Introduction to Regular Expressions

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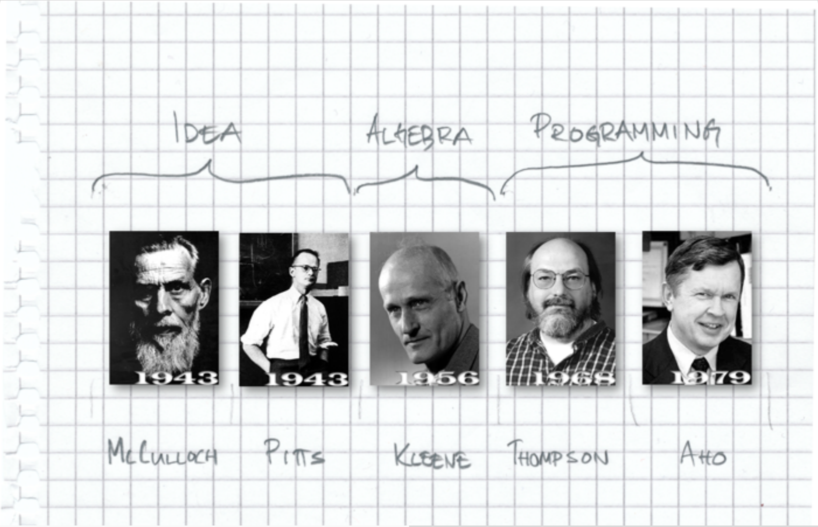
IDEA
ALGEBRA
PROGRAMMING
1943
1943
1956
1968
1979
McCULLOCH
PITTS
KLEENE
THOMPSON
AHO

Delivering Quality since December 31, 1997

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Release of Python 1.5

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- Deprecated old module ‘regex‘, based on Perl-style patterns.

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- Deprecated old module ‘regex‘, based on Perl-style patterns.
- ‘regex‘ finally removed in Python 2.5 (September 19, 2006)

Answer for questions:

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- "Does this string match the pattern?"
- "Is there a match for the pattern anywhere in this string?"

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- "Is there a match for the pattern anywhere in this string?"

- Replace part of it
- Split into pieces

re is handled as string - there is no special syntax for expressing it (advantage and disadvantage)

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re module is a C extension module (like `socket` or `zlib`)

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re patterns are compiled into bytecode

re module is a C extension module (like `socket` or `zlib`)

