РОССИЙСКИЙ УНИВЕРСИТЕТ ДРУЖБЫ НАРОДОВ

Факультет физико-математических и естественных наук

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ОТЧЕТ
ПО ЛАБОРАТОРНОЙ РАБОТЕ № 3

дисциплина: Компьютерный практикум

по статистическому данных анализ

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МОСКВА

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Постановка задачи

Основная цель работы — изучить несколько структур данных, реализованных в Julia, научиться применять их и операции над ними для решения задач.

1. Используя Jupyter Lab, повторите примеры
2. Выполните задания для самостоятельной работы.

Выполнение работы

1. Повторение примеров

In [1]:
```
# пока n<10 прибавить к n единицу и распечатать значение:
n = 0
while n < 10
    n += 1
    println(n)
end
```

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

In [2]:
```
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!
```

In [3]:
```
for n in 1:2:10
    println(n)
end
myfriends = ["Ted", "Robyn", "Barney", "Lily", "Marshall"]
for friend in myfriends
    println("Hi $friend, it's great to see you!")
end
```

```
1
3
5
7
9
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!
```

In [4]:
```
m, n = 5, 5
A = fill(0, (m, n))
# формирование массива, в котором значение каждой записи
# является суммой индексов строки и столбца:
for i in 1:m
    for j in 1:n
        A[i, j] = i + j
    end
end
A
```

Out[4]:
```
5×5 Array{Int64,2}:
 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
```

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

Out[5]:
```
5×5 Array{Int64,2}:
 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
```

In [6]:
```
C = [i + j for i in 1:m, j in 1:n]
C
```

Out[6]:
```
5×5 Array{Int64,2}:
 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
```

In [7]:
```
# используем `&&` для реализации операции "AND"
# операция % вычисляет остаток от деления
N=10
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
```

In [8]:
```
x = 5
y = 10
(x > y) ? x : y
```

Out[8]:
```
10
```

In [9]:
```
function sayhi(name)
    println("Hi $name, it's great to see you!")
end
# функция возведения в квадрат:
function f(x)
    x^2
end
```

Out[9]:
```
f (generic function with 1 method)
```

In [10]:
```
sayhi("C-3PO")
f(42)
```

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

Out[10]:
```
1764
```

In [11]:
```
sayhi2(name) = println("Hi $name, it's great to see you!")
f2(x) = x^2
```

Out[11]:
```
f2 (generic function with 1 method)
```

In [12]:
```
sayhi3 = name -> println("Hi $name, it's great to see you!")
f3 = x -> x^2
```

Out[12]:
```
#5 (generic function with 1 method)
```

In [13]:
```
# задаём массив v:
v = [3, 5, 2]
sort(v)
v
sort!(v)
v
```

Out[13]:
```
3-element Array{Int64,1}:
 2
 3
 5
```

In [14]:
```
map(f, [1, 2, 3])
```

Out[14]:
```
3-element Array{Int64,1}:
 1
 4
 9
```

In [15]:
```
map(x -> x^3, [1, 2, 3])
```

Out[15]:
```
3-element Array{Int64,1}:
  1
  8
 27
```

In [16]:
```
f(x) = x^2
broadcast(f, [1, 2, 3])
```

Out[16]:
```
3-element Array{Int64,1}:
 1
 4
 9
```

In [17]:
```
f.([1, 2, 3])
# Задаём матрицу A:
A = [i + 3*j for j in 0:2, i in 1:3]
# Вызываем функцию f возведения в квадрат
f(A)
```

Out[17]:
```
3×3 Array{Int64,2}:
  30   36   42
  66   81   96
 102  126  150
```

In [18]:
```
A .+ 2 .* f.(A) ./ A
@. A + 2 * f(A) / A
broadcast(x -> x + 2 * f(x) / x, A)
```

Out[18]:
```
3×3 Array{Float64,2}:
  3.0   6.0   9.0
 12.0  15.0  18.0
 21.0  24.0  27.0
```

In [19]:
```
import Pkg
Pkg.add("Example")
```

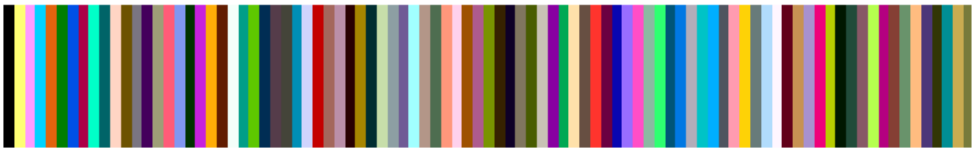
```
   Updating registry at `C:\Users\Admin\.julia\registries\General`
  Resolving package versions...
No Changes to `C:\Users\Admin\.julia\environments\v1.5\Project.toml`
No Changes to `C:\Users\Admin\.julia\environments\v1.5\Manifest.toml`
```

