\frac{1}{30}, -\frac{1}{42}\right\}, \left\{-\frac{1}{14}, 0, \frac{1}{3}, -\frac{1}{12}, -\frac{1}{20}, -\frac{1}{30}, -\frac{1}{42}\right\}, \left\{-\frac{1}{14}, 0, 0, \frac{1}{4}, -\frac{1}{20}, -\frac{1}{30}, -\frac{1}{42}\right\}, \left\{-\frac{1}{14}, 0, 0, 0, \frac{1}{5}, -\frac{1}{30}, -\frac{1}{42}\right\}, \left\{-\frac{1}{14}, 0, 0, 0, 0, \frac{1}{6}, -\frac{1}{42}\right\}, \left\{-\frac{1}{14}, 0, 0, 0, 0, 0, \frac{1}{7}\right\}\right\}$$

normMaxA = Max$\left[\text{Table}\left[\sum_{j=1}^{7} \text{Abs}[A[[i, j]]], \{i, 1, 7\}\right]\right]$

(*Норма-максимум матрицы A*)

14(*Норма-максимум матрицы A*)

```
normMaxInvA = Max[Table[Sum[Abs[invA[[i, j]]], {j, 1, 7}], {i, 1, 7}]]
```

$\frac{25}{14}$ (*Норма-максимум матрицы, обратной A *)

$\frac{25}{14}$

```
K = normMaxA * normMaxInvA
```

25 (*Число обусловленности матрицы A в норме-максимум*)

25

1. а) Ответ : 25

б) Решить точную систему линейных уравнений: AX=B.

```
X = LinearSolve[A, B]
```

$\left\{-\frac{45}{28}, \frac{39}{28}, \frac{53}{28}, \frac{131}{84}, \frac{17}{21}, -\frac{4}{21}, -\frac{19}{14}\right\}$

$\left\{-\frac{45}{28}, \frac{39}{28}, \frac{53}{28}, \frac{131}{84}, \frac{17}{21}, -\frac{4}{21}, -\frac{19}{14}\right\}$ (*Решение системы линейных уравнений*)

$\left\{-\frac{45}{28}, \frac{39}{28}, \frac{53}{28}, \frac{131}{84}, \frac{17}{21}, -\frac{4}{21}, -\frac{19}{14}\right\}$

1. б) Ответ : $\left\{-\frac{45}{28}, \frac{39}{28}, \frac{53}{28}, \frac{131}{84}, \frac{17}{21}, -\frac{4}{21}, -\frac{19}{14}\right\}$

в) вычислить 3 возмущённые системы вида A = B + ΔB

```
B1 = B
B2 = B
B3 = B

incrB = B[[7]]
```

{5, 8, 9, 8, 5, 0, -7}

{5, 8, 9, 8, 5, 0, -7}

{5, 8, 9, 8, 5, 0, -7}

-7

```
B1[[7]] = incrB + incrB * 0.0001(*Увеличиваем на 0.01%*)
```

-7.0007

```
B2[[7]] = incrB + incrB * 0.001(*Увеличиваем на 0.1%*)
```

-7.007

```
B3[[7]] = incrB + incrB * 0.01(*Увеличиваем на 1%*)
```

-7.07

```
X1 = N[LinearSolve[A, B1]] (*Решение первого возмущённого уравнения*)
X2 = N[LinearSolve[A, B2]](*Решение второго возмущённого уравнения*)
X3 = N[LinearSolve[A, B3]](*Решение третьего возмущённого уравнения*)
```

```
{-1.60713, 1.39287, 1.89287, 1.55954, 0.80954, -0.19046, -1.35724}
{-1.60698, 1.39302, 1.89302, 1.55969, 0.80969, -0.19031, -1.35814}
{-1.60548, 1.39452, 1.89452, 1.56119, 0.81119, -0.18881, -1.36714}
```

1. в) ответ :

г) найти прогнозируемую предельную относительную погрешность решения каждой возмущенной системы

```
pogrB1 = 0.00001 Round[K * Norm[Abs[B - B1], 1] / Norm[B + B - B1, 1] 100000]
(*прогнозируемая предельная относительная погрешность для 1 возм-й системы*)
```

```
0.00042
```

```
pogrB2 = 0.0001 Round[K * Norm[Abs[B - B2], 1] / Norm[B + B - B2, 1] 10000]
(*прогнозируемая предельная относительная погрешность для 2 возм-й системы*)
pogrB3 = 0.001 Round[K * Norm[Abs[B - B3], 1] / Norm[B + B - B3, 1] 1000]
(*прогнозируемая предельная относительная погрешность для 3 возм-й системы*)
```

```
0.0042
0.042
```

1. г) Ответ : 0.00042, 0.0042, 0.042

Д) найти относительную погрешность решения каждой возмущенной системы; сделать вывод о зависимости относительной погрешности от величины возмущения и числа обусловленности матрицы А.

```
absPogrX1 = Norm[Abs[X1 - X], 1]
 (*абсолютная погрешность решения первой возмущёенной системы*)
```

```
0.0002
```

```
absPogrX2 = 0.00001 Round[Norm[Abs[X2 - X], 1] 100000]
  (*абсолютная погрешность решения второй возмущёенной системы*)
```

```
0.002
```

```
absPogrX3 = 0.0001 Round[Norm[Abs[X3 - X], 1] 10000]
  (*абсолютная погрешность решения второй возмущёенной системы*)
```

```
0.02
```

```
(*Вычисление относительных погрешностей:*)
```

$$\texttt{relPogrX1 = 0.000001 Round}\left[\frac{\texttt{absPogrX1}}{\texttt{Norm[X1, 1]}}\ 1\,000\,000\right]$$

$$\texttt{relPogrX2 = 0.000001 Round}\left[\frac{\texttt{absPogrX2}}{\texttt{Norm[X2, 1]}}\ 1\,000\,000\right]$$

$$\texttt{relPogrX3 = 0.00001 Round}\left[\frac{\texttt{absPogrX3}}{\texttt{Norm[X3, 1]}}\ 100\,000\right]$$

```
0.000023

0.000227

0.00227
```

Вывод : Погрешность возмущенной задачи пропорционально возрастает с ростом возмущений правой части. Число,
характеризующее зависимость относительной погрешности решения СЛАУ от величины относительного возмущения правой части, называется числом обусловленности матрицы. Если число обусловленности матрицы велико, то говорят, что данная матрица плохо обусловлена.Если число обусловленности близко к единице, то матрица считается хорошо обусловленной.
1.Д) Ответ: 0.000023, 0.000227,0.00227

