Лабораторная работа № 3

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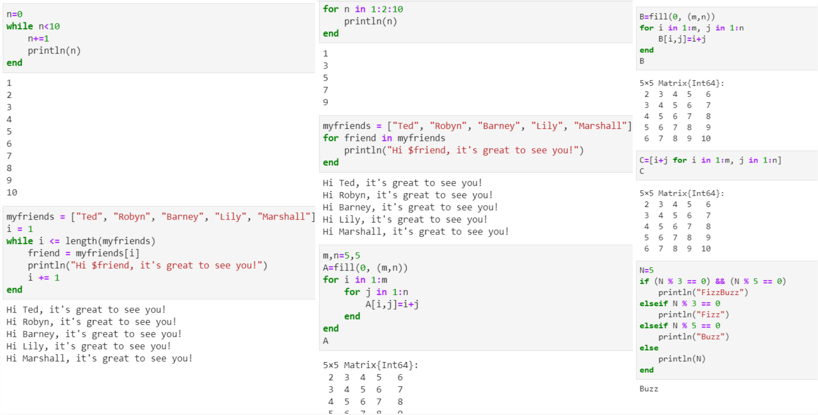
Цель работы

Освоить применение циклов функций и сторонних для Julia пакетов для решения задач линейной алгебры и работы с матрицами.

Ход работы. Примеры



```
n=0
while n<10
    n+=1
    println(n)
end
```

```
1
2
3
4
5
6
7
8
9
10
```

```
myfriends = ["Ted", "Robyn", "Barney", "Lily", "Marshall"]
i = 1
while i <= length(myfriends)
    friend = myfriends[i]
    println("Hi $friend, it's great to see you!")
    i += 1
end
```

```
Hi Ted, it's great to see you!
Hi Robyn, it's great to see you!
Hi Barney, it's great to see you!
Hi Lily, it's great to see you!
Hi Marshall, it's great to see you!
```

```
for n in 1:2:10
    println(n)
end
```

```
1
3
5
7
9
```

```
myfriends = ["Ted", "Robyn", "Barney", "Lily", "Marshall"]
for friend in myfriends
    println("Hi $friend, it's great to see you!")
end
```

```
Hi Ted, it's great to see you!
Hi Robyn, it's great to see you!
Hi Barney, it's great to see you!
Hi Lily, it's great to see you!
Hi Marshall, it's great to see you!
```

```
m,n=5,5
A=fill(0, (m,n))
for i in 1:m
    for j in 1:n
        A[i,j]=i+j
    end
end
A
```

```
5×5 Matrix{Int64}:
 2  3  4  5   6
 3  4  5  6   7
 4  5  6  7   8
 5  6  7  8   9
```

```
B=fill(0, (m,n))
for i in 1:m, j in 1:n
    B[i,j]=i+j
end
B
```

```
5×5 Matrix{Int64}:
 2  3  4  5   6
 3  4  5  6   7
 4  5  6  7   8
 5  6  7  8   9
 6  7  8  9  10
```

```
C=[i+j for i in 1:m, j in 1:n]
C
```

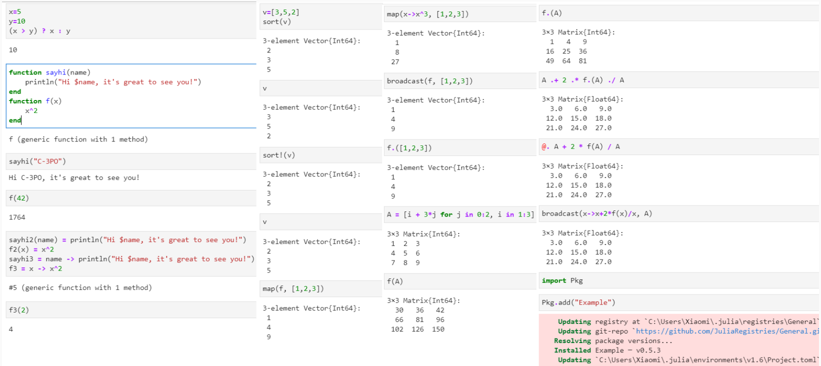
```
5×5 Matrix{Int64}:
 2  3  4  5   6
 3  4  5  6   7
 4  5  6  7   8
 5  6  7  8   9
 6  7  8  9  10
```

```
N=5
if (N % 3 == 0) && (N % 5 == 0)
    println("FizzBuzz")
elseif N % 3 == 0
    println("Fizz")
elseif N % 5 == 0
    println("Buzz")
else
    println(N)
end
```

```
Buzz
```