re language is relatively small and restricted

- not all possible string processing tasks can be done
- some of them can be done, but expression would be very complicated

```
(?:(?:\r\n)?[ \t])*(?:(?:(?:[^()<>@,;:\\".\[\] \000-\031]+(?:(?:(?:\r\n)?[ \t]
)+|\Z|(?=[\["()<>@,;:\\".\[\]]))|"(?:[^\"\r\\]|\\.|(?:(?:\r\n)?[ \t]))*"(?:(?:
\r\n)?[ \t])*)(?:\.(?:(?:\r\n)?[ \t])*(?:[^()<>@,;:\\".\[\] \000-\031]+(?:(?:(
?:\r\n)?[ \t])+|\Z|(?=[\["()<>@,;:\\".\[\]]))|"(?:[^\"\r\\]|\\.|(?:(?:\r\n)?[
\t]))*"(?:(?:\r\n)?[ \t])*))*@(?:(?:\r\n)?[ \t])*(?:[^()<>@,;:\\".\[\] \000-\0
31]+(?:(?:(?:\r\n)?[ \t])+|\Z|(?=[\["()<>@,;:\\".\[\]]))|\[([^\[\]\r\\]|\\.)*\
](?:(?:\r\n)?[ \t])*)(?:\.(?:(?:\r\n)?[ \t])*(?:[^()<>@,;:\\".\[\] \000-\031]+
(?:(?:(?:\r\n)?[ \t])+|\Z|(?=[\["()<>@,;:\\".\[\]]))|\[([^\[\]\r\\]|\\.)*\](?:
(?:\r\n)?[ \t])*))*|(?:[^()<>@,;:\\".\[\] \000-\031]+(?:(?:(?:\r\n)?[ \t])+|\Z
|(?=[\["()<>@,;:\\".\[\]]))|"(?:[^\"\r\\]|\\.|(?:(?:\r\n)?[ \t]))*"(?:(?:\r\n)
?[ \t])*)*\<(?:(?:\r\n)?[ \t])*(?:@(?:[^()<>@,;:\\".\[\] \000-\031]+(?:(?:(?:\
r\n)?[ \t])+|\Z|(?=[\["()<>@,;:\\".\[\]]))|\[([^\[\]\r\\]|\\.)*\](?:(?:\r\n)?[
 \t])*)(?:\.(?:(?:\r\n)?[ \t])*(?:[^()<>@,;:\\".\[\] \000-\031]+(?:(?:(?:\r\n)
?[ \t])+|\Z|(?=[\["()<>@,;:\\".\[\]]))|\[([^\[\]\r\\]|\\.)*\](?:(?:\r\n)?[ \t]
)*))*(?:,@(?:(?:\r\n)?[ \t])*(?:[^()<>@,;:\\".\[\] \000-\031]+(?:(?:(?:\r\n)?[
 \t])+|\Z|(?=[\["()<>@,;:\\".\[\]]))|\[([^\[\]\r\\]|\\.)*\](?:(?:\r\n)?[ \t])*
)(?:\.(?:(?:\r\n)?[ \t])*(?:[^()<>@,;:\\".\[\] \000-\031]+(?:(?:(?:\r\n)?[ \t]
)+|\Z|(?=[\["()<>@,;:\\".\[\]]))|\[([^\[\]\r\\]|\\.)*\](?:(?:\r\n)?[ \t])*))*)
*:(?:(?:\r\n)?[ \t])*)?(?:[^()<>@,;:\\".\[\] \000-\031]+(?:(?:(?:\r\n)?[ \t])+
|\Z|(?=[\["()<>@,;:\\".\[\]]))|"(?:[^\"\r\\]|\\.|(?:(?:\r\n)?[ \t]))*"(?:(?:\r
\n)?[ \t])*)(?:\.(?:(?:\r\n)?[ \t])*(?:[^()<>@,;:\\".\[\] \000-\031]+(?:(?:(?:
```

```
\r\n)?[ \t])+|\Z|(?=[\["()<>@,;:\\".\[\]]))|"(?:[^\"\r\\]|\\.|(?:(?:\r\n)?[ \t
]))*"(?:(?:\r\n)?[ \t])*))*@(?:(?:\r\n)?[ \t])*(?:[^()<>@,;:\\".\[\] \000-\031
]+(?:(?:(?:\r\n)?[ \t])+|\Z|(?=[\["()<>@,;:\\".\[\]]))|\[([^\[\]\r\\]|\\.)*\](
?:(?:\r\n)?[ \t])*)(?:\.(?:(?:\r\n)?[ \t])*(?:[^()<>@,;:\\".\[\] \000-\031]+(?
:(?:(?:\r\n)?[ \t])+|\Z|(?=[\["()<>@,;:\\".\[\]]))|\[([^\[\]\r\\]|\\.)*\](?:(?
:\r\n)?[ \t])*))*\>(?:(?:\r\n)?[ \t])*)|(?:[^()<>@,;:\\".\[\] \000-\031]+(?:(?
:(?:\r\n)?[ \t])+|\Z|(?=[\["()<>@,;:\\".\[\]]))|"(?:[^\"\r\\]|\\.|(?:(?:\r\n)?
[ \t]))*"(?:(?:\r\n)?[ \t])*)*:(?:(?:\r\n)?[ \t])*(?:(?:(?:[^()<>@,;:\\".\[\]
\000-\031]+(?:(?:(?:\r\n)?[ \t])+|\Z|(?=[\["()<>@,;:\\".\[\]]))|"(?:[^\"\r\\]|
\\.|(?:(?:\r\n)?[ \t]))*"(?:(?:\r\n)?[ \t])*)(?:\.(?:(?:\r\n)?[ \t])*(?:[^()<>
@,;:\\".\[\] \000-\031]+(?:(?:(?:\r\n)?[ \t])+|\Z|(?=[\["()<>@,;:\\".\[\]]))|"
(?:[^\"\r\\]|\\.|(?:(?:\r\n)?[ \t]))*"(?:(?:\r\n)?[ \t])*))*@(?:(?:\r\n)?[ \t]
)*(?:[^()<>@,;:\\".\[\] \000-\031]+(?:(?:(?:\r\n)?[ \t])+|\Z|(?=[\["()<>@,;:\\
".\[\]]))|\[([^\[\]\r\\]|\\.)*\](?:(?:\r\n)?[ \t])*)(?:\.(?:(?:\r\n)?[ \t])*(?
:[^()<>@,;:\\".\[\] \000-\031]+(?:(?:(?:\r\n)?[ \t])+|\Z|(?=[\["()<>@,;:\\".\[
\]]))|\[([^\[\]\r\\]|\\.)*\](?:(?:\r\n)?[ \t])*))*|(?:[^()<>@,;:\\".\[\] \000-
\031]+(?:(?:(?:\r\n)?[ \t])+|\Z|(?=[\["()<>@,;:\\".\[\]]))|"(?:[^\"\r\\]|\\.|(
?:(?:\r\n)?[ \t]))*"(?:(?:\r\n)?[ \t])*)*\<(?:(?:\r\n)?[ \t])*(?:@(?:[^()<>@,;
:\\".\[\] \000-\031]+(?:(?:(?:\r\n)?[ \t])+|\Z|(?=[\["()<>@,;:\\".\[\]]))|\[([
^\[\]\r\\]|\\.)*\](?:(?:\r\n)?[ \t])*)(?:\.(?:(?:\r\n)?[ \t])*(?:[^()<>@,;:\\"
.\[\] \000-\031]+(?:(?:(?:\r\n)?[ \t])+|\Z|(?=[\["()<>@,;:\\".\[\]]))|\[([^\[\
]\r\\]|\\.)*\](?:(?:\r\n)?[ \t])*))*(?:,@(?:(?:\r\n)?[ \t])*(?:[^()<>@,;:\\".\
[\] \000-\031]+(?:(?:(?:\r\n)?[ \t])+|\Z|(?=[\["()<>@,;:\\".\[\]]))|\[([^\[\]\
r\\]|\\.)*\](?:(?:\r\n)?[ \t])*)(?:\.(?:(?:\r\n)?[ \t])*(?:[^()<>@,;:\\".\[\]
\000-\031]+(?:(?:(?:\r\n)?[ \t])+|\Z|(?=[\["()<>@,;:\\".\[\]]))|\[([^\[\]\r\\]
|\\.)*\](?:(?:\r\n)?[ \t])*))*)*:(?:(?:\r\n)?[ \t])*)?(?:[^()<>@,;:\\".\[\] \0
00-\031]+(?:(?:(?:\r\n)?[ \t])+|\Z|(?=[\["()<>@,;:\\".\[\]]))|"(?:[^\"\r\\]|\\
.|(?:(?:\r\n)?[ \t]))*"(?:(?:\r\n)?[ \t])*)(?:\.(?:(?:\r\n)?[ \t])*(?:[^()<>@,
;:\\".\[\] \000-\031]+(?:(?:(?:\r\n)?[ \t])+|\Z|(?=[\["()<>@,;:\\".\[\]]))|"(?
:[^\"\r\\]|\\.|(?:(?:\r\n)?[ \t]))*"(?:(?:\r\n)?[ \t])*))*@(?:(?:\r\n)?[ \t])*
(?:[^()<>@,;:\\".\[\] \000-\031]+(?:(?:(?:\r\n)?[ \t])+|\Z|(?=[\["()<>@,;:\\".
\[\]]))|\[([^\[\]\r\\]|\\.)*\](?:(?:\r\n)?[ \t])*)(?:\.(?:(?:\r\n)?[ \t])*(?:[
^()<>@,;:\\".\[\] \000-\031]+(?:(?:(?:\r\n)?[ \t])+|\Z|(?=[\["()<>@,;:\\".\[\]
]))|\[([^\[\]\r\\]|\\.)*\](?:(?:\r\n)?[ \t])*))*\>(?:(?:\r\n)?[ \t])*)(?:,\s*(
?:(?:[^()<>@,;:\\".\[\] \000-\031]+(?:(?:(?:\r\n)?[ \t])+|\Z|(?=[\["()<>@,;:\\
".\[\]]))|"(?:[^\"\r\\]|\\.|(?:(?:\r\n)?[ \t]))*"(?:(?:\r\n)?[ \t])*)(?:\.(?:(
?:\r\n)?[ \t])*(?:[^()<>@,;:\\".\[\] \000-\031]+(?:(?:(?:\r\n)?[ \t])+|\Z|(?=[
\["()<>@,;:\\".\[\]]))|"(?:[^\"\r\\]|\\.|(?:(?:\r\n)?[ \t]))*"(?:(?:\r\n)?[ \t
])*))*@(?:(?:\r\n)?[ \t])*(?:[^()<>@,;:\\".\[\] \000-\031]+(?:(?:(?:\r\n)?[ \t
])+|\Z|(?=[\["()<>@,;:\\".\[\]]))|\[([^\[\]\r\\]|\\.)*\](?:(?:\r\n)?[ \t])*)(?
:\.(?:(?:\r\n)?[ \t])*(?:[^()<>@,;:\\".\[\] \000-\031]+(?:(?:(?:\r\n)?[ \t])+|
\Z|(?=[\["()<>@,;:\\".\[\]]))|\[([^\[\]\r\\]|\\.)*\](?:(?:\r\n)?[ \t])*))*|(?:
[^()<>@,;:\\".\[\] \000-\031]+(?:(?:(?:\r\n)?[ \t])+|\Z|(?=[\["()<>@,;:\\".\[\
]]))|"(?:[^\"\r\\]|\\.|(?:(?:\r\n)?[ \t]))*"(?:(?:\r\n)?[ \t])*)*\<(?:(?:\r\n)
```

```
?[ \t])*(?:@(?:[^()<>@,;:\\".\[\] \000-\031]+(?:(?:(?:\r\n)?[ \t])+|\Z|(?=[\["
()<>@,;:\\".\[\]]))|\[([^\[\]\r\\]|\\.)*\](?:(?:\r\n)?[ \t])*)(?:\.(?:(?:\r\n)
?[ \t])*(?:[^()<>@,;:\\".\[\] \000-\031]+(?:(?:(?:\r\n)?[ \t])+|\Z|(?=[\["()<>
@,;:\\".\[\]]))|\[([^\[\]\r\\]|\\.)*\](?:(?:\r\n)?[ \t])*))*(?:,@(?:(?:\r\n)?[
 \t])*(?:[^()<>@,;:\\".\[\] \000-\031]+(?:(?:(?:\r\n)?[ \t])+|\Z|(?=[\["()<>@,
;:\\".\[\]]))|\[([^\[\]\r\\]|\\.)*\](?:(?:\r\n)?[ \t])*)(?:\.(?:(?:\r\n)?[ \t]
)*(?:[^()<>@,;:\\".\[\] \000-\031]+(?:(?:(?:\r\n)?[ \t])+|\Z|(?=[\["()<>@,;:\\
".\[\]]))|\[([^\[\]\r\\]|\\.)*\](?:(?:\r\n)?[ \t])*))*)*:(?:(?:\r\n)?[ \t])*)?
(?:[^()<>@,;:\\".\[\] \000-\031]+(?:(?:(?:\r\n)?[ \t])+|\Z|(?=[\["()<>@,;:\\".
\[\]]))|"(?:[^\"\r\\]|\\.|(?:(?:\r\n)?[ \t]))*"(?:(?:\r\n)?[ \t])*)(?:\.(?:(?:
\r\n)?[ \t])*(?:[^()<>@,;:\\".\[\] \000-\031]+(?:(?:(?:\r\n)?[ \t])+|\Z|(?=[\[
"()<>@,;:\\".\[\]]))|"(?:[^\"\r\\]|\\.|(?:(?:\r\n)?[ \t]))*"(?:(?:\r\n)?[ \t])
*))*@(?:(?:\r\n)?[ \t])*(?:[^()<>@,;:\\".\[\] \000-\031]+(?:(?:(?:\r\n)?[ \t])
+|\Z|(?=[\["()<>@,;:\\".\[\]]))|\[([^\[\]\r\\]|\\.)*\](?:(?:\r\n)?[ \t])*)(?:\
.(?:(?:\r\n)?[ \t])*(?:[^()<>@,;:\\".\[\] \000-\031]+(?:(?:(?:\r\n)?[ \t])+|\Z
|(?=[\["()<>@,;:\\".\[\]]))|\[([^\[\]\r\\]|\\.)*\](?:(?:\r\n)?[ \t])*))*\>(?:(
?:\r\n)?[ \t])*))*)?;\s*)
```