Задание 1.2

$$\texttt{f[i\_, j\_] :=}\ \frac{1}{i+j-1}$$

```
A = Array[f, {7, 7}]
MatrixForm[A]
```

$$\left\{\left\{1, \frac{1}{2}, \frac{1}{3}, \frac{1}{4}, \frac{1}{5}, \frac{1}{6}, \frac{1}{7}\right\}, \left\{\frac{1}{2}, \frac{1}{3}, \frac{1}{4}, \frac{1}{5}, \frac{1}{6}, \frac{1}{7}, \frac{1}{8}\right\}, \left\{\frac{1}{3}, \frac{1}{4}, \frac{1}{5}, \frac{1}{6}, \frac{1}{7}, \frac{1}{8}, \frac{1}{9}\right\}, \left\{\frac{1}{4}, \frac{1}{5}, \frac{1}{6}, \frac{1}{7}, \frac{1}{8}, \frac{1}{9}, \frac{1}{10}\right\}, \left\{\frac{1}{5}, \frac{1}{6}, \frac{1}{7}, \frac{1}{8}, \frac{1}{9}, \frac{1}{10}, \frac{1}{11}\right\}, \left\{\frac{1}{6}, \frac{1}{7}, \frac{1}{8}, \frac{1}{9}, \frac{1}{10}, \frac{1}{11}, \frac{1}{12}\right\}, \left\{\frac{1}{7}, \frac{1}{8}, \frac{1}{9}, \frac{1}{10}, \frac{1}{11}, \frac{1}{12}, \frac{1}{13}\right\}\right\}$$

$$\begin{pmatrix} 1 & \frac{1}{2} & \frac{1}{3} & \frac{1}{4} & \frac{1}{5} & \frac{1}{6} & \frac{1}{7} \\ \frac{1}{2} & \frac{1}{3} & \frac{1}{4} & \frac{1}{5} & \frac{1}{6} & \frac{1}{7} & \frac{1}{8} \\ \frac{1}{3} & \frac{1}{4} & \frac{1}{5} & \frac{1}{6} & \frac{1}{7} & \frac{1}{8} & \frac{1}{9} \\ \frac{1}{4} & \frac{1}{5} & \frac{1}{6} & \frac{1}{7} & \frac{1}{8} & \frac{1}{9} & \frac{1}{10} \\ \frac{1}{5} & \frac{1}{6} & \frac{1}{7} & \frac{1}{8} & \frac{1}{9} & \frac{1}{10} & \frac{1}{11} \\ \frac{1}{6} & \frac{1}{7} & \frac{1}{8} & \frac{1}{9} & \frac{1}{10} & \frac{1}{11} & \frac{1}{12} \\ \frac{1}{7} & \frac{1}{8} & \frac{1}{9} & \frac{1}{10} & \frac{1}{11} & \frac{1}{12} & \frac{1}{13} \end{pmatrix} \texttt{(*матрица A*)}$$

```
g[i_] := 3 i - 6
B = Array[g, 7]
MatrixForm[B]
```

```
{-3, 0, 3, 6, 9, 12, 15}
```

$$\begin{pmatrix} -3 \\ 0 \\ 3 \\ 6 \\ 9 \\ 12 \\ 15 \end{pmatrix}$$ (*Матрица B*)

```
invA = Inverse[A] (*Обратная матрица матрице A*)
```

{{49, -1176, 8820, -29 400, 48 510, -38 808, 12 012},
{-1176, 37 632, -317 520, 1 128 960, -1 940 400, 1 596 672, -504 504},
{8820, -317 520, 2 857 680, -10 584 000, 18 711 000, -15 717 240, 5 045 040},
{-29 400, 1 128 960, -10 584 000, 40 320 000, -72 765 000, 62 092 800, -20 180 160},
{48 510, -1 940 400, 18 711 000, -72 765 000, 133 402 500, -115 259 760, 37 837 800},
{-38 808, 1 596 672, -15 717 240, 62 092 800, -115 259 760, 100 590 336, -33 297 264},
{12 012, -504 504, 5 045 040, -20 180 160, 37 837 800, -33 297 264, 11 099 088}}

normMaxA = $N\left[\text{Max}\left[\text{Table}\left[\sum_{j=1}^{7} \text{Abs}[A[[i, j]]], \{i, 1, 7\}\right]\right]\right]$

(*Норма-максимум матрицы A*)

2.59286

normMaxInvA = $\text{Max}\left[\text{Table}\left[\sum_{j=1}^{7} \text{Abs}[\text{invA}[[i, j]]], \{i, 1, 7\}\right]\right]$

(*Норма-максимум матрицы, обратной A*)

379 964 970

```
K = normMaxA * normMaxInvA
```

9.85195×10^{8}

(*Число обусловленности матрицы A в норме-максимум*)

Ответ : $9.85195 * 10^{8}$

б) Решить точную систему линейных уравнений : AX = B :

```
X = N[LinearSolve[A, B]](*Решение системы линейных уравнений*)
```

Ответ :

$\{987., -46368., 510300., -2.2176 \times 10^{6}, 4.46985 \times 10^{6}, -4.19126 \times 10^{6}, 1.47748 \times 10^{6}\}$

б) вычислить 3 возмущённые системы вида A = B + ΔB

```
B1 = B
B2 = B
B3 = B

incrB = B[[7]]
```

{-3, 0, 3, 6, 9, 12, 15}

{-3, 0, 3, 6, 9, 12, 15}

{-3, 0, 3, 6, 9, 12, 15}

15

```
B1[[7]] = incrB + incrB * 0.0001(*Увеличиваем на 0.01%*)
B2[[7]] = incrB + incrB * 0.001(*Увеличиваем на 0.1%*)
B3[[7]] = incrB + incrB * 0.01(*Увеличиваем на 1%*)
```

15.0015

15.015

15.15

```
X1 = N[LinearSolve[A, B1]] (*Решение первого возмущённого уравнения*)
X2 = N[LinearSolve[A, B2]](*Решение второго возмущённого уравнения*)
X3 = N[LinearSolve[A, B3]](*Решение третьего возмущённого уравнения*)
```

$\{1005.02, -47124.8, 517868., -2.24787\times10^6, 4.52661\times10^6, -4.24121\times10^6, 1.49412\times10^6\}$

$\{1167.18, -53935.6, 585976., -2.5203\times10^6, 5.03742\times10^6, -4.69072\times10^6, 1.64396\times10^6\}$

