30 Days Of Python: Day 18 - Regular Expressions

Regular Expressions

A regular expression or RegEx is a special text string that helps to find patterns in data. A RegEx can be used to check if some pattern exists in a different data type. To use RegEx in python first we should import the RegEx module which is called *re*.

The *re* Module

After importing the module we can use it to detect or find patterns.

```
import re
```

Methods in *re* Module

To find a pattern we use different set of *re* character sets that allows to search for a match in a string.

- *re.match()*: searches only in the beginning of the first line of the string and returns matched objects if found, else returns None.

- *re.search*: Returns a match object if there is one anywhere in the string, including multiline strings.
- *re.findall*: Returns a list containing all matches
- *re.split*: Takes a string, splits it at the match points, returns a list
- *re.sub*: Replaces one or many matches within a string

Match

```
# syntac
re.match(substring, string, re.I)
# substring is a string or a pattern, string is the text we look for a pattern ,
re.I is case ignore
import re

txt = 'I love to teach python and javaScript'
# It returns an object with span, and match
match = re.match('I love to teach', txt, re.I)
print(match)  # <re.Match object; span=(0, 15), match='I love to teach'>
# We can get the starting and ending position of the match as tuple using span
span = match.span()
print(span)     # (0, 15)
# Lets find the start and stop position from the span
start, end = span
print(start, end)  # 0, 15
substring = txt[start:end]
print(substring)       # I love to teach
```

As you can see from the example above, the pattern we are looking for (or the substring we are looking for) is *I love to teach*. The match function returns an object **only** if the text starts with the pattern.

```
import re

txt = 'I love to teach python and javaScript'
match = re.match('I like to teach', txt, re.I)
print(match)  # None
```

The string does not string with *I like to teach*, therefore there was no match and the match method returned None.

Search

```
# syntax
re.match(substring, string, re.I)
# substring is a pattern, string is the text we look for a pattern , re.I is case
ignore flag
import re

txt = '''Python is the most beautiful language that a human being has ever
created.
I recommend python for a first programming language'''

# It returns an object with span and match
match = re.search('first', txt, re.I)
print(match)  # <re.Match object; span=(100, 105), match='first'>
```

```
# We can get the starting and ending position of the match as tuple using span
span = match.span()
print(span)     # (100, 105)
# Lets find the start and stop position from the span
start, end = span
print(start, end)  # 100 105
substring = txt[start:end]
print(substring)       # first
```

As you can see, search is much better than match because it can look for the pattern throughout the text. Search returns a match object with a first match that was found, otherwise it returns *None*. A much better *re* function is *findall*. This function checks for the pattern through the whole string and returns all the matches as a list.

Searching for All Matches Using findall

findall() returns all the matches as a list

```
txt = '''Python is the most beautiful language that a human being has ever
created.
I recommend python for a first programming language'''

# It return a list
matches = re.findall('language', txt, re.I)
print(matches)  # ['language', 'language']
```

As you can see, the word *language* was found two times in the string. Let us practice some more. Now we will look for both Python and python words in the string:

```
txt = '''Python is the most beautiful language that a human being has ever
created.
I recommend python for a first programming language'''

# It returns list
matches = re.findall('python', txt, re.I)
print(matches)  # ['Python', 'python']
```

Since we are using *re.I* both lowercase and uppercase letters are included. If we do not have the re.I flag, then we will have to write our pattern differently. Let us check it out:

```
txt = '''Python is the most beautiful language that a human being has ever
created.
I recommend python for a first programming language'''

matches = re.findall('Python|python', txt)
print(matches)  # ['Python', 'python']

#
matches = re.findall('[Pp]ython', txt)
print(matches)  # ['Python', 'python']
```

Replacing a Substring

```
txt = '''Python is the most beautiful language that a human being has ever
created.
I recommend python for a first programming language'''
```

```
match_replaced = re.sub('Python|python', 'JavaScript', txt, re.I)
print(match_replaced)  # JavaScript is the most beautiful language that a human
being has ever created.
# OR
match_replaced = re.sub('[Pp]ython', 'JavaScript', txt, re.I)
print(match_replaced)  # JavaScript is the most beautiful language that a human
being has ever created.
```

Let us add one more example. The following string is really hard to read unless we remove the % symbol. Replacing the % with an empty string will clean the text.

```
txt = '''%I a%m te%%a%%che%r% a%n%d %% I l%o%ve te%ach%ing.
T%he%re i%s n%o%th%ing as r%ewarding a%s e%duc%at%i%ng a%n%d e%m%p%ow%er%ing
p%e%o%ple.
I fo%und te%a%ching m%ore i%n%t%er%%es%ting t%h%an any other %jobs.
D%o%es thi%s m%ot%iv%a%te %y%o%u to b%e a t%e%a%cher?'''

matches = re.sub('%', '', txt)
print(matches)
I am teacher and I love teaching.
There is nothing as rewarding as educating and empowering people.
I found teaching more interesting than any other jobs. Does this motivate you to
be a teacher?
```