Perl regex to validate email addresses according to the RFC 822
http://ex-parrot.com/~pdw/Mail-RFC822-Address

```
([a-zP]{18}) (\d{0,3}) [0-9]{4} (?P<name>[a-zA-Z]+),
    ↪  (?P=name)
```

```
>>> import re
>>> re.findall(’[a-zA-Z0-9]+’, ’Search test 03’)
[’Search’, ’test’, ’03’]
```

```
>>> import re
>>> re.findall(’[a-zA-Z0-9]+’, ’Search test 03’)
[’Search’, ’test’, ’03’]
```

```
>>> import re
>>> regex = re.compile(’[a-zA-Z0-9]+’)
>>> regex
re.compile(’[a-zA-Z0-9]+’)
>>> re.findall(regex, ’Search test 02’)
[’Search’, ’test’, ’02’]
```

```
>>> import re
>>> re.findall(’[a-zA-Z0-9]+’, ’Search test 03’)
[’Search’, ’test’, ’03’]

>>> import re
>>> regex = re.compile(’[a-zA-Z0-9]+’)
>>> regex
re.compile(’[a-zA-Z0-9]+’)
>>> re.findall(regex, ’Search test 02’)
[’Search’, ’test’, ’02’]

>>> import re
>>> regex = re.compile(’[a-zA-Z0-9]+’)
>>> regex
re.compile(’[a-zA-Z0-9]+’)
>>> regex.findall(’Search test 01’)
[’Search’, ’test’, ’01’]
```