Рис. 1: примеры1

Ход работы. Примеры



```
x=5
y=10
(x > y) ? x : y
```

```
10
```

```
function sayhi(name)
    println("Hi $name, it's great to see you!")
end
function f(x)
    x^2
end
```

```
f (generic function with 1 method)
```

```
sayhi("C-3PO")
```

```
Hi C-3PO, it's great to see you!
```

```
f(42)
```

```
1764
```

```
sayhi2(name) = println("Hi $name, it's great to see you!")
f2(x) = x^2
sayhi3 = name -> println("Hi $name, it's great to see you!")
f3 = x -> x^2
```

```
#5 (generic function with 1 method)
```

```
f3(2)
```

```
4
```

```
v=[3,5,2]
sort(v)
```

```
3-element Vector{Int64}:
 2
 3
 5
```

```
v
```

```
3-element Vector{Int64}:
 3
 5
 2
```

```
sort!(v)
```

```
3-element Vector{Int64}:
 2
 3
 5
```

```
v
```

```
3-element Vector{Int64}:
 2
 3
 5
```

```
map(f, [1,2,3])
```

```
3-element Vector{Int64}:
 1
 4
 9
```

```
map(x->x^3, [1,2,3])
```

```
3-element Vector{Int64}:
  1
  8
 27
```

```
broadcast(f, [1,2,3])
```

```
3-element Vector{Int64}:
 1
 4
 9
```

```
f.([1,2,3])
```

```
3-element Vector{Int64}:
 1
 4
 9
```

```
A = [i + 3*j for j in 0:2, i in 1:3]
```

```
3×3 Matrix{Int64}:
 1  2  3
 4  5  6
 7  8  9
```

```
f(A)
```

```
3×3 Matrix{Int64}:
  30   36   42
  66   81   96
 102  126  150
```

```
f.(A)
```

```
3×3 Matrix{Int64}:
  1   4   9
 16  25  36
 49  64  81
```

```
A .+ 2 .* f.(A) ./ A
```

```
3×3 Matrix{Float64}:
  3.0   6.0   9.0
 12.0  15.0  18.0
 21.0  24.0  27.0
```

```
@. A + 2 * f(A) / A
```

```
3×3 Matrix{Float64}:
  3.0   6.0   9.0
 12.0  15.0  18.0
 21.0  24.0  27.0
```

```
broadcast(x->x+2*f(x)/x, A)
```

```
3×3 Matrix{Float64}:
  3.0   6.0   9.0
 12.0  15.0  18.0
 21.0  24.0  27.0
```

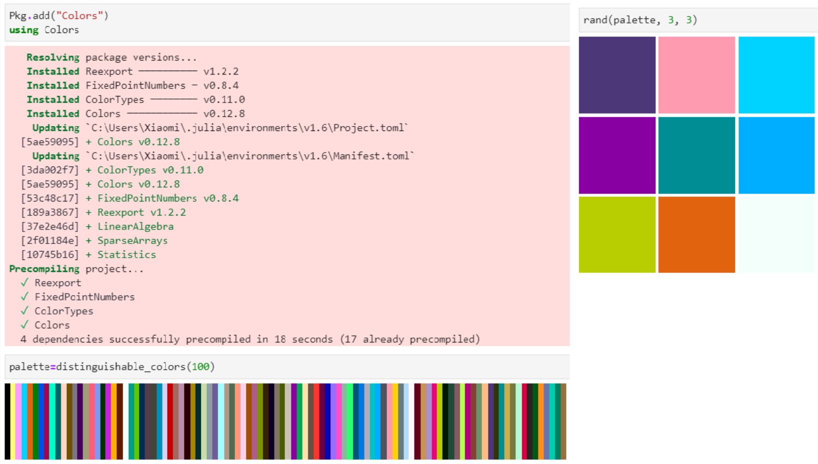
```
import Pkg
```

```
Pkg.add("Example")
```

```
    Updating registry at `C:\Users\Xiaomi\.julia\registries\General`
    Updating git-repo `https://github.com/JuliaRegistries/General.gi
   Resolving package versions...
   Installed Example ─ v0.5.3
    Updating `C:\Users\Xiaomi\.julia\environments\v1.6\Project.toml`
```

