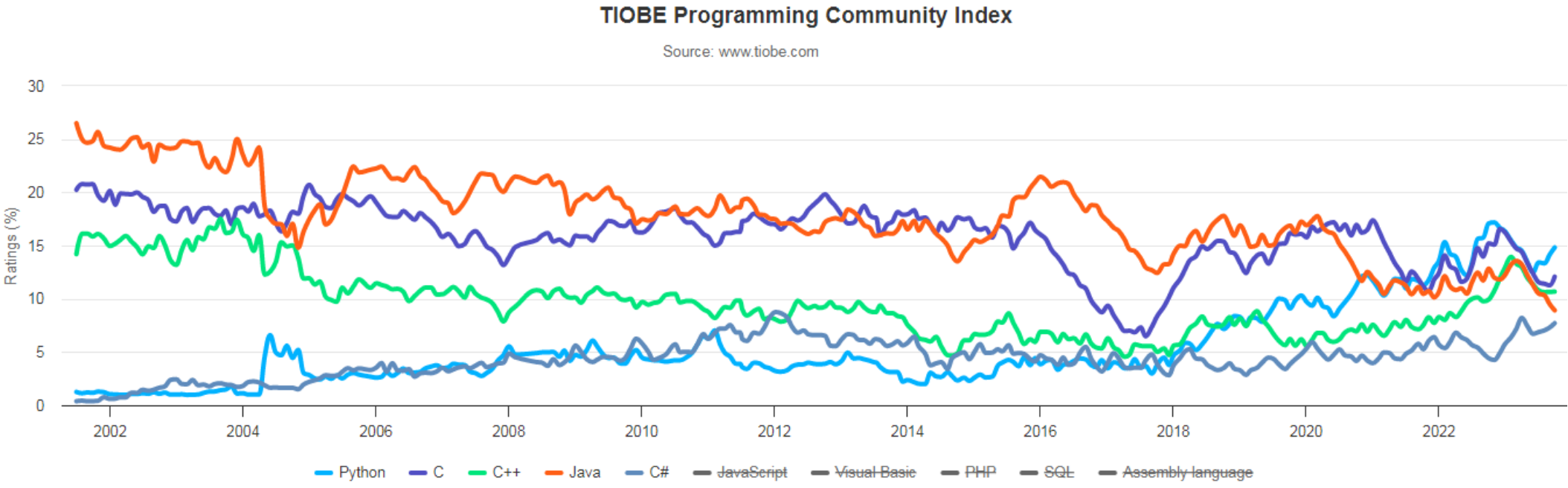
Информатика

Лекция №3. Тема: «Современные языки программирования. Python. Основы регулярных выражений.»

Статистика использования языков



https://www.tiobe.com/tiobe-index/

Статистика использования языков (2)

Python:

September 2017 = 2,98%
September 2018 = 7,65%
September 2019 = 9,88%
September 2020 = 10,47%
September 2021 = 11,67%
September 2022 = 15,74%
September 2023 = 14,82%

Oct 2023	Oct 2022	Change	Programming Language	Ratings	Change
1	1		Python	14.82%	-2.25%
2	2		C	12.08%	-3.13%
3	4	▲	C++	10.67%	+0.74%
4	3	▼	Java	8.92%	-3.92%
5	5		C#	7.71%	+3.29%
6	7	▲	JavaScript	2.91%	+0.17%
7	6	▼	Visual Basic	2.13%	-1.82%
8	9	▲	PHP	1.90%	-0.14%
9	10	▲	SQL	1.78%	+0.00%
10	8	▼	Assembly language	1.64%	-0.75%

Языки программирования лидеров IT-рынка

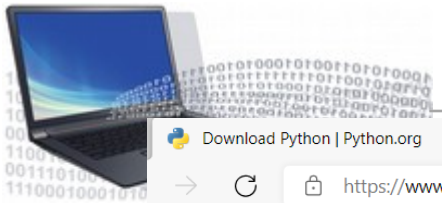
SAMSUNG	C, C++, Java, Python, JavaScript
Microsoft	C, C++, C#, HTML5/JavaScript
Google	C, C++, Java, Python, Go, HTML5/JavaScript
	Objective-C, Swift
facebook	PHP, HTML5/JavaScript, Hack
Интернет-стартапы	Python, Ruby

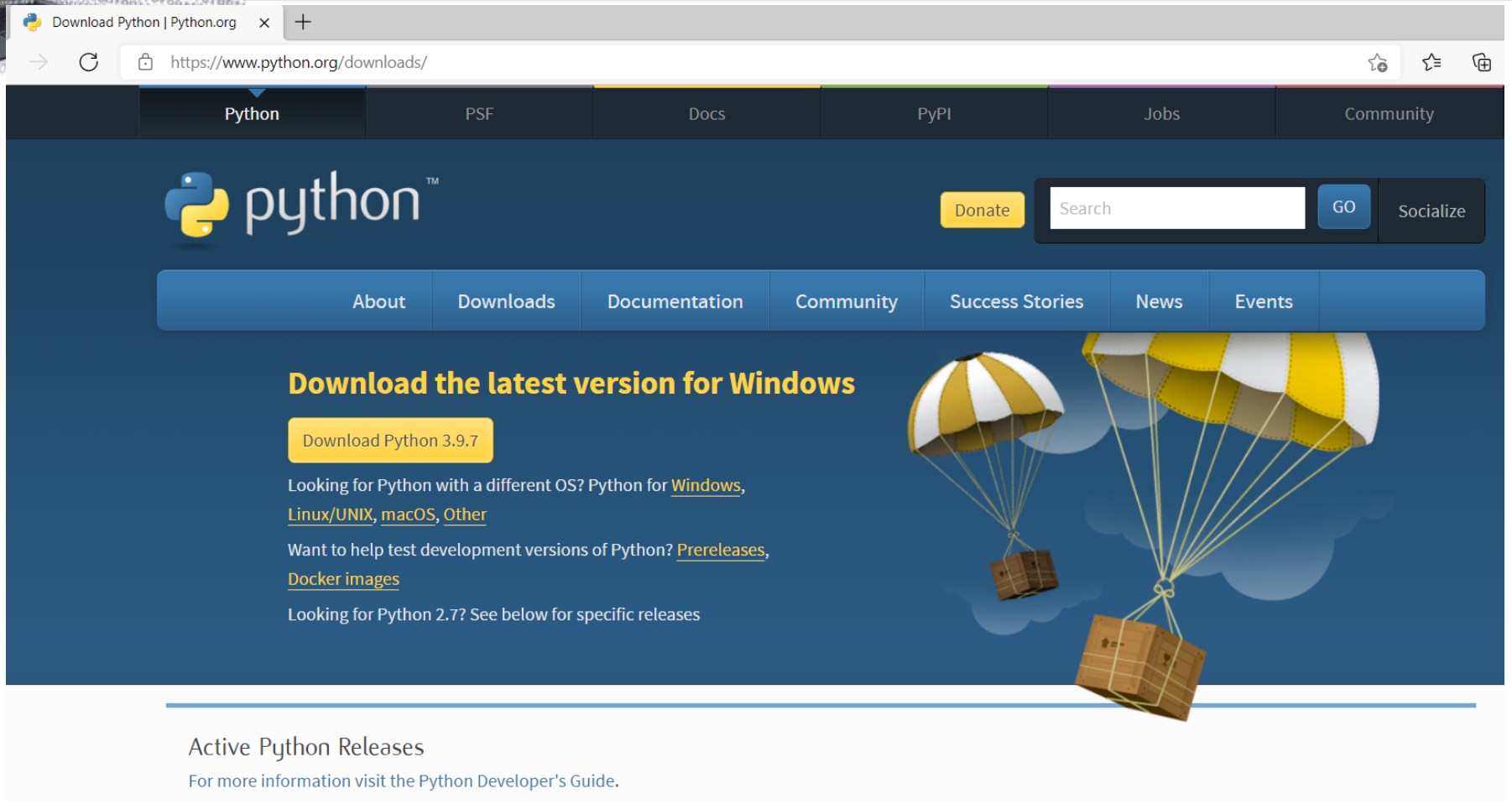
In [6]:

```
for i in range(20):
print (i)
```

```
  File "<ipython-input-6-db022ee2e780>",
line 2
    print (i)
        ^
IndentationError: expected an indented b
lock
```