Splitting Text Using RegEx Split

```
txt = '''I am teacher and  I love teaching.
There is nothing as rewarding as educating and empowering people.
I found teaching more interesting than any other jobs.
Does this motivate you to be a teacher?'''
print(re.split('\n', txt)) # splitting using \n - end of line symbol
['I am teacher and  I love teaching.', 'There is nothing as rewarding as educating
and empowering people.', 'I found teaching more interesting than any other jobs.',
'Does this motivate you to be a teacher?']
```

Writing RegEx Patterns

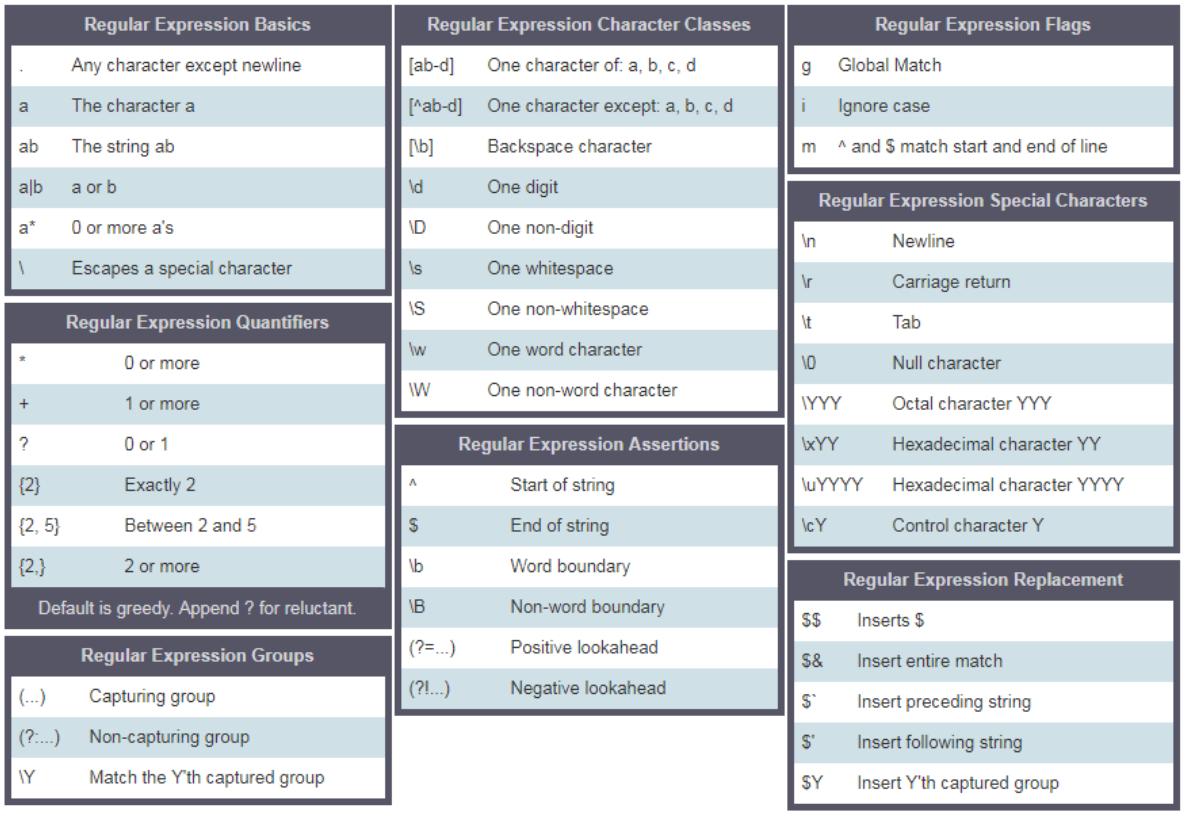
To declare a string variable we use a single or double quote. To declare RegEx variable *r''*. The following pattern only identifies apple with lowercase, to make it case insensitive either we should rewrite our pattern or we should add a flag.

```
import re

regex_pattern = r'apple'
txt = 'Apple and banana are fruits. An old cliche says an apple a day a doctor way
has been replaced by a banana a day keeps the doctor far far away. '
matches = re.findall(regex_pattern, txt)
print(matches)  # ['apple']

# To make case insensitive adding flag '
matches = re.findall(regex_pattern, txt, re.I)
print(matches)  # ['Apple', 'apple']
# or we can use a set of characters method
regex_pattern = r'[Aa]pple'  # this mean the first letter could be Apple or apple
```

```
matches = re.findall(regex_pattern, txt)
print(matches)  # ['Apple', 'apple']
```