In [20]:
```
Pkg.add("Colors")
using Colors
```

```
  Resolving package versions...
No Changes to `C:\Users\Admin\.julia\environments\v1.5\Project.toml`
No Changes to `C:\Users\Admin\.julia\environments\v1.5\Manifest.toml`
```

In [21]:
```
palette = distinguishable_colors(100)
```

Out[21]:



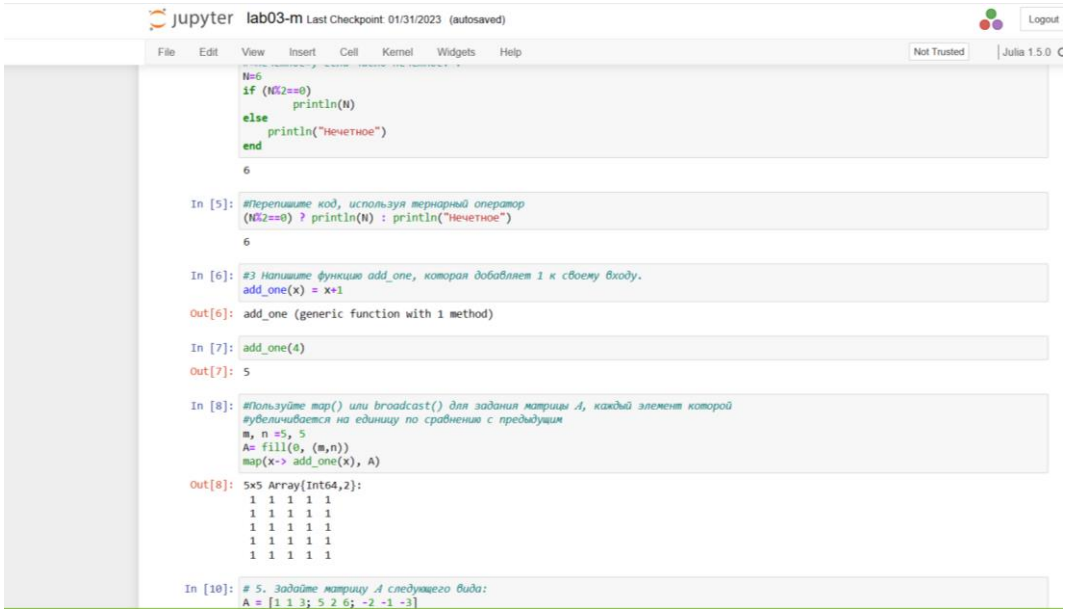
In [22]:
```
rand(palette, 3, 3)
```

Out[22]:

2.Выполните задания для самостоятельной работы

In [23]:
```
#выведите на экран целые числа от 1 до 100 и напечатайте их квадраты;
for n in 1:100
    println(n, " ", n^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
19 361
20 400
21 441
22 484
23 529
24 576
25 625
26 676
27 729
28 784
29 841
30 900
31 961
32 1024
33 1089
34 1156
35 1225
36 1296
37 1369
```



In [31]:
```
A^3
```

Out[31]:
```
3x3 Array{Int64,2}:
 0  0  0
 0  0  0
 0  0  0
```

In [32]:
```
A[:,3]=A[:,1]+A[:,2]
A
```

Out[32]:
```
3x3 Array{Int64,2}:
  1   1   2
  5   2   7
 -2  -1  -3
```

In [33]:
```
#Создайте матрицу B
B=repeat([10 -10 10], 15)
```

Out[33]:
```
15x3 Array{Int64,2}:
 10  -10  10
 10  -10  10
 10  -10  10
 10  -10  10
 10  -10  10
 10  -10  10
 10  -10  10
 10  -10  10
 10  -10  10
 10  -10  10
 10  -10  10
 10  -10  10
 10  -10  10
 10  -10  10
 10  -10  10
```

In [34]:
```
C=B'*B
```

Out[34]:
```
3x3 Array{Int64,2}:
  1500  -1500   1500
 -1500   1500  -1500
  1500  -1500   1500
```