- `re.DEBUG`
- `re.ASCII, re.A`
- `re.IGNORECASE, re.I`
- `re.MULTILINE, re.M`
- `re.DOTALL, re.S`
- `re.VERBOSE, re.X`
- `re.LOCALE, re.L` *Do not use. Deprecated in Py3.5, will be removed in Py3.6*

```
. ^ $ * + ? { } [ ] \ | ( )
```

[ ] - class: set of characters

```
>>> import re
>>> re.findall("[def]", "abcdefghi")
['d', 'e', 'f']
>>> re.findall("[d-f]", "abcdefghi")
['d', 'e', 'f']
>>>
```

[ ] - class: set of characters

```
>>> import re
>>> re.findall("[def]", "abcdefghi")
[’d’, ’e’, ’f’]
>>> re.findall("[d-f]", "abcdefghi")
[’d’, ’e’, ’f’]
>>>
```

Metacharacters are not active inside class

```
>>> re.findall("[d-f$]", "abcdefg$hi")
[’d’, ’e’, ’f’, ’$’]
```

^ - complement of set

```
>>> import re
>>> re.findall("[^5]", "abc 456 xyz")
['a', 'b', 'c', ' ', '4', '6', ' ', 'x', 'y', 'z']
>>>
```

. - dot. Matches anything except a newline character

```
>>> import re
>>> regex = re.compile(".")
>>> regex.findall("string")
[’s’, ’t’, ’r’, ’i’, ’n’, ’g’]
>>>
```