- []: A set of characters
    - [a-c] means, a or b or c
    - [a-z] means, any letter from a to z
    - [A-Z] means, any character from A to Z
    - [0-3] means, 0 or 1 or 2 or 3
    - [0-9] means any number from 0 to 9
    - [A-Za-z0-9] any single character, that is a to z, A to Z or 0 to 9

- \: uses to escape special characters
    - \d means: match where the string contains digits (numbers from 0-9)
    - \D means: match where the string does not contain digits
- . : any character except new line character(\n)
- ^: starts with
    - r'^substring' eg r'^love', a sentence that starts with a word love
    - r'[^abc] means not a, not b, not c.
- $: ends with
    - r'substring$' eg r'love$', sentence that ends with a word love
- *: zero or more times
    - r'[a]*' means a optional or it can occur many times.
- +: one or more times
    - r'[a]+' means at least once (or more)
- ?: zero or one time
    - r'[a]?' means zero times or once
- {3}: Exactly 3 characters
- {3,}: At least 3 characters
- {3,8}: 3 to 8 characters
- |: Either or
    - r'apple|banana' means either apple or a banana
- (): Capture and group



Regular Expression Basics	
.	Any character except newline
a	The character a
ab	The string ab
a|b	a or b
a*	0 or more a's
\	Escapes a special character

Regular Expression Quantifiers	
*	0 or more
+	1 or more
?	0 or 1
{2}	Exactly 2
{2, 5}	Between 2 and 5
{2,}	2 or more

Default is greedy. Append ? for reluctant.

Regular Expression Groups	
(...)	Capturing group
(?:...)	Non-capturing group
\Y	Match the Y'th captured group

Regular Expression Character Classes	
[ab-d]	One character of: a, b, c, d
[^ab-d]	One character except: a, b, c, d
[\b]	Backspace character
\d	One digit
\D	One non-digit
\s	One whitespace
\S	One non-whitespace
\w	One word character
\W	One non-word character

Regular Expression Assertions	
^	Start of string
$	End of string
\b	Word boundary
\B	Non-word boundary
(?=...)	Positive lookahead
(?!...)	Negative lookahead

Regular Expression Flags	
g	Global Match
i	Ignore case
m	^ and $ match start and end of line

Regular Expression Special Characters	
\n	Newline
\r	Carriage return
\t	Tab
\0	Null character
\YYY	Octal character YYY
\xYY	Hexadecimal character YY
\uYYYY	Hexadecimal character YYYY
\cY	Control character Y

Regular Expression Replacement	
$$	Inserts $
$&	Insert entire match
$`	Insert preceding string
$'	Insert following string
$Y	Insert Y'th captured group

Let us use examples to clarify the meta characters above

Square Bracket

Let us use square bracket to include lower and upper case

```
regex_pattern = r'[Aa]pple' # this square bracket mean either A or a
txt = 'Apple and banana are fruits. An old cliche says an apple a day a doctor way
has been replaced by a banana a day keeps the doctor far far away.'
matches = re.findall(regex_pattern, txt)
print(matches)  # ['Apple', 'apple']
```

If we want to look for the banana, we write the pattern as follows:

```
regex_pattern = r'[Aa]pple|[Bb]anana' # this square bracket means either A or a
txt = 'Apple and banana are fruits. An old cliche says an apple a day a doctor way
has been replaced by a banana a day keeps the doctor far far away.'
matches = re.findall(regex_pattern, txt)
print(matches)  # ['Apple', 'banana', 'apple', 'banana']
```

Using the square bracket and or operator , we manage to extract Apple, apple, Banana and banana.

Escape character(\) in RegEx

```
regex_pattern = r'\d'  # d is a special character which means digits
txt = 'This regular expression example was made on December 6,  2019 and revised
on July 8, 2021'
matches = re.findall(regex_pattern, txt)
```

```
print(matches)  # ['6', '2', '0', '1', '9', '8', '2', '0', '2', '1'], this is not
what we want
```

One or more times(+)

```
regex_pattern = r'\d+'  # d is a special character which means digits, + mean one
or more times
txt = 'This regular expression example was made on December 6,  2019 and revised
on July 8, 2021'
matches = re.findall(regex_pattern, txt)
print(matches)  # ['6', '2019', '8', '2021'] - now, this is better!
```

Period(.)

```
regex_pattern = r'[a].'  # this square bracket means a and . means any character
except new line
txt = '''Apple and banana are fruits'''
matches = re.findall(regex_pattern, txt)
print(matches)  # ['an', 'an', 'an', 'a ', 'ar']

regex_pattern = r'[a].+'  # . any character, + any character one or more times
matches = re.findall(regex_pattern, txt)
print(matches)  # ['and banana are fruits']
```

Zero or more times(*)

Zero or many times. The pattern could may not occur or it can occur many times.

```
regex_pattern = r'[a].*'  # . any character, * any character zero or more times
txt = '''Apple and banana are fruits'''
matches = re.findall(regex_pattern, txt)
print(matches)  # ['and banana are fruits']
```

Zero or one time(?)