Рис. 2: примеры2

Ход работы. Примеры



```
Pkg.add("Colors")
using Colors
```

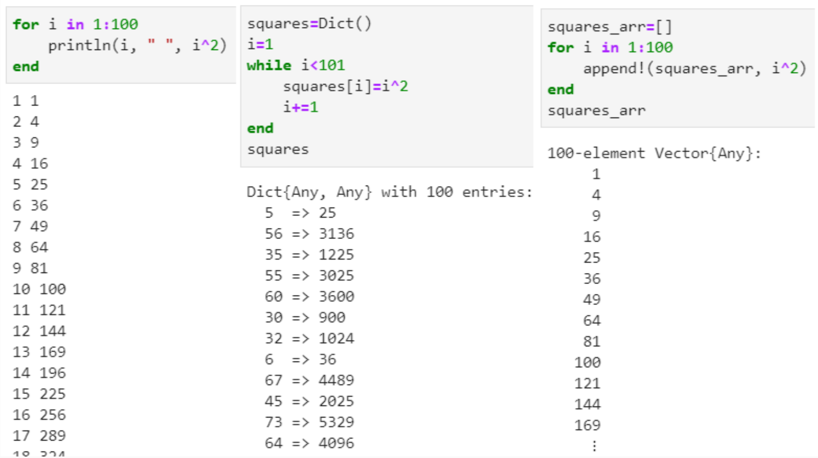
```
   Resolving package versions...
   Installed Reexport ────────── v1.2.2
   Installed FixedPointNumbers ─ v0.8.4
   Installed ColorTypes ──────── v0.11.0
   Installed Colors ──────────── v0.12.8
    Updating `C:\Users\Xiaomi\.julia\environments\v1.6\Project.toml`
  [5ae59095] + Colors v0.12.8
    Updating `C:\Users\Xiaomi\.julia\environments\v1.6\Manifest.toml`
  [3da002f7] + ColorTypes v0.11.0
  [5ae59095] + Colors v0.12.8
  [53c48c17] + FixedPointNumbers v0.8.4
  [189a3867] + Reexport v1.2.2
  [37e2e46d] + LinearAlgebra
  [2f01184e] + SparseArrays
  [10745b16] + Statistics
Precompiling project...
  ✓ Reexport
  ✓ FixedPointNumbers
  ✓ ColorTypes
  ✓ Colors
  4 dependencies successfully precompiled in 18 seconds (17 already precompiled)
```

```
palette=distinguishable_colors(100)
```

```
rand(palette, 3, 3)
```

Рис. 3: примеры3

Ход работы. 1



```
for i in 1:100
    println(i, " ", i^2)
end
```

```
1 1
2 4
3 9
4 16
5 25
6 36
7 49
8 64
9 81
10 100
11 121
12 144
13 169
14 196
15 225
16 256
17 289
18 324
```

```
squares=Dict()
i=1
while i<101
    squares[i]=i^2
    i+=1
end
squares
```