In [35]:
```
#создайте матрицы Z повторением элементов
Z=zeros(6,6)
E=ones(6,6)
Z1=zeros(6,6)
Z2=zeros(6,6)
Z3=zeros(6,6)
Z4=zeros(6,6)
for i in 1:6
    for j in 1:6
        if(i==j-1) || (i==j+1)
            Z1[i,j]=1
        end
        if(i==j) || (i==j+2) || (i==j-2)
            Z2[i,j]=1
        end
        if(i==5-j) || (i==7-j) || (i==9-j)
            Z3[i,j]=1
        end
         if(i+j)%2==0
            Z4[i,j]=1
        end
    end
end
```

In [36]:
```
Z1
```

Out[36]:
```
6×6 Array{Float64,2}:
 0.0  1.0  0.0  0.0  0.0  0.0
 1.0  0.0  1.0  0.0  0.0  0.0
 0.0  1.0  0.0  1.0  0.0  0.0
 0.0  0.0  1.0  0.0  1.0  0.0
 0.0  0.0  0.0  1.0  0.0  1.0
 0.0  0.0  0.0  0.0  1.0  0.0
```

In [37]:
```
Z2
```

Out[37]:
```
6×6 Array{Float64,2}:
 1.0  0.0  1.0  0.0  0.0  0.0
 0.0  1.0  0.0  1.0  0.0  0.0
 1.0  0.0  1.0  0.0  1.0  0.0
 0.0  1.0  0.0  1.0  0.0  1.0
 0.0  0.0  1.0  0.0  1.0  0.0
 0.0  0.0  0.0  1.0  0.0  1.0
```

In [38]:
```
Z3
```

Out[38]:
```
6×6 Array{Float64,2}:
 0.0  0.0  0.0  1.0  0.0  1.0
 0.0  0.0  1.0  0.0  1.0  0.0
 0.0  1.0  0.0  1.0  0.0  1.0
 1.0  0.0  1.0  0.0  1.0  0.0
 0.0  1.0  0.0  1.0  0.0  0.0
 1.0  0.0  1.0  0.0  0.0  0.0
```

In [39]:
```
Z4
```

Out[39]:
```
6×6 Array{Float64,2}:
 1.0  0.0  1.0  0.0  1.0  0.0
 0.0  1.0  0.0  1.0  0.0  1.0
 1.0  0.0  1.0  0.0  1.0  0.0
 0.0  1.0  0.0  1.0  0.0  1.0
 1.0  0.0  1.0  0.0  1.0  0.0
 0.0  1.0  0.0  1.0  0.0  1.0
```

In [40]:
```
function outer(X, Y, op)
    if (ndims(X)==1)
        X=reshape(X, (size(X,1), size(X,2)))
    end
    if (ndims(Y)==1)
        Y=reshape(Y, (size(Y,1), size(Y,2)))
    end
    Z=zeros(size(X)[1], size(Y)[2])
    for i in 1:size(X)[1], j in 1:size(Y)[2], k in size(X)[2]
        Z[i, j] = op(X[i,k], Y[k,j])
    end
    return Z
end
```

Out[40]:
```
outer (generic function with 1 method)
```

In [41]:
```
M1=[i for i in 0:4]
```

Out[41]:
```
5-element Array{Int64,1}:
 0
 1
 2
 3
 4
```

In [42]:
```
outer(M1, M1', +)
```

Out[42]:
```
5×5 Array{Float64,2}:
 0.0  1.0  2.0  3.0  4.0
 1.0  2.0  3.0  4.0  5.0
 2.0  3.0  4.0  5.0  6.0
 3.0  4.0  5.0  6.0  7.0
 4.0  5.0  6.0  7.0  8.0
```

In [43]:
```
M2=[i for i in 1:5]
outer(M1, M2', ^)
```

Out[43]:
```
5×5 Array{Float64,2}:
 0.0   0.0   0.0    0.0     0.0
 1.0   1.0   1.0    1.0     1.0
 2.0   4.0   8.0   16.0    32.0
 3.0   9.0  27.0   81.0   243.0
 4.0  16.0  64.0  256.0  1024.0
```

In [44]:
```
outer(M1, M1', +).%5
```

Out[44]:
```
5×5 Array{Float64,2}:
 0.0  1.0  2.0  3.0  4.0
 1.0  2.0  3.0  4.0  0.0
 2.0  3.0  4.0  0.0  1.0
 3.0  4.0  0.0  1.0  2.0
 4.0  0.0  1.0  2.0  3.0
```