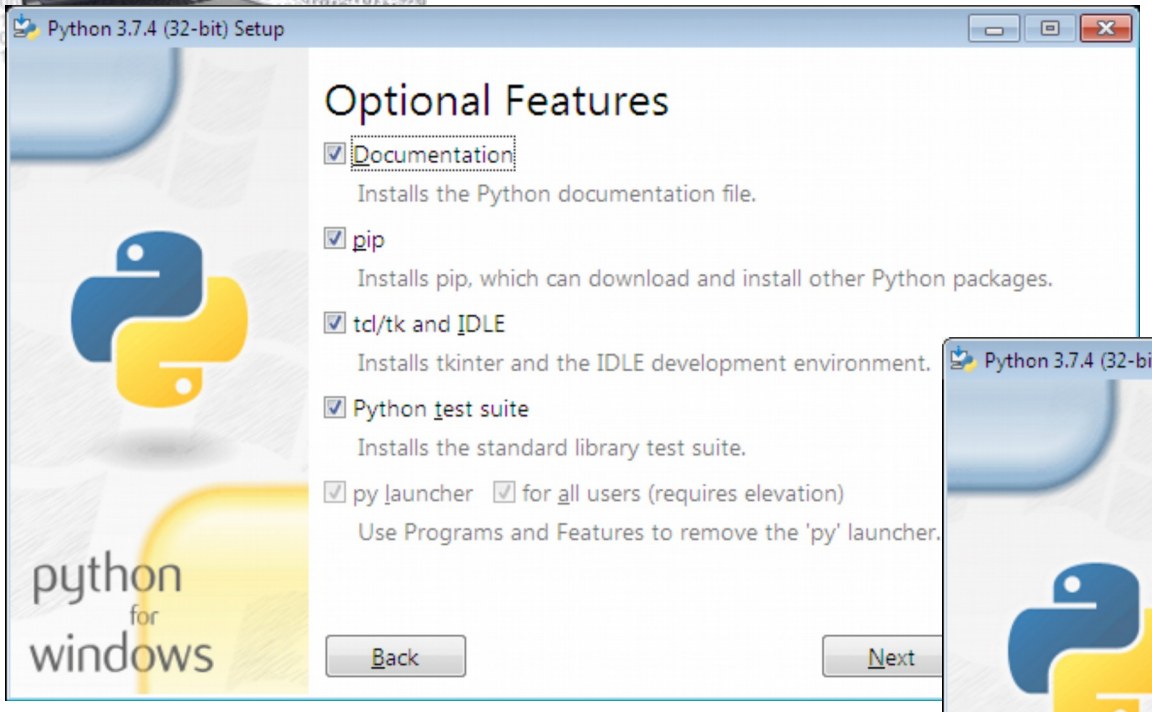

```
for i in range(20):
    print (i)
```

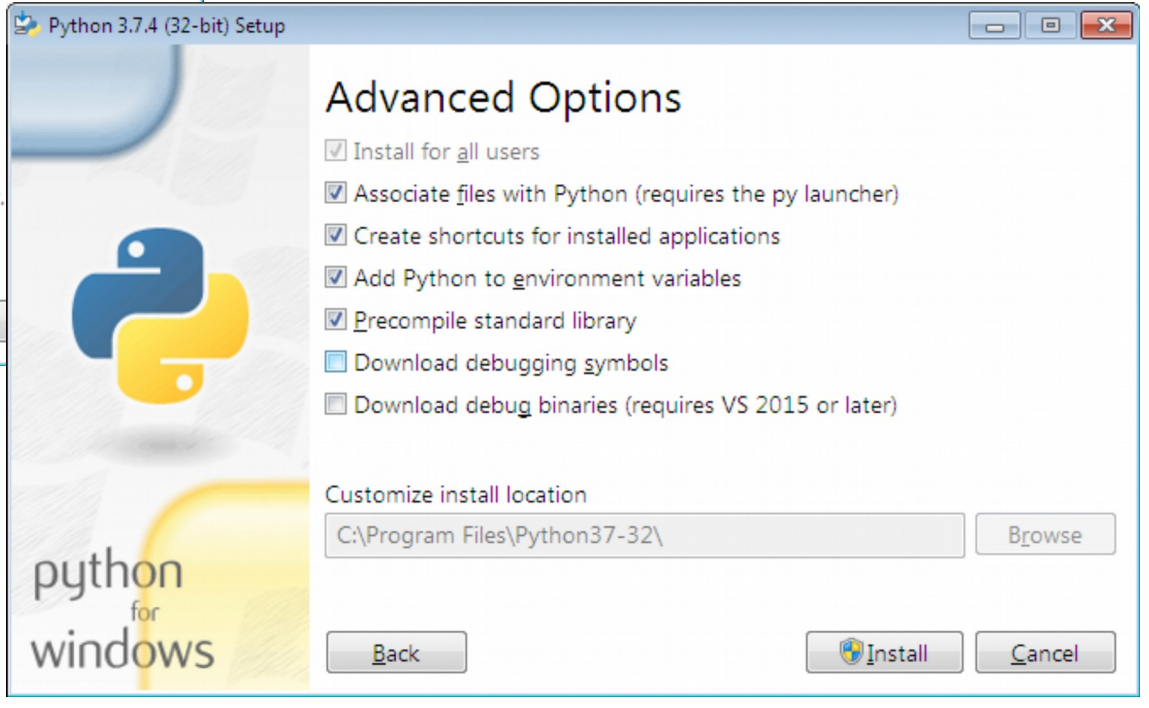




https://www.python.org/downloads/

Установка(2)





Важно установить pip для дальнейшего подключения пакетов/библиотек

Hello, world!