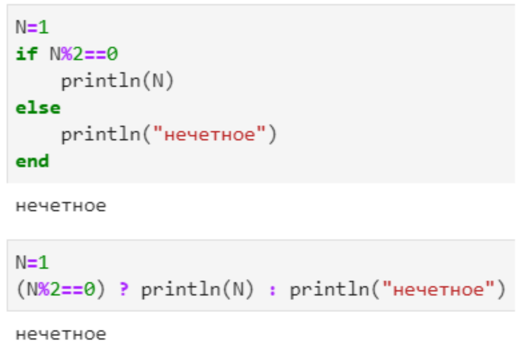
```
Dict{Any, Any} with 100 entries:
  5  => 25
  56 => 3136
  35 => 1225
  55 => 3025
  60 => 3600
  30 => 900
  32 => 1024
  6  => 36
  67 => 4489
  45 => 2025
  73 => 5329
  64 => 4096
```

```
squares_arr=[]
for i in 1:100
    append!(squares_arr, i^2)
end
squares_arr
```

```
100-element Vector{Any}:
    1
    4
    9
   16
   25
   36
   49
   64
   81
  100
  121
  144
  169
   ⋮
```

Рис. 4: номер1

Ход работы. 2



```
N=1
if N%2==0
    println(N)
else
    println("нечетное")
end
```

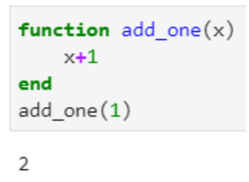
```
нечетное
```

```
N=1
(N%2==0) ? println(N) : println("нечетное")
```

```
нечетное
```

Рис. 5: номер2

Ход работы. 3

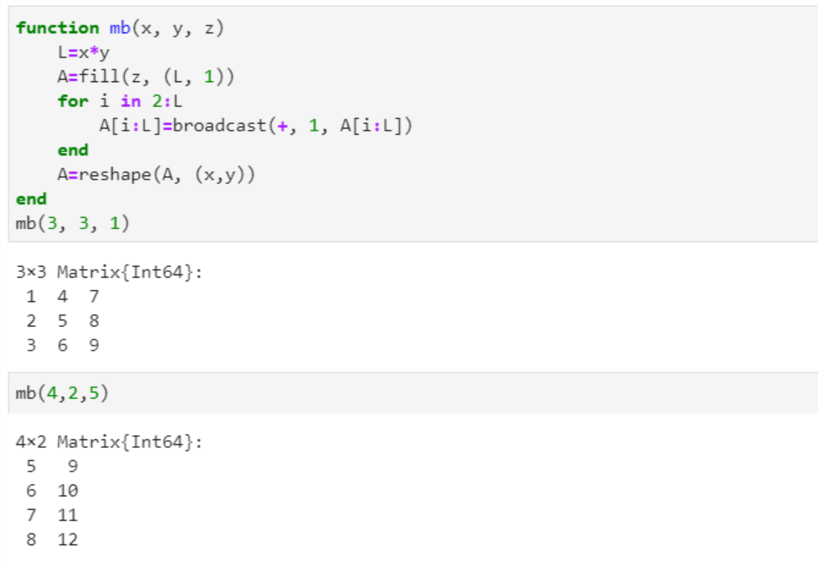


```
function add_one(x)
    x+1
end
add_one(1)
```

```
2
```

Рис. 6: номер3

Ход работы. 4



```
function mb(x, y, z)
    L=x*y
    A=fill(z, (L, 1))
    for i in 2:L
        A[i:L]=broadcast(+, 1, A[i:L])
    end
    A=reshape(A, (x,y))
end
mb(3, 3, 1)
```