. - dot. Matches anything except a newline character

```
>>> import re
>>> regex = re.compile(".")
>>> regex.findall("string")
[’s’, ’t’, ’r’, ’i’, ’n’, ’g’]
>>>
```

re.S compilation flag changes default behavior.

| - "or" operator

```
>>> re.findall("No|Yes", "Yes and No")
['Yes', 'No']
```

| - "or" operator

```
>>> re.findall("No|Yes", "Yes and No")
[’Yes’, ’No’]

>>> re.findall("Yes|No", "Yes|No")
[’Yes’, ’No’]
>>> re.findall("Yes\|No", "Yes|No")
[’Yes|No’]
>>>
```

⋆ - asterisk. Specifies that previous character can be matched zero or more times.

```
>>> re.findall("ca⋆t", "ct, cat, caat")
[’ct’, ’cat’, ’caat’]
```

⋆ - asterisk. Specifies that previous character can be matched zero or more times.

```
>>> re.findall("ca*t", "ct, cat, caat")
['ct', 'cat', 'caat']
```

+ - plus. Similar to ⋆, but requires at least one occurence of character.

```
>>> re.findall("ca+t", "ct, cat, caat")
['cat', 'caat']
```

$*$ - asterisk. Specifies that previous character can be matched zero or more times.

```
>>> re.findall("ca*t", "ct, cat, caat")
[’ct’, ’cat’, ’caat’]
```

$+$ - plus. Similar to $*$, but requires at least one occurence of character.

```
>>> re.findall("ca+t", "ct, cat, caat")
[’cat’, ’caat’]
```

? - question mark. Matches either once or zero times

```
>>> re.findall("ca?t", "ct, cat, caat")
[’ct’, ’cat’]
```

* - asterisk. Specifies that previous character can be matched zero or more times.

```
>>> re.findall("ca*t", "ct, cat, caat")
['ct', 'cat', 'caat']
```

+ - plus. Similar to *, but requires at least one occurence of character.

```
>>> re.findall("ca+t", "ct, cat, caat")
['cat', 'caat']
```

? - question mark. Matches either once or zero times

```
>>> re.findall("ca?t", "ct, cat, caat")
['ct', 'cat']
```

```
>>> re.findall("home-?brew", "homebrew, home-brew")
['homebrew', 'home-brew']
```

{m,n} - m and n are decimal numbers. There must be at least m repetitions, and at most n.

```
>>> re.findall("a/{1,2}b", "ab, a/b, a//b, a///b")
[’a/b’, ’a//b’]
```

`{m,n}` - `m` and `n` are decimal numbers. There must be at least m repetitions, and at most n.

```
>>> re.findall("a/{1,2}b", "ab, a/b, a//b, a///b")
[’a/b’, ’a//b’]
```

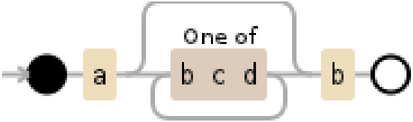
`m` and `n` can be ommited. When m ommited, there is zero, when n ommited, upper bound infinity (more precisely, 2 billions)

```
{0,} == "*"
{1,} == "+"
{,1} == {0,1} == "?"
```

⋆, `+`, `?` and `{m,n}` are greedy. Will try to repeat it as many times as possible (re engine can match only 2 billion characters (2GB) – C `int` limitation).

`*`, `+`, `?` and `{m,n}` are greedy. Will try to repeat it as many times as possible (re engine can match only 2 billion characters (2GB) – C `int` limitation).

`a[bcd]*b` - matches `a`, zero or more letters from `bcd`, and ends with `b`



src: `https://www.debuggex.com/r/NT7_HIVhxI_h64zk`

```
re.match("a[bcd]*b", "abcbd")
```

- matches `a`

```
re.match("a[bcd]*b", "abcbd")
```

- matches `a`
- matches `abcbd` to the end of the string

```
re.match("a[bcd]*b", "abcbd")
```

- matches `a`
- matches `abcbd` to the end of the string
- fails, because current position is the end of the string, so cannot match `b`

`re.match("a[bcd]*b", "abcbd")`

- matches `a`
- matches `abcbd` to the end of the string
- fails, because current position is the end of the string, so cannot match `b`
- matches `abcb` - one less character

`re.match("a[bcd]*b", "abcbd")`

- matches `a`
- matches `abcbd` to the end of the string
- fails, because current position is the end of the string, so cannot match `b`
- matches `abcb` - one less character
- fails, because current position is `d`, so cannot match `b`

```
re.match("a[bcd]*b", "abcbd")
```

- matches `a`
- matches `abcbd` to the end of the string
- fails, because current position is the end of the string, so cannot match `b`
- matches `abcb` - one less character
- fails, because current position is `d`, so cannot match `b`
- matches `abc`, so `[bcd]*` matches only `bc`

`re.match("a[bcd]*b", "abcbd")`

- matches `a`
- matches `abcbd` to the end of the string
- fails, because current position is the end of the string, so cannot match `b`
- matches `abcb` - one less character
- fails, because current position is `d`, so cannot match `b`
- matches `abc`, so `[bcd]*` matches only `bc`
- `abcb`, tries last character `b`, and it's on current position

```
re.match("a[bcd]*b", "abcbd")
```

- matches `a`
- matches `abcbd` to the end of the string
- fails, because current position is the end of the string, so cannot match `b`
- matches `abcb` - one less character
- fails, because current position is `d`, so cannot match `b`
- matches `abc`, so `[bcd]*` matches only `bc`
- `abcb`, tries last character `b`, and it’s on current position
- success

```
>>> re.findall(’a[bcd]*b’, ’abcbd’)
[’abcb’]
```

`*?`, `+?`, `??`, `{m,n}?` are non-greedy. Will try to match as few characters as possible.