Python 3.7.0 Shell

File Edit Shell Debug Options Window Help

```
Python 3.7.0 (v3.7.0:1bf9cc5093, Jun 27 2018, 04:59:51) [MSC v.1914 64 bit (AMD64)] on win32
Type "copyright", "credits" or "license()" for more information.
>>>
========== RESTART: C:\Users\balap\Desktop\Hello_World.py ==========
Hello, World!
>>>
```

Hello_World.py - C:\Users\balap\Desktop\Hello_World.py (3.7.0)

File Edit Format Run Options Window Help

```
print('Hello, World!')
```

Ln: 2 Col: 0

Ln: 6 Col: 4

Environmnet Jupyter

Онлайн Jupiter для целей ML&DS

Welcome To Colaboratory - Cola

colab.research.google.com

Welcome To Colaboratory

File Edit View Insert Runtime Tools Help

Table of contents

Getting started

Data science

Machine learning

More Resources

Featured examples

Section

+ Code + Text Copy to Drive

Welcome to Colab!

If you're already familiar with Colab, check out this video to learn about interactive tables, the executed code history view, palette.

What is Colab?

Colab, or "Colaboratory", allows you to write and execute Python in your browser, with

- Zero configuration required
- Access to GPUs free of charge
- Easy sharing

!pip — для установки библиотек

! — при использовании bash-скриптов

Примеры команд

pip install --upgrade ipython jupyter
pip install jupyterlab

cd C:\Users\<USER_NAME>\AppData\Local\Programs\Python\Python37\Scripts

jupyter-notebook.exe

```
C:\>pip install numpy
Collecting numpy
  Downloading https://files.pythonhosted.org/packages/96/d6/53a59338c613e0c3ec7e3052bbf068a5457a005a5f7ad4ae005167c3597e
/numpy-1.15.2-cp37-none-win_amd64.whl (13.5MB)
    100% |████████████████████████████████| 13.5MB 1.4MB/s
Installing collected packages: numpy
Successfully installed numpy-1.15.2
You are using pip version 10.0.1, however version 18.1 is available.
You should consider upgrading via the 'python -m pip install --upgrade pip' command.
```

Hello, world! (2)

Untitled1 - Jupyter Notebook

localhost:8888/notebooks/Untitled1.ipynb

jupyter Untitled1 Last Checkpoint: 42 minutes ago (autosaved)

Logout

File Edit View Insert Cell Kernel Widgets Help

Trusted | Python 3

Run Code

```
In [2]: print("Hello, world!")
        Hello, world!

In [ ]:
```


```
In [18]: 255 + 34
Out[18]: 289

In [19]: 5 * 2
Out[19]: 10

In [20]: 20 / 3
Out[20]: 6.666666666666667

In [21]: 20 // 3
Out[21]: 6

In [22]: 20 % 3
Out[22]: 2

In [23]: 3 ** 4
Out[23]: 81

In [24]: pow(3, 4)
Out[24]: 81
```

Функции в Python(2)

In [25]:
```
n = -37
print (bin(n))
n.bit_length()
```

```
-0b100101
```

Out[25]:
```
6
```

In [26]:
```
print ((1024).to_bytes(2, byteorder='big'))
print (int.from_bytes(b'\x00\x10', byteorder='big'))
```

```
b'\x04\x00'
16
```

In [27]:
```
print (bin(19))
print (oct(19))
print (hex(19))
print (0b10011)
print (int('10011', 2))
```

```
0b10011
0o23
0x13
19
19
```

Функции в Python(3)

In [28]:
```
import math
print (math.pi)
print (math.sqrt(85))
```

```
3.141592653589793
9.219544457292887
```

In [29]:
```
x = complex(1, 2)
print (x)
```

```
(1+2j)
```

In [31]:
```
S1 = 'spam'
S2 = 'eggs'
print (S1 + S2)
print (len('spam'))

print (S1[0])
print (S1[1])
print (S1[-2])
```

```
spameggs
4
s
p
a
```

Функции в Python(4)

In [32]:
```
a = " Hello, World! "
print(a.strip())
print(a.lower())
print(a.upper())
print(a.replace("H", "J"))
print(a.split(","))
```

```
Hello, World!
 hello, world!
 HELLO, WORLD!
 Jello, World!
[' Hello', ' World! ']
```

In [34]:
```
age = 36
txt = "My name is John, and I am {}"
print(txt.format(age))
age = "36"
txt = "My name is John, I am " + age
print(txt)
```

```
My name is John, and I am 36
My name is John, I am 36
```

Функции в Python(5)

In [8]:
```
def sum (x, y):
    total = x + y
    return total
```

In [13]:
```
a = sum(1, 5)
print ("sum of 1 and 5 is: ", a)
b = sum(1.5, 1.023)
print ("sum of 1.5 and 1.023 is: ", b)
```

```
sum of 1 and 5 is:  6
sum of 1.5 and 1.023 is:  2.5229999999999997
```

Функции в Python(6)

In [15]:
```
a = int(input())
if a < -5:
    print('Low')
elif -5 <= a <= 5:
    print('Mid')
else:
    print('High')
```

```
15
High
```

In [16]:
```
for i in 'hello world':
    print(i * 2, end='')
```

```
hheelllloo  wwoorrlldd
```

In [17]:
```
for i in 'hello world':
    if i == 'a':
        break
else:
    print('There is no letter "a"')
```

```
There is no letter "a"
```

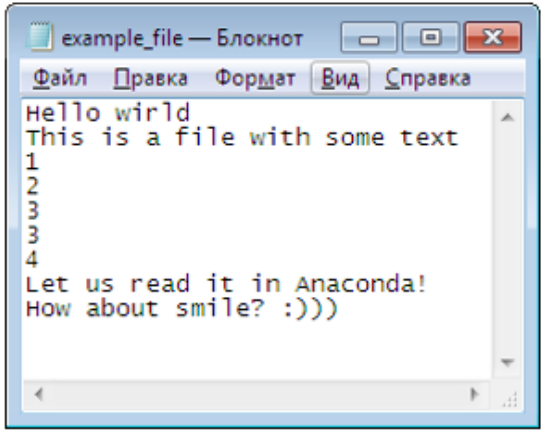
Работа с файлами в Python

In [44]:
```
address = 'D:\Jupiter\example_file.txt'
f = open(address, 'r')
print (f)
```

```
<_io.TextIOWrapper name='D:\\Jupiter\\example_file.txt' mode='r' encoding='c
p1251'>
```

In [45]:
```
print (f.read(1))

for line in f:
    print (line)
```

```
H
ello wirld

This is a file with some text

1

2

3

3

4

Let us read it in Anaconda!

How about smile? :)))
```



Работа с файлами в Python(2)

```
In [51]: l = [str(i)+str(i-1) for i in range(20)]
         print (l)

         f = open(address, 'w')

         for index in l:
              f.write(index + '\n')
         f.close()
```

```
['0-1', '10', '21', '32', '43', '54', '65', '76', '87', '98', '109', '1110',
'1211', '1312', '1413', '1514', '1615', '1716', '1817', '1918']
```

example_file — Блокнот

Файл Правка Формат Вид Справка

```
0-1
10
21
32
43
54
65
76
87
98
109
1110
1211
1312
1413
1514
1615
1716
1817
1918
```

Запуск из командной строки

D:\Jupiter\Hello_World.py - Notepad++

Файл Правка Поиск Вид Кодировки Синтаксис Опции Макросы
Запуск Плагины Окна ?