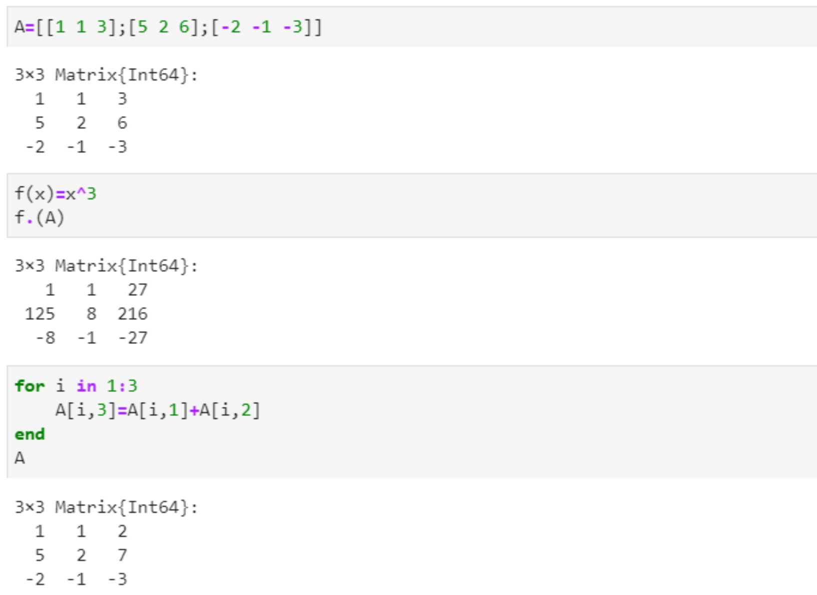
```
3×3 Matrix{Int64}:
 1  4  7
 2  5  8
 3  6  9
```

```
mb(4,2,5)
```

```
4×2 Matrix{Int64}:
 5   9
 6  10
 7  11
 8  12
```

Рис. 7: номер4

Ход работы. 5



```
A=[[1 1 3];[5 2 6];[-2 -1 -3]]
```

```
3×3 Matrix{Int64}:
  1   1   3
  5   2   6
 -2  -1  -3
```

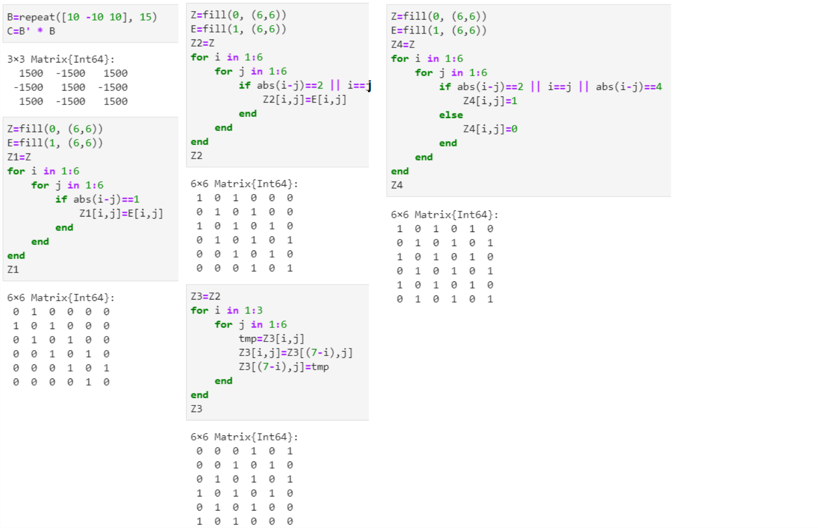
```
f(x)=x^3
f.(A)
```

```
3×3 Matrix{Int64}:
   1   1   27
 125   8  216
  -8  -1  -27
```

```
for i in 1:3
    A[i,3]=A[i,1]+A[i,2]
end
A
```

```
3×3 Matrix{Int64}:
  1   1   2
  5   2   7
 -2  -1  -3
```

Ход работы. 6-7



```
B=repeat([10 -10 10], 15)
C=B' * B
```

```
3×3 Matrix{Int64}:
  1500  -1500   1500
 -1500   1500  -1500
  1500  -1500   1500
```

```
Z=fill(0, (6,6))
E=fill(1, (6,6))
Z1=Z
for i in 1:6
    for j in 1:6
        if abs(i-j)==1
            Z1[i,j]=E[i,j]
        end
    end
end
Z1
```

```
6×6 Matrix{Int64}:
 0  1  0  0  0  0
 1  0  1  0  0  0
 0  1  0  1  0  0
 0  0  1  0  1  0
 0  0  0  1  0  1
 0  0  0  0  1  0
```

```
Z=fill(0, (6,6))
E=fill(1, (6,6))
Z2=Z
for i in 1:6
    for j in 1:6
        if abs(i-j)==2 || i==j
            Z2[i,j]=E[i,j]
        end
    end
end
Z2
```

```
6×6 Matrix{Int64}:
 1  0  1  0  0  0
 0  1  0  1  0  0
 1  0  1  0  1  0
 0  1  0  1  0  1
 0  0  1  0  1  0
 0  0  0  1  0  1
```

```
Z3=Z2
for i in 1:3
    for j in 1:6
        tmp=Z3[i,j]
        Z3[i,j]=Z3[(7-i),j]
        Z3[(7-i),j]=tmp
    end
end
Z3
```