$\{2788.8, -122044., 1.26706\times10^6, -5.24462\times10^6, 1.01455\times10^7, -9.18585\times10^6, 3.14234\times10^6\}$

1. в) Ответ :

г) найти прогнозируемую предельную относительную погрешность решения каждой возмущенной системы

```
pogrB1 = 0.00001 Round[K * Norm[Abs[B - B1], 1] / Norm[B + B - B1, 1] 100 000]
(*прогнозируемая предельная относительная погрешность для 1 возм-й системы*)
pogrB2 = 0.0001 Round[K * Norm[Abs[B - B2], 1] / Norm[B + B - B2, 1] 10 000]
(*прогнозируемая предельная относительная погрешность для 2 возм-й системы*)
pogrB3 = 0.001 Round[K * Norm[Abs[B - B3], 1] / Norm[B + B - B3, 1] 1000]
(*прогнозируемая предельная относительная погрешность для 3 возм-й системы*)
```

30 788.3

307 970.

3.08839×10^6

1. д) ответ :

Д) найти относительную погрешность решения каждой возмущенной системы; сделать вывод о зависимости относительной погрешности от величины возмущения и числа обусловленности матрицы А.

```
absPogrX1 = Norm[Abs[X1 - X], 1]
(*абсолютная погрешность решения первой возмущённой системы*)
absPogrX2 = 0.00001 Round[Norm[Abs[X2 - X], 1] 100 000]
(*абсолютная погрешность решения второй возмущённой системы*)
absPogrX3 = 0.0001 Round[Norm[Abs[X3 - X], 1] 10 000]
(*абсолютная погрешность решения второй возмущённой системы*)
```

161 964.

1.61964×10^6

1.61964×10^7

```
(*Вычисление относительных погрешностей:*)
relPogrX1 = 0.000001 Round[absPogrX1 / Norm[X1, 1] 1 000 000]
relPogrX2 = 0.000001 Round[absPogrX2 / Norm[X2, 1] 1 000 000]
relPogrX3 = 0.00001 Round[absPogrX3 / Norm[X3, 1] 100 000]
```

0.012387

0.111442

0.55638

Задание 2 : Решить методом прогонки трехдиагональную систему
Вариант 11

In[9]:= A = $\begin{pmatrix} 20 & 7 & 0 & 0 & 0 \\ 3 & 12 & 8 & 0 & 0 \\ 0 & 10 & 14 & 3 & 0 \\ 0 & 0 & 5 & 11 & 3 \\ 0 & 0 & 0 & 10 & 11 \end{pmatrix}$

Out[9]= {{20, 7, 0, 0, 0}, {3, 12, 8, 0, 0},
{0, 10, 14, 3, 0}, {0, 0, 5, 11, 3}, {0, 0, 0, 10, 11}}

In[102]:= B = {20, 11, 14, 8, 11}

Out[102]= {20, 11, 14, 8, 11}

In[68]:=
```
(*Инициализируем векторы прогоночных коэффициентов*)
(*По формулам определяем первые элементы векторов:*)
(*L[1] = -A[1][2]/A[1][1]*)
(*M[1] = B[1]/A[1][1]*)
```
L = $\left\{\frac{-7}{20}, 0, 0, 0, 0\right\}$

M = {1, 0, 0, 0, 0}

Out[68]= $\left\{-\frac{7}{20}, 0, 0, 0, 0\right\}$

Out[69]= {1, 0, 0, 0, 0}

koefL[i_] := $\frac{-A[[i, i+1]]}{A[[i, i]] + A[[i, i-1]] * L[[i-1]]}$

koefM[i_] := $\frac{B[[i]] - A[[i, i-1]] * M[[i-1]]}{A[[i, i]] + A[[i, i-1]] * L[[i-1]]}$

In[103]:=
```
L[[2]] = koefL[2]
L[[3]] = koefL[3]
L[[4]] = koefL[4]
L[[5]] = 0

M[[2]] = koefM[2]
M[[3]] = koefM[3]
M[[4]] = koefM[4]
M[[5]] = (A[[5 - 1, 5 - 2]] * M[[5 - 2]] - B[[5 - 1]]) /
  (-A[[5 - 1, 5 - 1]] - A[[5 - 1, 5 - 2]] * L[[5 - 2]])
```

Out[103]= $-\frac{160}{219}$

Out[104]= $-\frac{657}{1466}$

Out[105]= $-\frac{4398}{12\,841}$

Out[106]= 0

Out[107]= $\frac{160}{219}$

Out[108]= 1

Out[109]= $\frac{4398}{12\,841}$

Out[110]= $\frac{4398}{12\,841}$

In[111]:= `L`

Out[111]= $\left\{-\frac{7}{20}, -\frac{160}{219}, -\frac{657}{1466}, -\frac{4398}{12\,841}, 0\right\}$

In[112]:= `M`

Out[112]= $\left\{1, \frac{160}{219}, 1, \frac{4398}{12\,841}, \frac{4398}{12\,841}\right\}$

```
(*Обратная прогонка*)
```

In[113]:= `X = {0, 0, 0, 0, 0}`

Out[113]= {0, 0, 0, 0, 0}

In[116]:=
```
X[[5]] = M[[5]]
Do[X[[i]] = L[[i]] * X[[i + 1]] + M[[i]], {i, 5 - 1, 1, -1}]
```

Out[116]= $\frac{4398}{12\,841}$

In[118]:=
```
X
```

Out[118]=
$$\left\{\frac{160\,636\,009}{164\,891\,281}, \frac{12\,157\,920}{164\,891\,281}, \frac{148\,250\,128}{164\,891\,281}, \frac{37\,132\,314}{164\,891\,281}, \frac{4398}{12\,841}\right\}$$

In[119]:=
```
N[X]
```

Out[119]= {0.974193, 0.0737329, 0.899078, 0.225193, 0.342497}

Ответ

Задание 3:Решить систему n-го порядка
методом Якоби и методом Зейделя

In[158]:=
```
(*Метод Зейделя*)
k = 11
n = 10
```

Out[158]= 11

Out[159]= 10

In[160]:=
```
f[i_, j_] := Which[i ≠ j, 1, i == j, 2 * n]
```
$$g[i\_] := (2 * n - 1) * i + \frac{n * (n + 1)}{2} + (3 * n - 1)\ (k + 1)$$