Hello_World.py

```
1   print('Hello, World!')
```

Ln : 1 Col : 23 Sel : 0 Dos\Windows ANSI

C:\Windows\system32\cmd.exe

```
Microsoft Windows [Version 6.1.7601]
(c) Корпорация Майкрософт (Microsoft Corp.), 2009. Все права защищены.

C:\Users\Aglaia>python
Python 3.7.4 (tags/v3.7.4:e09359112e, Jul  8 2019, 19:29:22) [MSC v.1916 32 bit
(Intel)] on win32
Type "help", "copyright", "credits" or "license" for more information.
>>> age = 36
>>> txt = "My name is John, and I am {}"
>>> print(txt.format(age))
My name is John, and I am 36
>>> age = "36"
>>> txt = "My name is John, I am " + age
>>> print(txt)
My name is John, I am 36
>>> exit()

C:\Users\Aglaia>D:

D:\>cd Jupiter\

D:\Jupiter>python Hello_World.py
Hello, World!

D:\Jupiter>
```

Полезные функции для работы со строками

capitalize()	Converts the first character to upper case	ljust()	Returns a left justified version of the string
casefold()	Converts string into lower case	lower()	Converts a string into lower case
center()	Returns a centered string	lstrip()	Returns a left trim version of the string
count()	Returns the number of times a specified value occurs in a string	maketrans()	Returns a translation table to be used in translations
encode()	Returns an encoded version of the string	partition()	Returns a tuple where the string is parted into three parts
endswith()	Returns true if the string ends with the specified value	replace()	Returns a string where a specified value is replaced with a specified value
expandtabs()	Sets the tab size of the string	rfind()	Searches the string for a specified value and returns the last position of where it was found
find()	Searches the string for a specified value and returns the position of where it was found	rindex()	Searches the string for a specified value and returns the last position of where it was found
format()	Formats specified values in a string	rjust()	Returns a right justified version of the string
format_map()	Formats specified values in a string	rpartition()	Returns a tuple where the string is parted into three parts
index()	Searches the string for a specified value and returns the position of where it was found	rsplit()	Splits the string at the specified separator, and returns a list
isalnum()	Returns True if all characters in the string are alphanumeric	rstrip()	Returns a right trim version of the string
isalpha()	Returns True if all characters in the string are in the alphabet	split()	Splits the string at the specified separator, and returns a list
isdecimal()	Returns True if all characters in the string are decimals	splitlines()	Splits the string at line breaks and returns a list

Полезные функции для работы со строками(2)

isdigit()	Returns True if all characters in the string are digits	startswith()	Returns true if the string starts with the specified value
isidentifier()	Returns True if the string is an identifier	strip()	Returns a trimmed version of the string
islower()	Returns True if all characters in the string are lower case	swapcase()	Swaps cases, lower case becomes upper case and vice versa
isnumeric()	Returns True if all characters in the string are numeric	title()	Converts the first character of each word to upper case
isprintable()	Returns True if all characters in the string are printable	translate()	Returns a translated string
isspace()	Returns True if all characters in the string are whitespaces	upper()	Converts a string into upper case
istitle()	Returns True if the string follows the rules of a title	zfill()	Fills the string with a specified number of 0 values at the beginning
isupper()	Returns True if all characters in the string are upper case	ljust()	Returns a left justified version of the string
join()	Joins the elements of an iterable to the end of the string	lower()	Converts a string into lower case
capitalize()	Converts the first character to upper case	lstrip()	Returns a left trim version of the string
casefold()	Converts string into lower case	maketrans()	Returns a translation table to be used in translations
center()	Returns a centered string	partition()	Returns a tuple where the string is parted into three parts
count()	Returns the number of times a specified value occurs in a string	replace()	Returns a string where a specified value is replaced with a specified value
encode()	Returns an encoded version of the string	rfind()	Searches the string for a specified value and returns the last position of where it was found
endswith()	Returns true if the string ends with the specified value	rindex()	Searches the string for a specified value and returns the last position of where it was found

Полезные функции для работы со строками(3)

expandtabs()	Sets the tab size of the string	rjust()	Returns a right justified version of the string
find()	Searches the string for a specified value and returns the position of where it was found	rpartition()	Returns a tuple where the string is parted into three parts
format()	Formats specified values in a string	rsplit()	Splits the string at the specified separator, and returns a list
format_map()	Formats specified values in a string	rstrip()	Returns a right trim version of the string
index()	Searches the string for a specified value and returns the position of where it was found	split()	Splits the string at the specified separator, and returns a list

Дополнительные библиотеки и пакеты

python™

NumPy

IPython

SciPy

matplotlib

SymPy

Mayavi

pandas

Cython

StatsModels
Statistics in Python

scikits
learn
machine learning in Python

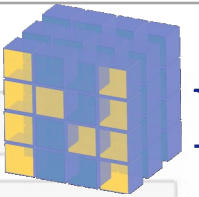
scikits-image
image processing in python

PyTables

NetworkX

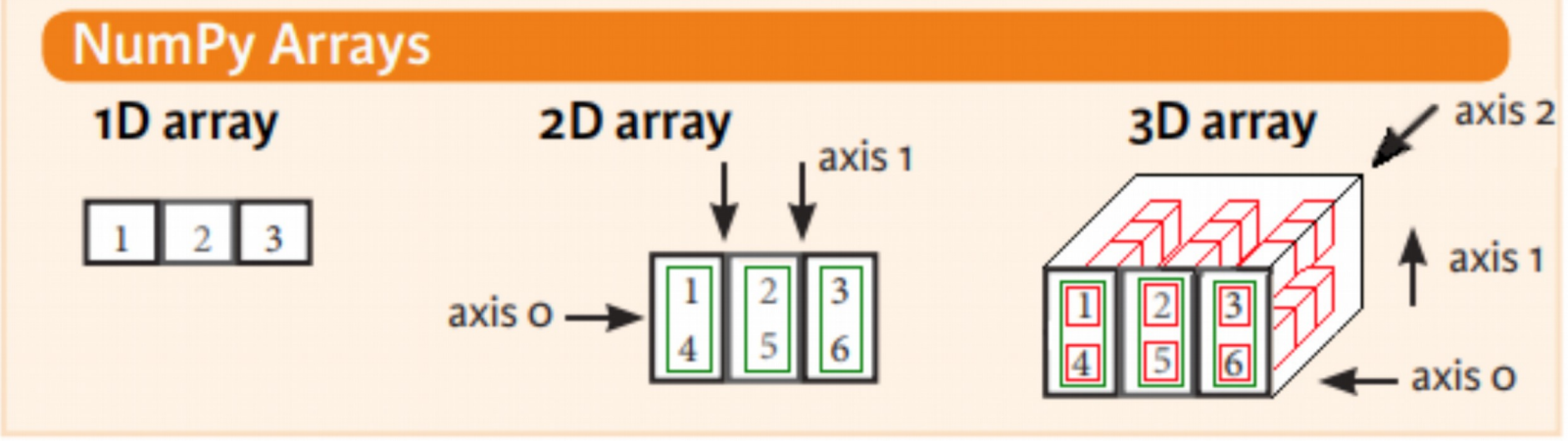
По материалам Жумагулова Я.В.