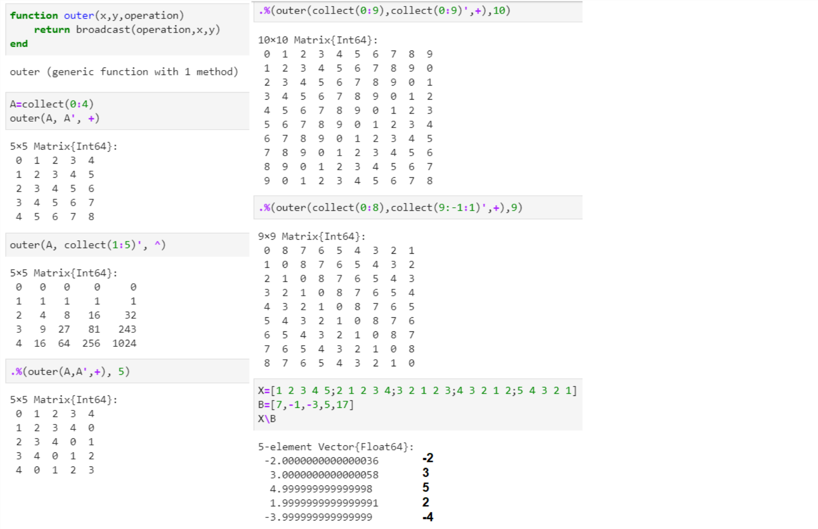
```
6×6 Matrix{Int64}:
 0  0  0  1  0  1
 0  0  1  0  1  0
 0  1  0  1  0  1
 1  0  1  0  1  0
 0  1  0  1  0  0
 1  0  1  0  0  0
```

```
Z=fill(0, (6,6))
E=fill(1, (6,6))
Z4=Z
for i in 1:6
    for j in 1:6
        if abs(i-j)==2 || i==j || abs(i-j)==4
            Z4[i,j]=1
        else
            Z4[i,j]=0
        end
    end
end
Z4
```

```
6×6 Matrix{Int64}:
 1  0  1  0  1  0
 0  1  0  1  0  1
 1  0  1  0  1  0
 0  1  0  1  0  1
 1  0  1  0  1  0
 0  1  0  1  0  1
```

Рис. 9: номер6-7

Ход работы. 8-9



```
function outer(x,y,operation)
    return broadcast(operation,x,y)
end
```

```
outer (generic function with 1 method)
```

```
A=collect(0:4)
outer(A, A', +)
```

```
5×5 Matrix{Int64}:
 0  1  2  3  4
 1  2  3  4  5
 2  3  4  5  6
 3  4  5  6  7
 4  5  6  7  8
```

```
outer(A, collect(1:5)', ^)
```

```
5×5 Matrix{Int64}:
 0   0   0    0     0
 1   1   1    1     1
 2   4   8   16    32
 3   9  27   81   243
 4  16  64  256  1024
```

```
.%(outer(A,A',+), 5)
```

```
5×5 Matrix{Int64}:
 0  1  2  3  4
 1  2  3  4  0
 2  3  4  0  1
 3  4  0  1  2
 4  0  1  2  3
```

```
.%(outer(collect(0:9),collect(0:9)',+),10)
```

```
10×10 Matrix{Int64}:
 0  1  2  3  4  5  6  7  8  9
 1  2  3  4  5  6  7  8  9  0
 2  3  4  5  6  7  8  9  0  1
 3  4  5  6  7  8  9  0  1  2
 4  5  6  7  8  9  0  1  2  3
 5  6  7  8  9  0  1  2  3  4
 6  7  8  9  0  1  2  3  4  5
 7  8  9  0  1  2  3  4  5  6
 8  9  0  1  2  3  4  5  6  7
 9  0  1  2  3  4  5  6  7  8
```

```
.%(outer(collect(0:8),collect(9:-1:1)',+),9)
```