Zero or one time. The pattern may not occur or it may occur once.

```
txt = '''I am not sure if there is a convention how to write the word e-mail.
Some people write it as email others may write it as Email or E-mail.'''
regex_pattern = r'[Ee]-?mail'  # ? means here that '-' is optional
matches = re.findall(regex_pattern, txt)
print(matches)  # ['e-mail', 'email', 'Email', 'E-mail']
```

Quantifier in RegEx

We can specify the length of the substring we are looking for in a text, using a curly bracket. Let us imagine, we are interested in a substring with a length of 4 characters:

```
txt = 'This regular expression example was made on December 6,  2024 and revised
on July 8, 2025'
regex_pattern = r'\d{4}'  # exactly four times
```

```
matches = re.findall(regex_pattern, txt)
print(matches)  # ['2024', '2025']

txt = 'This regular expression example was made on December 6,  2024 and revised
on July 8, 2025'
regex_pattern = r'\d{1, 4}'   # 1 to 4
matches = re.findall(regex_pattern, txt)
print(matches)  # ['6', '2024', '8', '2025']
```

Cart ^

- Starts with

```
txt = 'This regular expression example was made on December 6,  2024 and revised
on July 8, 2025'
regex_pattern = r'^This'  # ^ means starts with
matches = re.findall(regex_pattern, txt)
print(matches)  # ['This']
```

- Negation

```
txt = 'This regular expression example was made on December 6,  2024 and revised
on July 8, 2025'
regex_pattern = r'[^A-Za-z ]+'  # ^ in set character means negation, not A to Z,
not a to z, no space
matches = re.findall(regex_pattern, txt)
print(matches)  # ['6,', '2024', '8', '2025']
```

💻 Exercises: Day 18

Exercises: Level 1

1. What is the most frequent word in the following paragraph?

```
    paragraph = 'I love teaching. If you do not love teaching what else can you
love. I love Python if you do not love something which can give you all the
capabilities to develop an application what else can you love.
    [
    (6, 'love'),
    (5, 'you'),
    (3, 'can'),
    (2, 'what'),
    (2, 'teaching'),
    (2, 'not'),
    (2, 'else'),
    (2, 'do'),
    (2, 'I'),
    (1, 'which'),
    (1, 'to'),
    (1, 'the'),
    (1, 'something'),
    (1, 'if'),
    (1, 'give'),
```

```
(1, 'develop'),
(1, 'capabilities'),
(1, 'application'),
(1, 'an'),
(1, 'all'),
(1, 'Python'),
(1, 'If')
]
```

2. The position of some particles on the horizontal x-axis are -12, -4, -3 and -1 in the negative direction, 0 at origin, 4 and 8 in the positive direction. Extract these numbers from this whole text and find the distance between the two furthest particles.

```
points = ['-12', '-4', '-3', '-1', '0', '4', '8']
sorted_points =  [-12, -4, -3, -1, -1, 0, 2, 4, 8]
distance = 8 -(-12) # 20
```

Exercises: Level 2

1. Write a pattern which identifies if a string is a valid python variable

```
2. is_valid_variable('first_name') # True
3. is_valid_variable('first-name') # False
4. is_valid_variable('1first_name') # False
   is_valid_variable('firstname') # True
```

Exercises: Level 3

1. Clean the following text. After cleaning, count three most frequent words in the string.

```
2. sentence = '''%I $am@% a %tea@cher%, &and& I lo%#ve %tea@ching%;. There $is
   nothing; &as& mo@re rewarding as educa@ting &and& @emp%o@wering peo@ple. ;I
   found tea@ching m%o@re interesting tha@n any other %jo@bs. %Do@es thi%s
   mo@tivate yo@u to be a tea@cher!?'''
3.
4. print(clean_text(sentence));
5. I am a teacher and I love teaching There is nothing as more rewarding as
   educating and empowering people I found teaching more interesting than any
   other jobs Does this motivate you to be a teacher
   print(most_frequent_words(cleaned_text)) # [(3, 'I'), (2, 'teaching'), (2,
   'teacher')]
```

🎉 CONGRATULATIONS ! 🎉