Дополнительные библиотеки и пакеты(2)

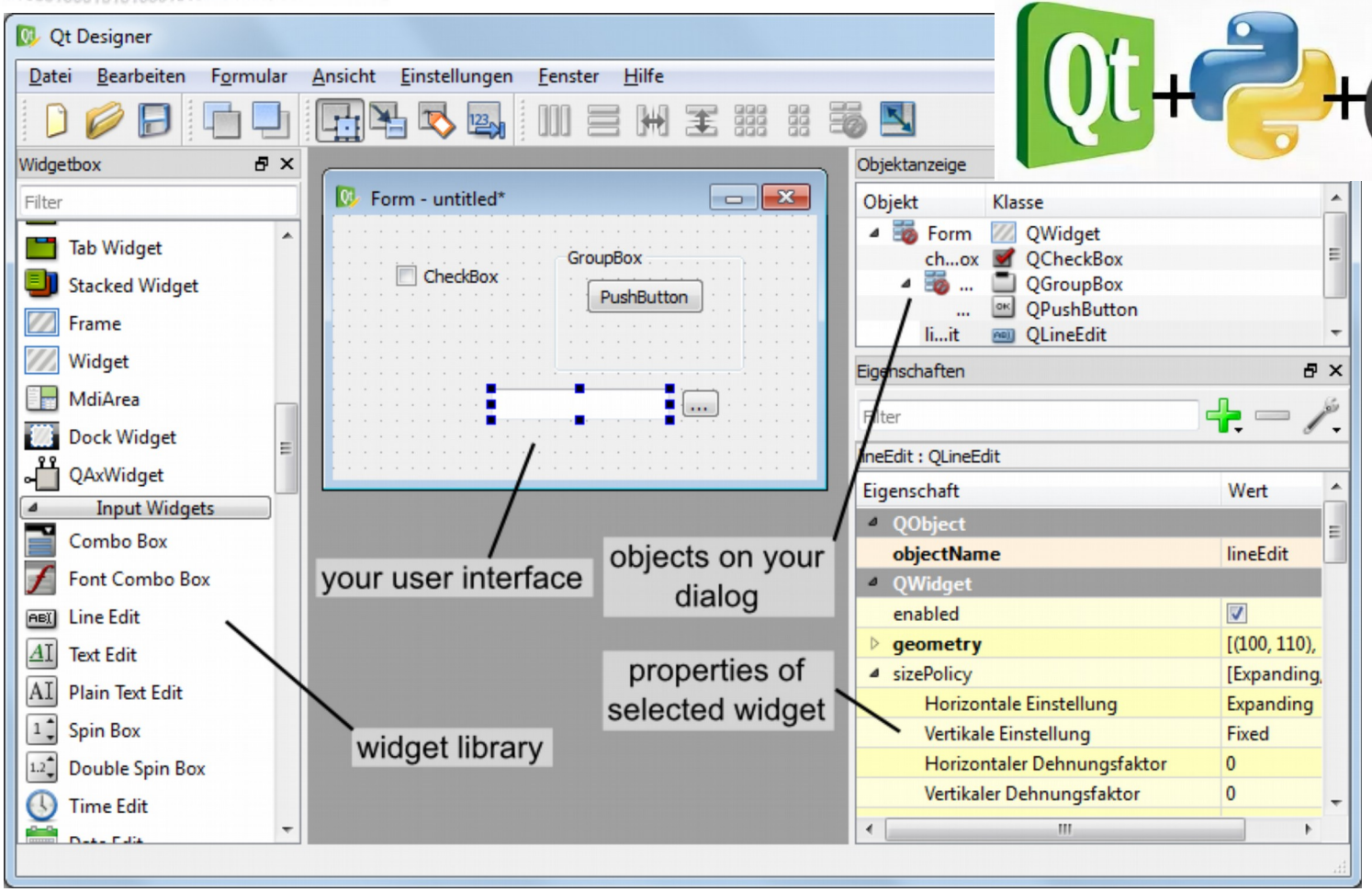


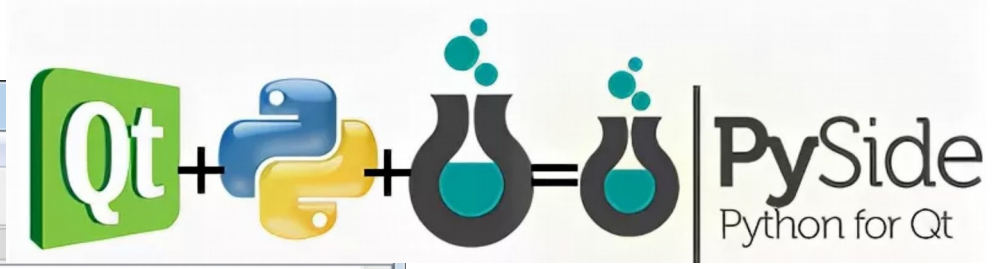
NumPy

```
In [1]: import numpy as np

In [2]: a = np.arange(12).reshape(2, 2, 3)

In [3]: a

Out[3]: array([[[ 0,  1,  2],
                [ 3,  4,  5]],

               [[ 6,  7,  8],
                [ 9, 10, 11]]])
```



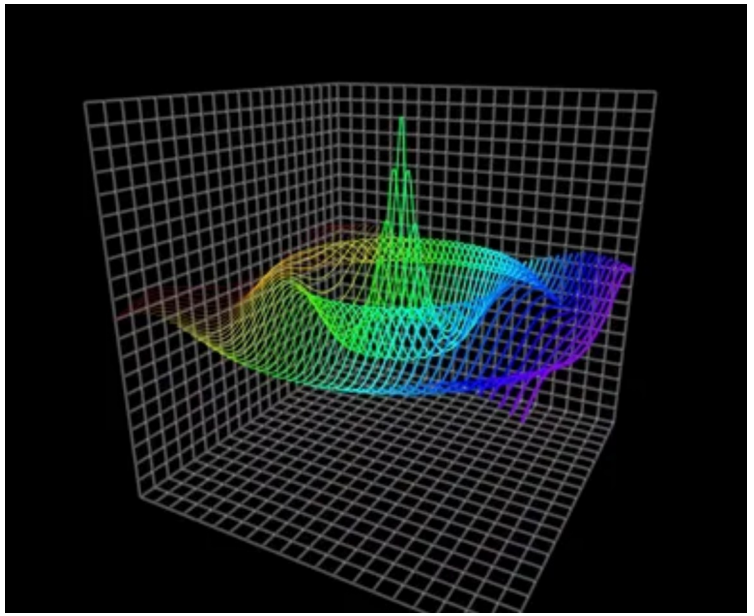
Дополнительные библиотеки и пакеты(3)