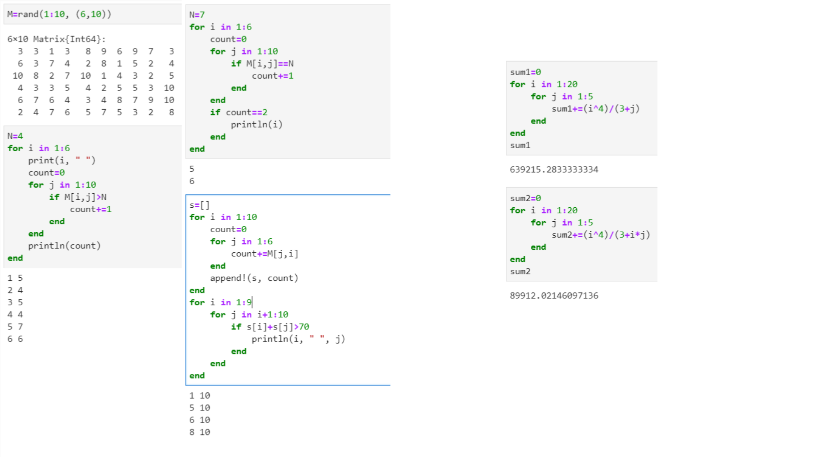
```
9×9 Matrix{Int64}:
 0  8  7  6  5  4  3  2  1
 1  0  8  7  6  5  4  3  2
 2  1  0  8  7  6  5  4  3
 3  2  1  0  8  7  6  5  4
 4  3  2  1  0  8  7  6  5
 5  4  3  2  1  0  8  7  6
 6  5  4  3  2  1  0  8  7
 7  6  5  4  3  2  1  0  8
 8  7  6  5  4  3  2  1  0
```

```
X=[1 2 3 4 5;2 1 2 3 4;3 2 1 2 3;4 3 2 1 2;5 4 3 2 1]
B=[7,-1,-3,5,17]
X\B
```

```
5-element Vector{Float64}:
 -2.0000000000000036        -2
  3.0000000000000058        3
  4.999999999999998         5
  1.9999999999999991        2
 -3.999999999999999         -4
```

Рис. 10: номер8-9

Ход работы. 10-11



```
M=rand(1:10, (6,10))
```

```
6×10 Matrix{Int64}:
  3  3  1  3   8  9  6  9  7   3
  6  3  7  4   2  8  1  5  2   4
 10  8  2  7  10  1  4  3  2   5
  4  3  3  5   4  2  5  5  3  10
  6  7  6  4   3  4  8  7  9  10
  2  4  7  6   5  7  5  3  2   8
```

```
N=4
for i in 1:6
    print(i, " ")
    count=0
    for j in 1:10
        if M[i,j]>N
            count+=1
        end
    end
    println(count)
end
```

```
1 5
2 4
3 5
4 4
5 7
6 6
```

```
N=7
for i in 1:6
    count=0
    for j in 1:10
        if M[i,j]==N
            count+=1
        end
    end
    if count==2
        println(i)
    end
end
```

```
5
6
```

```
s=[]
for i in 1:10
    count=0
    for j in 1:6
        count+=M[j,i]
    end
    append!(s, count)
end
for i in 1:9
    for j in i+1:10
        if s[i]+s[j]>70
            println(i, " ", j)
        end
    end
end
```

```
1 10
5 10
6 10
8 10
```

```
sum1=0
for i in 1:20
    for j in 1:5
        sum1+=(i^4)/(3+j)
    end
end
sum1
```

```
639215.2833333334
```

```
sum2=0
for i in 1:20
    for j in 1:5
        sum2+=(i^4)/(3+i*j)
    end
end
sum2
```

```
89912.02146097136
```

Рис. 11: номер10-11

Выводы

Освоил применение циклов функций и сторонних для Julia пакетов для решения задач линейной алгебры и работы с матрицами.