In[162]:=
```
A = Array[f, {n, n}]
```

Out[162]= {{20, 1, 1, 1, 1, 1, 1, 1, 1, 1}, {1, 20, 1, 1, 1, 1, 1, 1, 1, 1},
{1, 1, 20, 1, 1, 1, 1, 1, 1, 1}, {1, 1, 1, 20, 1, 1, 1, 1, 1, 1},
{1, 1, 1, 1, 20, 1, 1, 1, 1, 1}, {1, 1, 1, 1, 1, 20, 1, 1, 1, 1},
{1, 1, 1, 1, 1, 1, 20, 1, 1, 1}, {1, 1, 1, 1, 1, 1, 1, 20, 1, 1},
{1, 1, 1, 1, 1, 1, 1, 1, 20, 1}, {1, 1, 1, 1, 1, 1, 1, 1, 1, 20}}

In[163]:=
```
B = Array[g, n]
```

Out[163]= {422, 441, 460, 479, 498, 517, 536, 555, 574, 593}

In[164]:=
```
diagA = DiagonalMatrix[Diagonal[A]](*Главная диагональ*)
upTriA = UpperTriangularize[A] - diagA(*Верхняя треугольная матрица*)
lwTriA = LowerTriangularize[A] - diagA(*Нижняя треугольная матрица*)
```

Out[164]=
```
{{20, 0, 0, 0, 0, 0, 0, 0, 0, 0}, {0, 20, 0, 0, 0, 0, 0, 0, 0, 0},
 {0, 0, 20, 0, 0, 0, 0, 0, 0, 0}, {0, 0, 0, 20, 0, 0, 0, 0, 0, 0},
 {0, 0, 0, 0, 20, 0, 0, 0, 0, 0}, {0, 0, 0, 0, 0, 20, 0, 0, 0, 0},
 {0, 0, 0, 0, 0, 0, 20, 0, 0, 0}, {0, 0, 0, 0, 0, 0, 0, 20, 0, 0},
 {0, 0, 0, 0, 0, 0, 0, 0, 20, 0}, {0, 0, 0, 0, 0, 0, 0, 0, 0, 20}}
```

Out[165]=
```
{{0, 1, 1, 1, 1, 1, 1, 1, 1, 1}, {0, 0, 1, 1, 1, 1, 1, 1, 1, 1},
 {0, 0, 0, 1, 1, 1, 1, 1, 1, 1}, {0, 0, 0, 0, 1, 1, 1, 1, 1, 1},
 {0, 0, 0, 0, 0, 1, 1, 1, 1, 1}, {0, 0, 0, 0, 0, 0, 1, 1, 1, 1},
 {0, 0, 0, 0, 0, 0, 0, 1, 1, 1}, {0, 0, 0, 0, 0, 0, 0, 0, 1, 1},
 {0, 0, 0, 0, 0, 0, 0, 0, 0, 1}, {0, 0, 0, 0, 0, 0, 0, 0, 0, 0}}
```

Out[166]=
```
{{0, 0, 0, 0, 0, 0, 0, 0, 0, 0}, {1, 0, 0, 0, 0, 0, 0, 0, 0, 0},
 {1, 1, 0, 0, 0, 0, 0, 0, 0, 0}, {1, 1, 1, 0, 0, 0, 0, 0, 0, 0},
 {1, 1, 1, 1, 0, 0, 0, 0, 0, 0}, {1, 1, 1, 1, 1, 0, 0, 0, 0, 0},
 {1, 1, 1, 1, 1, 1, 0, 0, 0, 0}, {1, 1, 1, 1, 1, 1, 1, 0, 0, 0},
 {1, 1, 1, 1, 1, 1, 1, 1, 0, 0}, {1, 1, 1, 1, 1, 1, 1, 1, 1, 0}}
```

In[169]:=
```
x = ConstantArray[0, n]
```

Out[169]=
```
{0, 0, 0, 0, 0, 0, 0, 0, 0, 0}
```

In[168]:=
```
xIncreasedAccurancy[x_] := Inverse[lwTriA + diagA].(B - upTriA.x)
(*функция решения СЛАУ по Зейделю в матричной форме*)
```

In[170]:=
```
x = N[xIncreasedAccurancy[x]]
```

Out[170]=
```
{21.1, 20.995, 20.8953, 20.8005, 20.7105,
 20.6249, 20.5437, 20.4665, 20.3932, 20.3235}
```

In[171]:=
```
x = N[xIncreasedAccurancy[x]]
```

Out[171]=
```
{11.8123, 13.2215, 14.5552, 15.8174,
 17.0121, 18.1427, 19.2128, 20.2255, 21.1838, 22.0908}
```

In[172]:=
```
x = N[xIncreasedAccurancy[x]]
```

Out[172]=
```
{13.0269, 13.9866, 14.9651, 15.9577,
 16.9604, 17.9695, 18.9817, 19.9939, 21.0034, 22.0077}
```

In[173]:=
```
x = N[xIncreasedAccurancy[x]]
```

Out[173]=
```
{13.0087, 14.0076, 15.0055, 16.0031,
 17.0009, 17.9994, 18.9985, 19.9983, 20.9985, 21.999}
```

In[174]:=
```
x = N[xIncreasedAccurancy[x]]
```

Out[174]=
```
{12.9995, 13.9999, 15.0002, 16.0003, 17.0003, 18.0003, 19.0002, 20.0001, 21., 22.}
```