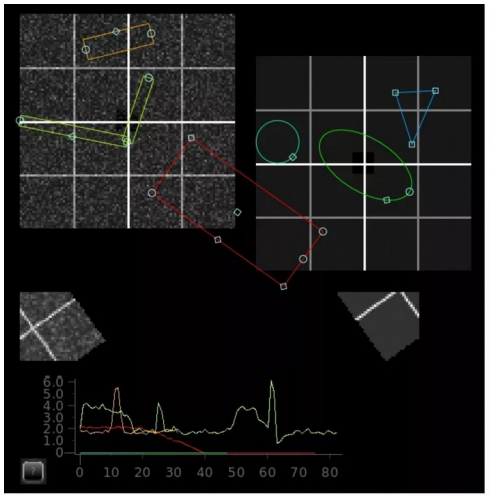


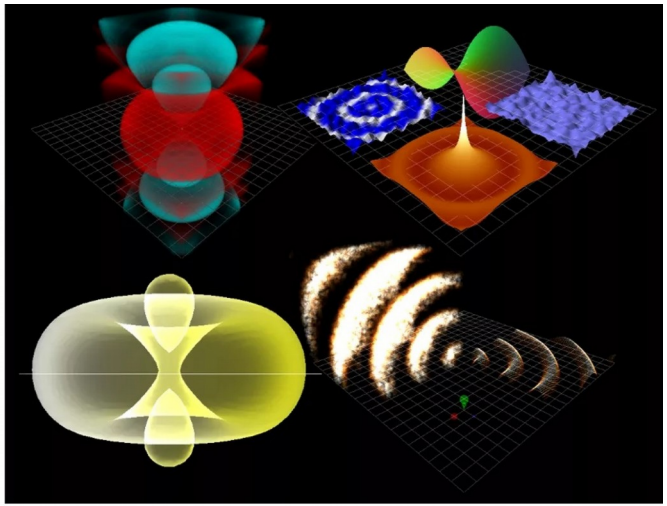


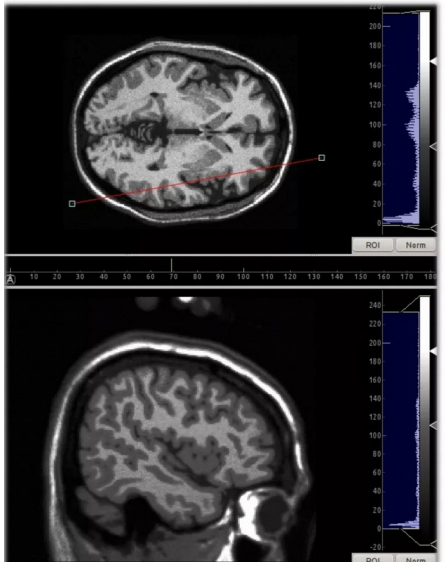
Дополнительные библиотеки и пакеты(4)

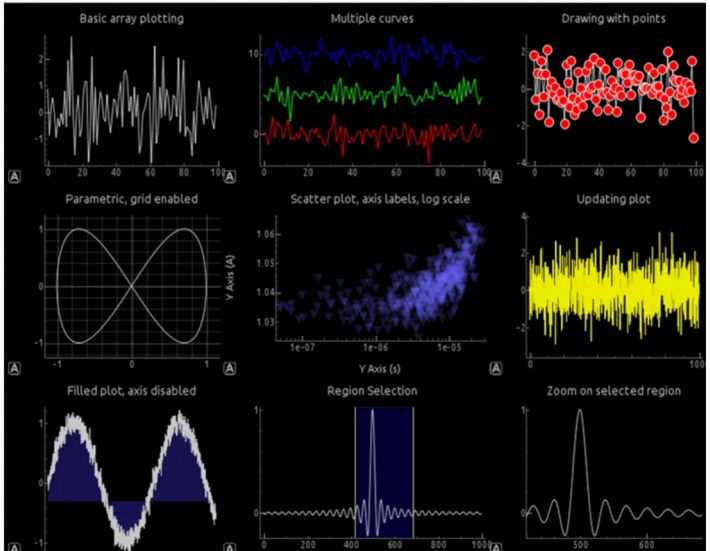
Pyqtgraph











Полезные ссылки

https://ru.wikiversity.org/wiki/Программирование_и_научные_вычисления_на_языке_Python

https://realpython.com/ - Простые примеры

https://habr.com/post/352678/ - Установка и использование NumPy

https://www.lfd.uci.edu/~gohlke/pythonlibs/ - Набор готовых библиотек

https://learnxinyminutes.com/docs/ru-ru/python-ru/ - Экспресс-курс

https://books.ifmo.ru/file/pdf/2256.pdf - Методическое пособие Лямина А.В.

Полезные ссылки (2)

https://tproger.ru/translations/jupyter-notebook-python-3/ - Командная оболочка Jupyter для интерактивных вычислений

https://www.jetbrains.com/pycharm/ - Интегрированная среда разработки

https://thonny.org/ - Ещё одна интегрированная среда*

Немного шуток

ПЕРВЫЙ ДЕНЬ ПИТОН ПРОГРАММИСТА:

Google

how to learn python

Google Search I'm Feeling Lucky

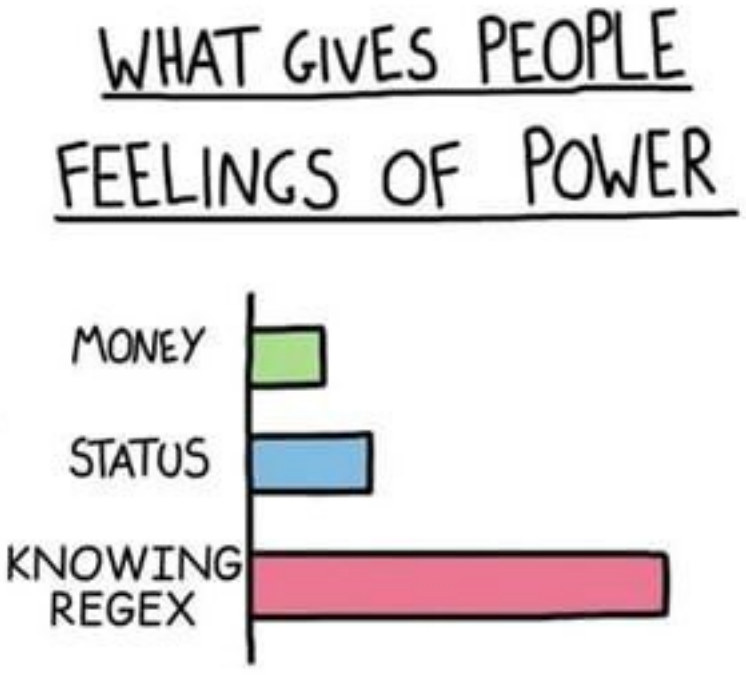
ВТОРОЙ ДЕНЬ ПИТОН ПРОГРАММИСТА:

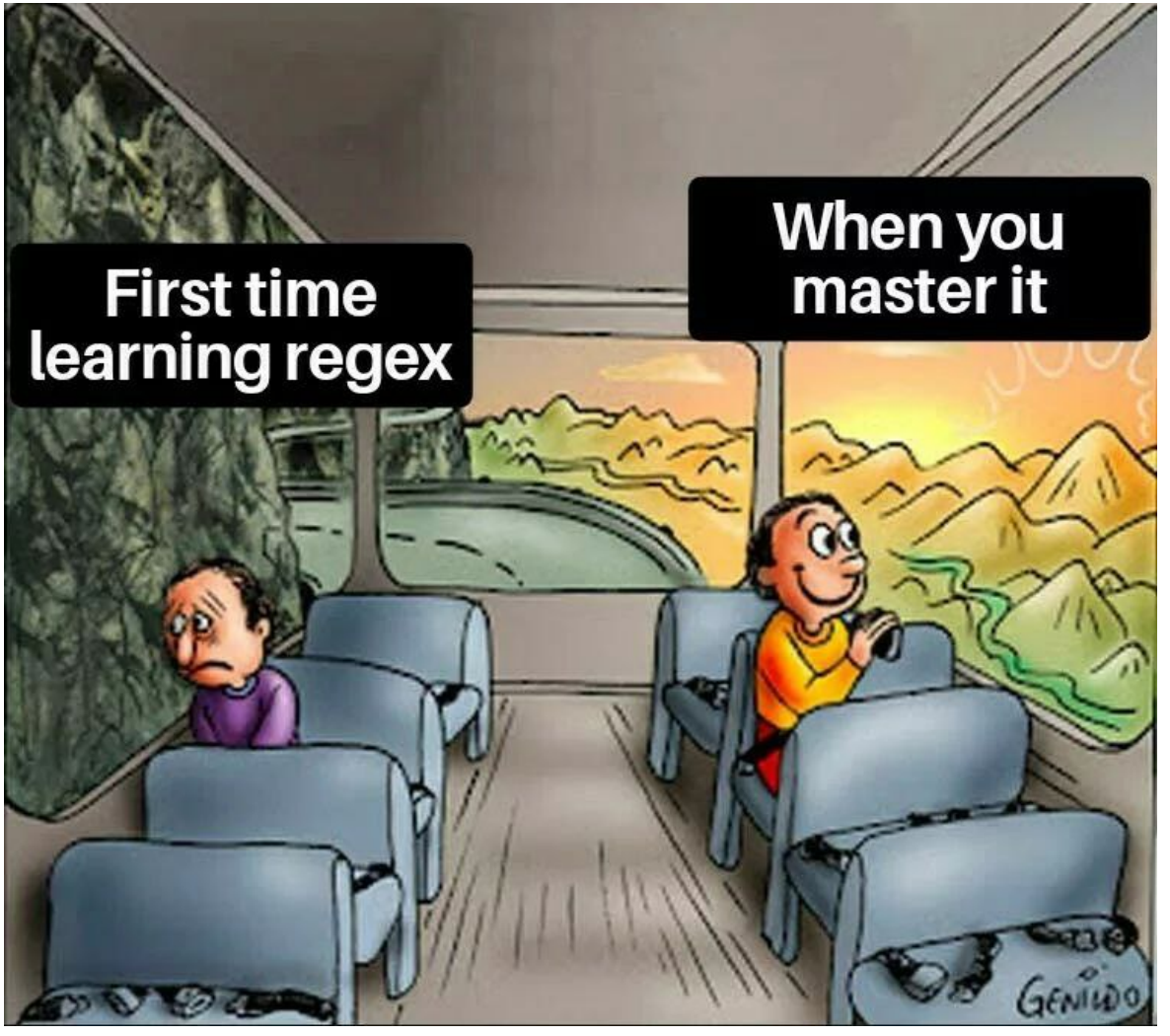
Google

how to become machine learning engineer

Google Search I'm Feeling Lucky

Немного шуток (2)



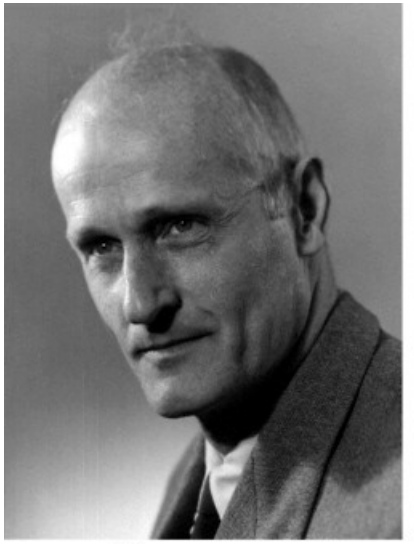


Определение

Регулярные выражения (regular expressions) — последовательность символов, определяющая шаблон для поиска в строках.

Их поддерживают ряд языков, включая Python, Perl, R, C++, Java.

https://regex101.com/



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Примеры регулярных выражений

REGULAR EXPRESSION

348 matches (709 steps, 0.3ms)

/ . / gm

TEST STRING

```
My IP-address \home\: 192.168.1.0
My IP-address \home\: 192.168.1.1
My IP-address \home\: 192.168.1.2
My IP-address \home\: 192.168.1.3
...
My IP-address \work\: 192.168.1.100
My IP-address \work\: 192.168.1.101
My IP-address \work\: 192.168.1.102
...
My IP-address \home\: 192.168.1.253
My IP-address \home\: 192.168.1.254
My IP-address \home\: 192.168.1.255
```

REGULAR EXPRESSION

92 matches (184 steps, 0.2ms)

/ \d / gm

TEST STRING

```
My IP-address \home\: 192.168.1.0
My IP-address \home\: 192.168.1.1
My IP-address \home\: 192.168.1.2
My IP-address \home\: 192.168.1.3
...
My IP-address \work\: 192.168.1.100
My IP-address \work\: 192.168.1.101
My IP-address \work\: 192.168.1.102
...
My IP-address \home\: 192.168.1.253
My IP-address \home\: 192.168.1.254
My IP-address \home\: 192.168.1.255
```

Примеры регулярных выражений

REGULAR EXPRESSION

4 matches (138 steps, 0.2ms)

/ 192\.168\.1\.1 / gm

TEST STRING

```
My IP-address \home\: 192.168.1.0
My IP-address \home\: 192.168.1.1
My IP-address \home\: 192.168.1.2
My IP-address \home\: 192.168.1.3
...
My IP-address \work\: 192.168.1.100
My IP-address \work\: 192.168.1.101
My IP-address \work\: 192.168.1.102
...
My IP-address \home\: 192.168.1.253
My IP-address \home\: 192.168.1.254
My IP-address \home\: 192.168.1.255
```

REGULAR EXPRESSION

10 matches (120 steps, 0.3ms)