`*?, +?, ??, {m,n}?` are non-greedy. Will try to match as few characters as possible.

```
>>> import re
>>> text =
    ↪  "<html><head><title>Title</title></head></html>"
```

`*?, +?, ??, {m,n}?` are non-greedy. Will try to match as few characters as possible.

```
>>> import re
>>> text =
    ↪  "<html><head><title>Title</title></head></html>"

>>> greedy_regex = re.compile("<.*>")
>>> greedy_regex.findall(text)
['<html><head><title>Title</title></head></html>']
```

`*?`, `+?`, `??`, `{m,n}?` are non-greedy. Will try to match as few characters as possible.

```
>>> import re
>>> text =
    ↪  "<html><head><title>Title</title></head></html>"

>>> greedy_regex = re.compile("<.*>")
>>> greedy_regex.findall(text)
['<html><head><title>Title</title></head></html>']

>>> non_greedy_regex = re.compile("<.*?>")
>>> non_greedy_regex.findall(text)
['<html>', '<head>', '<title>', '</title>', '</head>',
    ↪  '</html>']
>>>
```

\ - backslash (escape metacharacters)

For matching [or \ you can use \[or \\

```
>>> re.findall("\[\]", "Find brackets []")
['[]']
```

\ - backslash (escape metacharacters)
For matching `[` or `\` you can use `\[` or `\\`

```
>>> re.findall("\[\]", "Find brackets []")
['[]']
```

Some of special sequences beginning with \ express predefined sets of characters: set of digits, letters, everything but whitespace

- \d - any decimal digit, equivalent of [0−9]
- \D - everything but decimal digit, equivalent of [^0−9]

```
>>> re.findall("\d", "abc789xyz")
['7', '8', '9']
>>> re.findall("[0-9]", "abc789xyz")
['7', '8', '9']
```

- `\d` - any decimal digit, equivalent of `[0-9]`
- `\D` - everything but decimal digit, equivalent of `[^0-9]`

```
>>> re.findall("\d", "abc789xyz")
[’7’, ’8’, ’9’]
>>> re.findall("[0-9]", "abc789xyz")
[’7’, ’8’, ’9’]

>>> re.findall("\D", "abc789xyz")
[’a’, ’b’, ’c’, ’x’, ’y’, ’z’]
>>> re.findall("[^0-9]", "abc789xyz")
[’a’, ’b’, ’c’, ’x’, ’y’, ’z’]
```

- `\w` - any alphanumeric: `[a-zA-Z0-9_]`
- `\W` - any non-alphanumeric: `[^a-zA-Z0-9_]`

```
>>> re.findall('\w+', 'abc 789 xyz')
['abc', '789', 'xyz']
>>> re.findall('[a-zA-Z0-9_]+', 'abc 789 xyz')
['abc', '789', 'xyz']
```

- `\w` - any alphanumeric: `[a−zA−Z0−9_]`
- `\W` - any non-alphanumeric: `[ˆa−zA−Z0−9_]`

```
>>> re.findall(’\w+’, ’abc 789 xyz’)
[’abc’, ’789’, ’xyz’]
>>> re.findall(’[a−zA−Z0−9_]+’, ’abc 789 xyz’)
[’abc’, ’789’, ’xyz’]

>>> re.findall(’\W+’, ’abc 789 xyz’)
[’ ’, ’ ’]
>>> re.findall(’[ˆa−zA−Z0−9_]+’, ’abc 789 xyz’)
[’ ’, ’ ’]
```

- `\s` - any whitespace character: `[ \t\n\r\f\v]` (space, tab (ASCII 0x09), newline (0x0A), return (0x0D), form feed - page break(0x0C), vertical tab (0x0B))
- `\S` - any non-whitespace character: `[^ \t\n\r\f\v]`