In[175]:=
```
x = N[xIncreasedAccurancy[x]]
```

Out[175]=
```
{12.9999, 13.9999, 14.9999, 16., 17., 18., 19., 20., 21., 22.}
```

```
In[176]:= x = N[xIncreasedAccurancy[x]]

Out[176]= {13., 14., 15., 16., 17., 18., 19., 20., 21., 22.}

          (*7 итераций*)

In[177]:= LinearSolve[A, B]

Out[177]= {13, 14, 15, 16, 17, 18, 19, 20, 21, 22}

In[178]:= n = 20
          A = Array[f, {n, n}]
          B = Array[g, n]

Out[178]= 20

Out[179]= {{40, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1},
           {1, 40, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1},
           {1, 1, 40, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1},
           {1, 1, 1, 40, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1},
           {1, 1, 1, 1, 40, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1},
           {1, 1, 1, 1, 1, 40, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1},
           {1, 1, 1, 1, 1, 1, 40, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1},
           {1, 1, 1, 1, 1, 1, 1, 40, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1},
           {1, 1, 1, 1, 1, 1, 1, 1, 40, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1},
           {1, 1, 1, 1, 1, 1, 1, 1, 1, 40, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1},
           {1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 40, 1, 1, 1, 1, 1, 1, 1, 1, 1},
           {1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 40, 1, 1, 1, 1, 1, 1, 1, 1},
           {1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 40, 1, 1, 1, 1, 1, 1, 1},
           {1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 40, 1, 1, 1, 1, 1, 1},
           {1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 40, 1, 1, 1, 1, 1},
           {1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 40, 1, 1, 1, 1},
           {1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 40, 1, 1, 1},
           {1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 40, 1, 1},
           {1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 40, 1},
           {1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 40}}

Out[180]= {957, 996, 1035, 1074, 1113, 1152, 1191, 1230, 1269,
           1308, 1347, 1386, 1425, 1464, 1503, 1542, 1581, 1620, 1659, 1698}

In[181]:= diagA = DiagonalMatrix[Diagonal[A]](*Главная диагональ*)
          upTriA = UpperTriangularize[A] - diagA(*Верхняя треугольная матрица*)
          lwTriA = LowerTriangularize[A] - diagA(*Нижняя треугольная матрица*)
```

```
Out[181]= {{40, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0},
  {0, 40, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0},
  {0, 0, 40, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0},
  {0, 0, 0, 40, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0},
  {0, 0, 0, 0, 40, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0},
  {0, 0, 0, 0, 0, 40, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0},
  {0, 0, 0, 0, 0, 0, 40, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0},
  {0, 0, 0, 0, 0, 0, 0, 40, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0},
  {0, 0, 0, 0, 0, 0, 0, 0, 40, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0},
  {0, 0, 0, 0, 0, 0, 0, 0, 0, 40, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0},
  {0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 40, 0, 0, 0, 0, 0, 0, 0, 0, 0},
  {0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 40, 0, 0, 0, 0, 0, 0, 0, 0},
  {0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 40, 0, 0, 0, 0, 0, 0, 0},
  {0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 40, 0, 0, 0, 0, 0, 0},
  {0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 40, 0, 0, 0, 0, 0},
  {0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 40, 0, 0, 0, 0},
  {0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 40, 0, 0, 0},
  {0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 40, 0, 0},
  {0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 40, 0},
  {0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 40}}

Out[182]= {{0, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1},
  {0, 0, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1},
  {0, 0, 0, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1},
  {0, 0, 0, 0, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1},
  {0, 0, 0, 0, 0, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1},
  {0, 0, 0, 0, 0, 0, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1},
  {0, 0, 0, 0, 0, 0, 0, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1},
  {0, 0, 0, 0, 0, 0, 0, 0, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1},
  {0, 0, 0, 0, 0, 0, 0, 0, 0, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1},
  {0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1},
  {0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 1, 1, 1, 1, 1, 1, 1, 1, 1},
  {0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 1, 1, 1, 1, 1, 1, 1, 1},
  {0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 1, 1, 1, 1, 1, 1, 1},
  {0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 1, 1, 1, 1, 1, 1},
  {0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 1, 1, 1, 1, 1},
  {0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 1, 1, 1, 1},
  {0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 1, 1, 1},
  {0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 1, 1},
  {0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 1},
  {0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0}}
```

```
Out[183]= {{0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0},
  {1, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0},
  {1, 1, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0},
  {1, 1, 1, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0},
  {1, 1, 1, 1, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0},
  {1, 1, 1, 1, 1, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0},
  {1, 1, 1, 1, 1, 1, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0},
  {1, 1, 1, 1, 1, 1, 1, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0},
  {1, 1, 1, 1, 1, 1, 1, 1, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0},
  {1, 1, 1, 1, 1, 1, 1, 1, 1, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0},
  {1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0},
  {1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 0, 0, 0, 0, 0, 0, 0, 0, 0},
  {1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 0, 0, 0, 0, 0, 0, 0, 0},
  {1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 0, 0, 0, 0, 0, 0, 0},
  {1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 0, 0, 0, 0, 0, 0},
  {1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 0, 0, 0, 0, 0},
  {1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 0, 0, 0, 0},
  {1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 0, 0, 0},
  {1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 0, 0},
  {1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 0}}

In[186]:= x = ConstantArray[0, n]

Out[186]= {0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0}

In[189]:= xIncreasedAccurancy[x_] := Inverse[lwTriA + diagA].(B - upTriA.x)
  (*функция решения СЛАУ по Зейделю в матричной форме*)
  x = N[xIncreasedAccurancy[x]]

Out[190]= {11.0126, 12.3198, 13.6036, 14.8642, 16.102, 17.3174,
  18.5107, 19.6823, 20.8324, 21.9615, 23.0699, 24.1579, 25.2258,
  26.274, 27.3027, 28.3124, 29.3032, 30.2756, 31.2298, 32.1661}

In[191]:= x = N[xIncreasedAccurancy[x]]

Out[191]= {13.1122, 14.0674, 15.0308, 16.0016, 16.9792, 17.9626,
  18.9513, 19.9446, 20.9418, 21.9423, 22.9455, 23.9508, 24.9577,
  25.9656, 26.974, 27.9825, 28.9905, 29.9976, 31.0034, 32.0075}

In[192]:= x = N[xIncreasedAccurancy[x]]

Out[192]= {13.0101, 14.0115, 15.012, 16.0117, 17.0109, 18.0097,
  19.0083, 20.0067, 21.005, 22.0035, 23.002, 24.0007, 24.9997,
  25.9988, 26.9982, 27.9978, 28.9976, 29.9976, 30.9978, 31.998}

In[193]:= x = N[xIncreasedAccurancy[x]]

Out[193]= {12.9983, 13.9986, 14.999, 15.9993, 16.9996, 17.9998,
  19., 20.0002, 21.0003, 22.0004, 23.0005, 24.0005, 25.0004,
  26.0004, 27.0003, 28.0003, 29.0002, 30.0001, 31.0001, 32.}
```

In[194]:=
```
x = N[xIncreasedAccurancy[x]]
```
Out[194]=
```
{13., 14., 14.9999, 15.9999, 16.9999, 17.9999, 18.9999, 19.9999,
 20.9999, 21.9999, 23., 24., 25., 26., 27., 28., 29., 30., 31., 32.}
```

In[195]:=
```
x = N[xIncreasedAccurancy[x]]
```
Out[195]=
```
{13., 14., 15., 16., 17., 18., 19., 20., 21.,
 22., 23., 24., 25., 26., 27., 28., 29., 30., 31., 32.}
```

In[196]:=
```
(*6 итераций*)
LinearSolve[A, B]
```
Out[196]=
```
{13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32}
```