/ 192\.168\.1\.\d{1,3} / gm

TEST STRING

```
My IP-address \home\: 192.168.1.0
My IP-address \home\: 192.168.1.1
My IP-address \home\: 192.168.1.2
My IP-address \home\: 192.168.1.3
...
My IP-address \work\: 192.168.1.100
My IP-address \work\: 192.168.1.101
My IP-address \work\: 192.168.1.102
...
My IP-address \home\: 192.168.1.253
My IP-address \home\: 192.168.1.254
My IP-address \home\: 192.168.1.255
```

Примеры регулярных выражений

REGULAR EXPRESSION

29 matches (511 steps, 6.2ms)

/ \w\s / gm

TEST STRING

```
My IP-address \home\: 192.168.1.0
My IP-address \home\: 192.168.1.1
My IP-address \home\: 192.168.1.2
My IP-address \home\: 192.168.1.3
...
My IP-address \work\: 192.168.1.100
My IP-address \work\: 192.168.1.101
My IP-address \work\: 192.168.1.102
...
My IP-address \home\: 192.168.1.253
My IP-address \home\: 192.168.1.254
My IP-address \home\: 192.168.1.255
```

Буквенный/цифровой + пробельный символ

REGULAR EXPRESSION

40 matches (80 steps, 0.5ms)

/ [ds] / gm

TEST STRING

```
My IP-address \home\: 192.168.1.0
My IP-address \home\: 192.168.1.1
My IP-address \home\: 192.168.1.2
My IP-address \home\: 192.168.1.3
...
My IP-address \work\: 192.168.1.100
My IP-address \work\: 192.168.1.101
My IP-address \work\: 192.168.1.102
...
My IP-address \home\: 192.168.1.253
My IP-address \home\: 192.168.1.254
My IP-address \home\: 192.168.1.255
```

Примеры регулярных выражений

REGULAR EXPRESSION

10 matches (95 steps, 0.1ms)

/ address|addrass / gm

TEST STRING

```
My IP-address \home\: 192.168.1.0
My IP-address \home\: 192.168.1.1
My IP-address \home\: 192.168.1.2
My IP-address \home\: 192.168.1.3
...
My IP-addrass \work\: 192.168.1.100
My IP-addrass \work\: 192.168.1.101
My IP-addrass \work\: 192.168.1.102
...
My IP-address \home\: 192.168.1.253
My IP-address \home\: 192.168.1.254
My IP-address \home\: 192.168.1.255
```

REGULAR EXPRESSION

10 matches (107 steps, 0.1ms)

/ addr(a|e)ss / gm

TEST STRING

```
My IP-address \home\: 192.168.1.0
My IP-address \home\: 192.168.1.1
My IP-address \home\: 192.168.1.2
My IP-address \home\: 192.168.1.3
...
My IP-addrass \work\: 192.168.1.100
My IP-addrass \work\: 192.168.1.101
My IP-addrass \work\: 192.168.1.102
...
My IP-address \home\: 192.168.1.253
My IP-address \home\: 192.168.1.254
My IP-address \home\: 192.168.1.255
```

Примеры регулярных выражений

REGULAR EXPRESSION

13 matches (26 steps, 0.1ms)

/ M / gm

TEST STRING

```
My IP-address \home\: 192.168.1.0
My IP-address \home\: 192.168.1.1
My IP-address \home\: 192.168.1.2
My IP-address \home\: 192.168.1.3
...
My IP-address \work\: 192.168.1.100
My IP-address \work\: 192.168.1.101
My IP-address \work\: 192.168.1.102
...
My IP-address \HOME\: 192.168.1.253
My IP-address \HOME\: 192.168.1.254
My IP-address \HOME\: 192.168.1.255
```

REGULAR EXPRESSION

10 matches (44 steps, 0.0ms)

/ ^M / gm

TEST STRING

```
My IP-address \home\: 192.168.1.0
My IP-address \home\: 192.168.1.1
My IP-address \home\: 192.168.1.2
My IP-address \home\: 192.168.1.3
...
My IP-address \work\: 192.168.1.100
My IP-address \work\: 192.168.1.101
My IP-address \work\: 192.168.1.102
...
My IP-address \HOME\: 192.168.1.253
My IP-address \HOME\: 192.168.1.254
My IP-address \HOME\: 192.168.1.255
```

Примеры регулярных выражений

REGULAR EXPRESSION

14 matches (28 steps, 0.0ms)

/ e / gm

TEST STRING

```
My IP-address \home\: 192.168.1.0
My IP-address \home\: 192.168.1.1
My IP-address \home\: 192.168.1.2
My IP-address \home\: 192.168.1.3
...
My IP-address \work\: 192.168.1.100
My IP-address \work\: 192.168.1.101
My IP-address \work\: 192.168.1.102
...
My IP-address \HOME\: 192.168.1.253
My IP-address \HOME\: 192.168.1.254
My IP-address \HOME\: 192.168.1.255
```

REGULAR EXPRESSION

4 matches (32 steps, 0.0ms)

/ e\b / gm

TEST STRING

```
My IP-address \home\: 192.168.1.0
My IP-address \home\: 192.168.1.1
My IP-address \home\: 192.168.1.2
My IP-address \home\: 192.168.1.3
...
My IP-address \work\: 192.168.1.100
My IP-address \work\: 192.168.1.101
My IP-address \work\: 192.168.1.102
...
My IP-address \HOME\: 192.168.1.253
My IP-address \HOME\: 192.168.1.254
My IP-address \HOME\: 192.168.1.255
```

Примеры регулярных выражений

REGULAR EXPRESSION

pattern error

/ \ / gm

TEST STRING

```
My IP-address \home\: 192.168.1.0
My IP-address \home\: 192.168.1.1
My IP-address \home\: 192.168.1.2
My IP-address \home\: 192.168.1.3
...
My IP-address \work\: 192.168.1.100
My IP-address \work\: 192.168.1.101
My IP-address \work\: 192.168.1.102
...
My IP-address \home\: 192.168.1.253
My IP-address \home\: 192.168.1.254
My IP-address \home\: 192.168.1.255
```

REGULAR EXPRESSION

20 matches (40 steps, 0.2ms)

/ \\ / gm

TEST STRING

```
My IP-address \home\: 192.168.1.0
My IP-address \home\: 192.168.1.1
My IP-address \home\: 192.168.1.2
My IP-address \home\: 192.168.1.3
...
My IP-address \work\: 192.168.1.100
My IP-address \work\: 192.168.1.101
My IP-address \work\: 192.168.1.102
...
My IP-address \home\: 192.168.1.253
My IP-address \home\: 192.168.1.254
My IP-address \home\: 192.168.1.255
```

https://docs.python.org/3/library/re.html

```
import re
```

Основные причины использования:

- поиск в строке;
- разбиение строки на подстроки;
- замена части строки.

Функции в регулярных выражениях в Python

re.compile()

re.match()
re.search()
re.fullmatch()
re.findall()
re.split()
re.sub()
re.finditer()

Полезные ссылки (3)

https://habr.com/ru/post/349860/ - Много примеров, заданий и объяснений

https://extendsclass.com/regex-tester.html#python - Хороший онлайн редактор с объяснением

https://regexcrossword.com/ - Обучение регулярным выражениям в полуигровой форме