- `\s` - any whitespace character: `[ \t\n\r\f\v]` (space, tab (ASCII 0x09), newline (0x0A), return (0x0D), form feed - page break(0x0C), vertical tab (0x0B))
- `\S` - any non-whitespace character: `[^ \t\n\r\f\v]`
- NOTE! Remember that Windows text files use `\r\n` to terminate lines, while UNIX text files use `\n`.

```
>>> text = "line,\nwith \ttab,\vvertical,\rreturn and
    ↪  \nnewlines."
>>> print(text)
line,
with    tab,
return and  vertical,
newlines.
```

```
>>> text = "line,\nwith \ttab,\vvertical,\rreturn and
    ↪  \nnewlines."
>>> print(text)
line,
with    tab,
return and  vertical,
newlines.

>>> re.findall("\s+", text)
['\n', ' \t', '\x0b', '\r', ' ', ' \n']
```

```
>>> text = "line,\nwith \ttab,\vvertical,\rreturn and
    ↪  \nnewlines."
>>> print(text)
line,
with    tab,
return and  vertical,
newlines.

>>> re.findall("\s+", text)
['\n', ' \t', '\x0b', '\r', ' ', ' \n']

>>> re.findall("\S+", text)
['line,', 'with', 'tab,', 'vertical,', 'return', 'and',
    ↪  'newlines.']
```

^, \A - beginning of lines

```
>>> text = """Your own personal Jesus
... Someone to hear your prayers
... Someone who cares
... Your own personal Jesus"""
```

^, \A - beginning of lines

```
>>> text = """Your own personal Jesus
... Someone to hear your prayers
... Someone who cares
... Your own personal Jesus"""

>>> re.findall("^Your", text)
[’Your’]
>>> re.findall("\AYour", text)
[’Your’]
```

^, \A - beginning of lines

```
>>> text = """Your own personal Jesus
... Someone to hear your prayers
... Someone who cares
... Your own personal Jesus"""

>>> re.findall("^Your", text)
[’Your’]
>>> re.findall("\AYour", text)
[’Your’]

>>> re.findall("^Your", text, re.M)
[’Your’, ’Your’]
>>> re.findall("\AYour", text, re.M)
[’Your’]
```

`$`, `\Z` - end of lines

```
>>> text = """Your own personal Jesus
... Someone to hear your prayers
... Someone who cares
... Your own personal Jesus"""
```

$, \Z - end of lines

```
>>> text = """Your own personal Jesus
... Someone to hear your prayers
... Someone who cares
... Your own personal Jesus"""

>>> re.findall("Jesus$", text)
['Jesus']
>>> re.findall("Jesus\Z", text)
['Jesus']
```

$, \Z - end of lines

```
>>> text = """Your own personal Jesus
... Someone to hear your prayers
... Someone who cares
... Your own personal Jesus"""

>>> re.findall("Jesus$", text)
[’Jesus’]
>>> re.findall("Jesus\Z", text)
[’Jesus’]

>>> re.findall("Jesus$", text, re.M)
[’Jesus’, ’Jesus’]
>>> re.findall("Jesus\Z", text, re.M)
[’Jesus’]
```

\b, \B - word boundaries

```
>>> text = "People in class heard that Pluto should be
    ↪  reclassified, because it is no longer a planet."
```

\b, \B - word boundaries

```
>>> text = "People in class heard that Pluto should be
    ↪  reclassified, because it is no longer a planet."

>>> re.sub("class", "room", text)
'People in room heard that Pluto should be reroomified,
    ↪  because it is no longer a planet.'
```

\b, \B - word boundaries

```
>>> text = "People in class heard that Pluto should be
    ↪  reclassified, because it is no longer a planet."

>>> re.sub("class", "room", text)
'People in room heard that Pluto should be reroomified,
    ↪  because it is no longer a planet.'

>>> re.sub(r"\bclass\b", "room", text)
'People in room heard that Pluto should be
    ↪  reclassified, because it is no longer a planet.'
```

\b, \B - word boundaries

```
>>> text = "People in class heard that Pluto should be
    ↪  reclassified, because it is no longer a planet."

>>> re.sub("class", "room", text)
'People in room heard that Pluto should be reroomified,
    ↪  because it is no longer a planet.'

>>> re.sub(r"\bclass\b", "room", text)
'People in room heard that Pluto should be
    ↪  reclassified, because it is no longer a planet.'

>>> re.sub(r"\Bclass\B", "qual", text)
'People in class heard that Pluto should be
    ↪  requalified, because it is no longer a planet.'
```

- re is handled as string

- re is handled as string
- one of `re` metacharacters is \

- re is handled as string
- one of `re` metacharacters is \
- backslash for escaping in `re` conflicts with the same purpose in Python

Characters	Stage
`\section`	Text string to be matched
`\\section`	Escaped backslash for `re.compile()`
`"\\\\section"`	Escaped backslashes for a string literal

Characters	Stage
`\section`	Text string to be matched
`\\section`	Escaped backslash for `re.compile()`
`"\\\\section"`	Escaped backslashes for a string literal

re string needs to be written as `"\\\\"` because regular expression must be `\\` and each must be escaped `\\` inside a regular Python string literal.

Characters	Stage
`\section`	Text string to be matched
`\\section`	Escaped backslash for `re.compile()`
`"\\\\section"`	Escaped backslashes for a string literal

re string needs to be written as `"\\\\"` because regular expression must be `\\` and each must be escaped `\\` inside a regular Python string literal.