Метод Якоби

In[197]:=
```
n = 10
A = Array[f, {n, n}]
B = Array[g, n]
```
Out[197]=
```
10
```
Out[198]=
```
{{20, 1, 1, 1, 1, 1, 1, 1, 1, 1}, {1, 20, 1, 1, 1, 1, 1, 1, 1, 1},
 {1, 1, 20, 1, 1, 1, 1, 1, 1, 1}, {1, 1, 1, 20, 1, 1, 1, 1, 1, 1},
 {1, 1, 1, 1, 20, 1, 1, 1, 1, 1}, {1, 1, 1, 1, 1, 20, 1, 1, 1, 1},
 {1, 1, 1, 1, 1, 1, 20, 1, 1, 1}, {1, 1, 1, 1, 1, 1, 1, 20, 1, 1},
 {1, 1, 1, 1, 1, 1, 1, 1, 20, 1}, {1, 1, 1, 1, 1, 1, 1, 1, 1, 20}}
```
Out[199]=
```
{422, 441, 460, 479, 498, 517, 536, 555, 574, 593}
```

```
In[200]:= diagA = DiagonalMatrix[Diagonal[A]](*Диагональная матрица матрицы A*)
          reversedDiagA = Inverse[diagA]
          residualA = A - diagA(*Остаточная матрицы A*)

Out[200]= {{20, 0, 0, 0, 0, 0, 0, 0, 0, 0}, {0, 20, 0, 0, 0, 0, 0, 0, 0, 0},
           {0, 0, 20, 0, 0, 0, 0, 0, 0, 0}, {0, 0, 0, 20, 0, 0, 0, 0, 0, 0},
           {0, 0, 0, 0, 20, 0, 0, 0, 0, 0}, {0, 0, 0, 0, 0, 20, 0, 0, 0, 0},
           {0, 0, 0, 0, 0, 0, 20, 0, 0, 0}, {0, 0, 0, 0, 0, 0, 0, 20, 0, 0},
           {0, 0, 0, 0, 0, 0, 0, 0, 20, 0}, {0, 0, 0, 0, 0, 0, 0, 0, 0, 20}}
```

Out[201]=

$$\left\{\left\{\frac{1}{20}, 0, 0, 0, 0, 0, 0, 0, 0, 0\right\}, \left\{0, \frac{1}{20}, 0, 0, 0, 0, 0, 0, 0, 0\right\}, \left\{0, 0, \frac{1}{20}, 0, 0, 0, 0, 0, 0, 0\right\}, \left\{0, 0, 0, \frac{1}{20}, 0, 0, 0, 0, 0, 0\right\}, \left\{0, 0, 0, 0, \frac{1}{20}, 0, 0, 0, 0, 0\right\}, \left\{0, 0, 0, 0, 0, \frac{1}{20}, 0, 0, 0, 0\right\}, \left\{0, 0, 0, 0, 0, 0, \frac{1}{20}, 0, 0, 0\right\}, \left\{0, 0, 0, 0, 0, 0, 0, \frac{1}{20}, 0, 0\right\}, \left\{0, 0, 0, 0, 0, 0, 0, 0, \frac{1}{20}, 0\right\}, \left\{0, 0, 0, 0, 0, 0, 0, 0, 0, \frac{1}{20}\right\}\right\}$$

```
Out[202]= {{0, 1, 1, 1, 1, 1, 1, 1, 1, 1}, {1, 0, 1, 1, 1, 1, 1, 1, 1, 1},
           {1, 1, 0, 1, 1, 1, 1, 1, 1, 1}, {1, 1, 1, 0, 1, 1, 1, 1, 1, 1},
           {1, 1, 1, 1, 0, 1, 1, 1, 1, 1}, {1, 1, 1, 1, 1, 0, 1, 1, 1, 1},
           {1, 1, 1, 1, 1, 1, 0, 1, 1, 1}, {1, 1, 1, 1, 1, 1, 1, 0, 1, 1},
           {1, 1, 1, 1, 1, 1, 1, 1, 0, 1}, {1, 1, 1, 1, 1, 1, 1, 1, 1, 0}}

In[203]:= x = ConstantArray[0, n]

Out[203]= {0, 0, 0, 0, 0, 0, 0, 0, 0, 0}

In[204]:= xIncreasedAccurancy[x_] := reversedDiagA.(B - residualA.x)
            (*функция для решения СЛАУ по Якоби в матричной форме*)

In[205]:= x = N[xIncreasedAccurancy[x]]

Out[205]= {21.1, 22.05, 23., 23.95, 24.9, 25.85, 26.8, 27.75, 28.7, 29.65}

In[208]:= x = N[xIncreasedAccurancy[x]]

Out[208]= {9.4675, 10.465, 11.4625, 12.46, 13.4575, 14.455, 15.4525, 16.45, 17.4475, 18.445}

In[209]:= x = N[xIncreasedAccurancy[x]]

Out[209]= {14.5953, 15.5951, 16.595, 17.5949,
           18.5948, 19.5946, 20.5945, 21.5944, 22.5943, 23.5941}

In[210]:= x = N[xIncreasedAccurancy[x]]

Out[210]= {12.2824, 13.2824, 14.2824, 15.2824,
           16.2824, 17.2824, 18.2824, 19.2824, 20.2824, 21.2824}
```

```
In[211]:= x = N[xIncreasedAccurancy[x]]
Out[211]= {13.3229, 14.3229, 15.3229, 16.3229,
  17.3229, 18.3229, 19.3229, 20.3229, 21.3229, 22.3229}

In[212]:= x = N[xIncreasedAccurancy[x]]
Out[212]= {12.8547, 13.8547, 14.8547, 15.8547,
  16.8547, 17.8547, 18.8547, 19.8547, 20.8547, 21.8547}

In[213]:= x = N[xIncreasedAccurancy[x]]
Out[213]= {13.0654, 14.0654, 15.0654, 16.0654,
  17.0654, 18.0654, 19.0654, 20.0654, 21.0654, 22.0654}

In[214]:= x = N[xIncreasedAccurancy[x]]
Out[214]= {12.9706, 13.9706, 14.9706, 15.9706,
  16.9706, 17.9706, 18.9706, 19.9706, 20.9706, 21.9706}

In[215]:= x = N[xIncreasedAccurancy[x]]
Out[215]= {13.0132, 14.0132, 15.0132, 16.0132,
  17.0132, 18.0132, 19.0132, 20.0132, 21.0132, 22.0132}

In[216]:= x = N[xIncreasedAccurancy[x]]
Out[216]= {12.994, 13.994, 14.994, 15.994, 16.994, 17.994, 18.994, 19.994, 20.994, 21.994}

In[217]:= x = N[xIncreasedAccurancy[x]]
Out[217]= {13.0027, 14.0027, 15.0027, 16.0027,
  17.0027, 18.0027, 19.0027, 20.0027, 21.0027, 22.0027}

In[218]:= x = N[xIncreasedAccurancy[x]]
Out[218]= {12.9988, 13.9988, 14.9988, 15.9988,
  16.9988, 17.9988, 18.9988, 19.9988, 20.9988, 21.9988}

In[219]:= x = N[xIncreasedAccurancy[x]]
Out[219]= {13.0005, 14.0005, 15.0005, 16.0005,
  17.0005, 18.0005, 19.0005, 20.0005, 21.0005, 22.0005}

(*13 итераций*)

In[220]:= LinearSolve[A, B]
Out[220]= {13, 14, 15, 16, 17, 18, 19, 20, 21, 22}

In[221]:= n = 20
Out[221]= 20
```