In [45]:
```
outer([i for i in 0:9], [i for i in 0:9]', +).%10
```

Out[45]:
```
10×10 Array{Float64,2}:
 0.0  1.0  2.0  3.0  4.0  5.0  6.0  7.0  8.0  9.0
 1.0  2.0  3.0  4.0  5.0  6.0  7.0  8.0  9.0  0.0
 2.0  3.0  4.0  5.0  6.0  7.0  8.0  9.0  0.0  1.0
 3.0  4.0  5.0  6.0  7.0  8.0  9.0  0.0  1.0  2.0
 4.0  5.0  6.0  7.0  8.0  9.0  0.0  1.0  2.0  3.0
 5.0  6.0  7.0  8.0  9.0  0.0  1.0  2.0  3.0  4.0
 6.0  7.0  8.0  9.0  0.0  1.0  2.0  3.0  4.0  5.0
 7.0  8.0  9.0  0.0  1.0  2.0  3.0  4.0  5.0  6.0
 8.0  9.0  0.0  1.0  2.0  3.0  4.0  5.0  6.0  7.0
 9.0  0.0  1.0  2.0  3.0  4.0  5.0  6.0  7.0  8.0
```

In [46]:
```
outer([i for i in 0:8], [i for i in -9:-1]', -).%9
```

Out[46]:
```
9×9 Array{Float64,2}:
 0.0  8.0  7.0  6.0  5.0  4.0  3.0  2.0  1.0
 1.0  0.0  8.0  7.0  6.0  5.0  4.0  3.0  2.0
 2.0  1.0  0.0  8.0  7.0  6.0  5.0  4.0  3.0
 3.0  2.0  1.0  0.0  8.0  7.0  6.0  5.0  4.0
 4.0  3.0  2.0  1.0  0.0  8.0  7.0  6.0  5.0
 5.0  4.0  3.0  2.0  1.0  0.0  8.0  7.0  6.0
 6.0  5.0  4.0  3.0  2.0  1.0  0.0  8.0  7.0
 7.0  6.0  5.0  4.0  3.0  2.0  1.0  0.0  8.0
 8.0  7.0  6.0  5.0  4.0  3.0  2.0  1.0  0.0
```

In [47]:
```
#решить систему
A=outer([i for i in 1:5], [i for i in 1:5]',-)
A=abs.(A)
A=A.+1
y=[7, -1, -3, 5, 17]
x=inv(A)*y
```

Out[47]:
```
5-element Array{Float64,1}:
 -2.0
  3.0
  4.999999999999999
  1.9999999999999982
 -3.999999999999999
```

In [51]:
```
N =4
for i in 1:6
    c=0
    for j in 1:10
        if M[i,j]>N
            c =c+1
        end
    end
    println(" line ", i, "contains ", c, " elements > ", N)
end
```

```
 line 1contains 6 elements > 4
 line 2contains 3 elements > 4
 line 3contains 6 elements > 4
 line 4contains 5 elements > 4
 line 5contains 6 elements > 4
 line 6contains 7 elements > 4
```

In [52]:
```
N =4
for i in 1:6
    c=0
    for j in 1:10
        if M[i,j]==N
            c =c+1
        end
    end
    if c==2
    println(" строка ", i, "содержит чило ", N, " ровно 2 раза ")
    end
end
```

```
 строка 3содержит чило4 ровно 2 раза
```

In [57]:
```
K=75
sum=0
for j in 1:10
    for k in (j+1):10
        for i in 1:6
            sum =sum + M[i,j]+M[i,k]
        end
        if sum > K
            println(" Сумма столбцов ", j, " ", k, " = ", sum)
        end
        sum =0
    end
end
```

```
 Сумма столбцов 2 6 = 76
 Сумма столбцов 2 7 = 82
 Сумма столбцов 2 9 = 77
 Сумма столбцов 6 7 = 76
 Сумма столбцов 7 9 = 77
```

In [60]:
```
# Вычислить сумму
```

In [52]:
```
#Вычислите суммы
Arr=[(i^4)/(3+j) for j in 1:5, i in 1:20]
sum = 0
for i in 1:5
    for j in 1:20
        sum = sum + Arr[i,j]
    end
end
sum
```

Out[52]: 639215.2833333338

In [53]:
```
Arr=[(i^4)/(3+i*j) for j in 1:5, i in 1:20]
sum = 0
for i in 1:5
    for j in 1:20
        sum = sum + Arr[i,j]
    end
end
sum
```

Out[53]: 89912.02146097131

Выводы

Получал навыки работы с матрицами и функциями в Julia