In[222]:=
```
A = Array[f, {n, n}]
B = Array[g, n]
```

Out[222]=
```
{{40, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1},
 {1, 40, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1},
 {1, 1, 40, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1},
 {1, 1, 1, 40, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1},
 {1, 1, 1, 1, 40, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1},
 {1, 1, 1, 1, 1, 40, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1},
 {1, 1, 1, 1, 1, 1, 40, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1},
 {1, 1, 1, 1, 1, 1, 1, 40, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1},
 {1, 1, 1, 1, 1, 1, 1, 1, 40, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1},
 {1, 1, 1, 1, 1, 1, 1, 1, 1, 40, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1},
 {1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 40, 1, 1, 1, 1, 1, 1, 1, 1, 1},
 {1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 40, 1, 1, 1, 1, 1, 1, 1, 1},
 {1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 40, 1, 1, 1, 1, 1, 1, 1},
 {1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 40, 1, 1, 1, 1, 1, 1},
 {1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 40, 1, 1, 1, 1, 1},
 {1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 40, 1, 1, 1, 1},
 {1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 40, 1, 1, 1},
 {1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 40, 1, 1},
 {1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 40, 1},
 {1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 40}}
```

Out[223]=
```
{957, 996, 1035, 1074, 1113, 1152, 1191, 1230, 1269,
 1308, 1347, 1386, 1425, 1464, 1503, 1542, 1581, 1620, 1659, 1698}
```

In[224]:=
```
diagA = DiagonalMatrix[Diagonal[A]](*Диагональная матрица матрицы A*)
reversedDiagA = Inverse[diagA]
residualA = A - diagA(*Остаточная матрицы A*)
```

```
Out[224]= {{40, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0},
  {0, 40, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0},
  {0, 0, 40, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0},
  {0, 0, 0, 40, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0},
  {0, 0, 0, 0, 40, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0},
  {0, 0, 0, 0, 0, 40, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0},
  {0, 0, 0, 0, 0, 0, 40, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0},
  {0, 0, 0, 0, 0, 0, 0, 40, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0},
  {0, 0, 0, 0, 0, 0, 0, 0, 40, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0},
  {0, 0, 0, 0, 0, 0, 0, 0, 0, 40, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0},
  {0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 40, 0, 0, 0, 0, 0, 0, 0, 0, 0},
  {0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 40, 0, 0, 0, 0, 0, 0, 0, 0},
  {0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 40, 0, 0, 0, 0, 0, 0, 0},
  {0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 40, 0, 0, 0, 0, 0, 0},
  {0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 40, 0, 0, 0, 0, 0},
  {0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 40, 0, 0, 0, 0},
  {0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 40, 0, 0, 0},
  {0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 40, 0, 0},
  {0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 40, 0},
  {0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 40}}
```

Out[225]= $\{\{\frac{1}{40}, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0\},$
$\{0, \frac{1}{40}, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0\},$
$\{0, 0, \frac{1}{40}, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0\},$
$\{0, 0, 0, \frac{1}{40}, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0\},$
$\{0, 0, 0, 0, \frac{1}{40}, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0\},$
$\{0, 0, 0, 0, 0, \frac{1}{40}, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0\},$
$\{0, 0, 0, 0, 0, 0, \frac{1}{40}, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0\},$
$\{0, 0, 0, 0, 0, 0, 0, \frac{1}{40}, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0\},$
$\{0, 0, 0, 0, 0, 0, 0, 0, \frac{1}{40}, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0\},$
$\{0, 0, 0, 0, 0, 0, 0, 0, 0, \frac{1}{40}, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0\},$
$\{0, 0, 0, 0, 0, 0, 0, 0, 0, 0, \frac{1}{40}, 0, 0, 0, 0, 0, 0, 0, 0, 0\},$
$\{0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, \frac{1}{40}, 0, 0, 0, 0, 0, 0, 0, 0\},$
$\{0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, \frac{1}{40}, 0, 0, 0, 0, 0, 0, 0\},$
$\{0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, \frac{1}{40}, 0, 0, 0, 0, 0, 0\},$
$\{0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, \frac{1}{40}, 0, 0, 0, 0, 0\},$
$\{0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, \frac{1}{40}, 0, 0, 0, 0\},$
$\{0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, \frac{1}{40}, 0, 0, 0\},$
$\{0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, \frac{1}{40}, 0, 0\},$
$\{0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, \frac{1}{40}, 0\},$
$\{0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, \frac{1}{40}\}\}$

```
Out[226]= {{0, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1},
  {1, 0, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1},
  {1, 1, 0, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1},
  {1, 1, 1, 0, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1},
  {1, 1, 1, 1, 0, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1},
  {1, 1, 1, 1, 1, 0, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1},
  {1, 1, 1, 1, 1, 1, 0, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1},
  {1, 1, 1, 1, 1, 1, 1, 0, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1},
  {1, 1, 1, 1, 1, 1, 1, 1, 0, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1},
  {1, 1, 1, 1, 1, 1, 1, 1, 1, 0, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1},
  {1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 0, 1, 1, 1, 1, 1, 1, 1, 1, 1},
  {1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 0, 1, 1, 1, 1, 1, 1, 1, 1},
  {1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 0, 1, 1, 1, 1, 1, 1, 1},
  {1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 0, 1, 1, 1, 1, 1, 1},
  {1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 0, 1, 1, 1, 1, 1},
  {1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 0, 1, 1, 1, 1},
  {1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 0, 1, 1, 1},
  {1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 0, 1, 1},
  {1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 0, 1},
  {1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 0}}

In[227]:= x = ConstantArray[0, n]

Out[227]= {0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0}

In[228]:= xIncreasedAccurancy[x_] := reversedDiagA.(B - residualA.x)
   (*функция для решения СЛАУ по Якоби в матричной форме*)

In[229]:= x = N[xIncreasedAccurancy[x]]

Out[229]= {23.925, 24.9, 25.875, 26.85, 27.825, 28.8, 29.775, 30.75, 31.725, 32.7,
  33.675, 34.65, 35.625, 36.6, 37.575, 38.55, 39.525, 40.5, 41.475, 42.45}

In[230]:= x = N[xIncreasedAccurancy[x]]

Out[230]= {7.92937, 8.92875, 9.92813, 10.9275, 11.9269, 12.9263,
  13.9256, 14.925, 15.9244, 16.9238, 17.9231, 18.9225, 19.9219,
  20.9213, 21.9206, 22.92, 23.9194, 24.9188, 25.9181, 26.9175}

In[231]:= x = N[xIncreasedAccurancy[x]]

Out[231]= {15.4115, 16.4115, 17.4115, 18.4115, 19.4115, 20.4114,
  21.4114, 22.4114, 23.4114, 24.4114, 25.4114, 26.4113, 27.4113,
  28.4113, 29.4113, 30.4113, 31.4113, 32.4112, 33.4112, 34.4112}

In[232]:= x = N[xIncreasedAccurancy[x]]

Out[232]= {11.8546, 12.8546, 13.8546, 14.8546, 15.8546, 16.8546,
  17.8546, 18.8546, 19.8546, 20.8546, 21.8546, 22.8546, 23.8546,
  24.8546, 25.8546, 26.8546, 27.8546, 28.8546, 29.8546, 30.8546}
```

In[233]:=
```
x = N[xIncreasedAccurancy[x]]
```

Out[233]=
```
{13.5441, 14.5441, 15.5441, 16.5441, 17.5441, 18.5441,
 19.5441, 20.5441, 21.5441, 22.5441, 23.5441, 24.5441, 25.5441,
 26.5441, 27.5441, 28.5441, 29.5441, 30.5441, 31.5441, 32.5441}
```

In[234]:=
```
x = N[xIncreasedAccurancy[x]]
```

Out[234]=
```
{12.7416, 13.7416, 14.7416, 15.7416, 16.7416, 17.7416,
 18.7416, 19.7416, 20.7416, 21.7416, 22.7416, 23.7416, 24.7416,
 25.7416, 26.7416, 27.7416, 28.7416, 29.7416, 30.7416, 31.7416}
```

In[235]:=
```
x = N[xIncreasedAccurancy[x]]
```

Out[235]=
```
{13.1228, 14.1228, 15.1228, 16.1228, 17.1228, 18.1228,
 19.1228, 20.1228, 21.1228, 22.1228, 23.1228, 24.1228, 25.1228,
 26.1228, 27.1228, 28.1228, 29.1228, 30.1228, 31.1228, 32.1228}
```

In[236]:=
```
x = N[xIncreasedAccurancy[x]]
```

Out[236]=
```
{12.9417, 13.9417, 14.9417, 15.9417, 16.9417, 17.9417,
 18.9417, 19.9417, 20.9417, 21.9417, 22.9417, 23.9417, 24.9417,
 25.9417, 26.9417, 27.9417, 28.9417, 29.9417, 30.9417, 31.9417}
```

In[237]:=
```
x = N[xIncreasedAccurancy[x]]
```

Out[237]=
```
{13.0277, 14.0277, 15.0277, 16.0277, 17.0277, 18.0277,
 19.0277, 20.0277, 21.0277, 22.0277, 23.0277, 24.0277, 25.0277,
 26.0277, 27.0277, 28.0277, 29.0277, 30.0277, 31.0277, 32.0277}
```

In[238]:=
```
x = N[xIncreasedAccurancy[x]]
```

Out[238]=
```
{12.9868, 13.9868, 14.9868, 15.9868, 16.9868, 17.9868,
 18.9868, 19.9868, 20.9868, 21.9868, 22.9868, 23.9868, 24.9868,
 25.9868, 26.9868, 27.9868, 28.9868, 29.9868, 30.9868, 31.9868}
```

In[239]:=
```
x = N[xIncreasedAccurancy[x]]
```

Out[239]=
```
{13.0062, 14.0062, 15.0062, 16.0062, 17.0062, 18.0062,
 19.0062, 20.0062, 21.0062, 22.0062, 23.0062, 24.0062, 25.0062,
 26.0062, 27.0062, 28.0062, 29.0062, 30.0062, 31.0062, 32.0062}
```

In[240]:=
```
x = N[xIncreasedAccurancy[x]]
```

Out[240]=
```
{12.997, 13.997, 14.997, 15.997, 16.997, 17.997, 18.997, 19.997, 20.997, 21.997,
 22.997, 23.997, 24.997, 25.997, 26.997, 27.997, 28.997, 29.997, 30.997, 31.997}
```

In[241]:=
```
x = N[xIncreasedAccurancy[x]]
```

Out[241]=
```
{13.0014, 14.0014, 15.0014, 16.0014, 17.0014, 18.0014,
 19.0014, 20.0014, 21.0014, 22.0014, 23.0014, 24.0014, 25.0014,
 26.0014, 27.0014, 28.0014, 29.0014, 30.0014, 31.0014, 32.0014}
```

In[242]:=
```
x = N[xIncreasedAccurancy[x]]
```

Out[242]=
```
{12.9993, 13.9993, 14.9993, 15.9993, 16.9993, 17.9993,
 18.9993, 19.9993, 20.9993, 21.9993, 22.9993, 23.9993, 24.9993,
 25.9993, 26.9993, 27.9993, 28.9993, 29.9993, 30.9993, 31.9993}
```

In[243]:=
```
x = N[xIncreasedAccurancy[x]]
```

Out[243]=
```
{13.0003, 14.0003, 15.0003, 16.0003, 17.0003, 18.0003,
 19.0003, 20.0003, 21.0003, 22.0003, 23.0003, 24.0003, 25.0003,
 26.0003, 27.0003, 28.0003, 29.0003, 30.0003, 31.0003, 32.0003}
```

```
(*15 итераций*)
```

In[244]:=
```
LinearSolve[A, B]
```

Out[244]=
```
{13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32}
```