Solution - raw string

Regular string	Raw string
`"ab*"`	`r"ab*"`
`"\\\\section"`	`r"\\section"`
`"\\w+\\s+"`	`r"\w+\s+"`

```
>>> latex = """
... \begin{document}
... \section{History}
... \subsection{Origins}
... \begin{frame}
... Content
... \end{frame}
... \end{document}
... """
```

```
>>> latex = """
... \begin{document}
... \section{History}
... \subsection{Origins}
... \begin{frame}
... Content
... \end{frame}
... \end{document}
... """

>>> latex
'\n\x08egin{document}\n\\section{History}\n\\subsection{Origin
```

```
>>> latex = """
... \begin{document}
... \section{History}
... \subsection{Origins}
... \begin{frame}
... Content
... \end{frame}
... \end{document}
... """

>>> latex
'\n\x08egin{document}\n\\section{History}\n\\subsection{Origin

>>> print(re.findall(r"\\section{.*}", latex))
['\\section{History}']
>>> print(re.findall(r"\\section{.*}", latex)[0])
\section{History}
```

match() vs. search()

```
>>> text = 'Your own personal Jesus Someone to hear
    ↪  your prayers Someone who cares Your own
    ↪  personal Jesus'
```

match() vs. search()

```
>>> text = 'Your own personal Jesus Someone to hear
    ↪  your prayers Someone who cares Your own
    ↪  personal Jesus'

>>> re.search("Your", text)
<_sre.SRE_Match object; span=(0, 4), match='Your'>
```

match() vs. search()

```
>>> text = 'Your own personal Jesus Someone to hear
    ↪  your prayers Someone who cares Your own
    ↪  personal Jesus'

>>> re.search("Your", text)
<_sre.SRE_Match object; span=(0, 4), match='Your'>

>>> re.match("Your", text)
<_sre.SRE_Match object; span=(0, 4), match='Your'>
```

match() vs. search()

```
>>> text = 'Your own personal Jesus Someone to hear
    ↪  your prayers Someone who cares Your own
    ↪  personal Jesus'

>>> re.search("Your", text)
<_sre.SRE_Match object; span=(0, 4), match='Your'>

>>> re.match("Your", text)
<_sre.SRE_Match object; span=(0, 4), match='Your'>

>>> re.search("Jesus", text)
<_sre.SRE_Match object; span=(18, 23), match='Jesus'>
```

match() vs. search()

```
>>> text = ’Your own personal Jesus Someone to hear
    ↪  your prayers Someone who cares Your own
    ↪  personal Jesus’

>>> re.search("Your", text)
<_sre.SRE_Match object; span=(0, 4), match=’Your’>

>>> re.match("Your", text)
<_sre.SRE_Match object; span=(0, 4), match=’Your’>

>>> re.search("Jesus", text)
<_sre.SRE_Match object; span=(18, 23), match=’Jesus’>

>>> re.match("Jesus", text)
>>>
```

findall() vs. finditer()

```
>>> text = 'Your own personal Jesus Someone to hear
    ↪  your prayers Someone who cares Your own
    ↪  personal Jesus'
```

`findall()` vs. `finditer()`

```
>>> text = 'Your own personal Jesus Someone to hear
    ↪  your prayers Someone who cares Your own
    ↪  personal Jesus'

>>> output_findall = re.findall("Someone", text)
>>> output_finditer = re.finditer("Someone", text)
```

findall() vs. finditer()

```
>>> text = 'Your own personal Jesus Someone to hear
    ↪  your prayers Someone who cares Your own
    ↪  personal Jesus'

>>> output_findall = re.findall("Someone", text)
>>> output_finditer = re.finditer("Someone", text)

>>> type(output_findall)
<class 'list'>
>>> type(output_finditer)
<class 'callable_iterator'>
```

```
>>> output_findall
['Someone', 'Someone']
>>> output_finditer
<callable_iterator object at 0x7f69ffd267b8>
```

```
>>> output_findall
['Someone', 'Someone']
>>> output_finditer
<callable_iterator object at 0x7f69ffd267b8>

>>> list(output_finditer)
[<_sre.SRE_Match object; span=(24, 31),
    ↪  match='Someone'>, <_sre.SRE_Match object;
    ↪  span=(53, 60), match='Someone'>]
>>>
```

```
>>> matched = re.match("\d{0,2}-\d{0,3}", "88-299")
>>> matched
<_sre.SRE_Match object; span=(0, 6), match=’88-299’>
>>> if matched:
...     # do something
...     pass
...
```

```
>>> matched = re.match("\d{0,2}-\d{0,3}", "88-299")
>>> matched
<_sre.SRE_Match object; span=(0, 6), match='88-299'>
>>> if matched:
...     # do something
...     pass
...

>>> non_matched = re.match("(\d?)-(\d{0,3})", "88-299")
>>> non_matched
>>> non_matched == None
True
>>>
```

start() and end()

```
>>> text = "Soft Kitty, warm Kitty"
>>> matched = re.search("Kitty", text)
>>> matched.start()
5
>>> matched.end()
10
```

`match.re` and `match.string`

```
>>> matched = re.match(r"(\w+)@(\w+\.\w+)",
    ↪  "login@server.com")
```

match.re and match.string

```
>>> matched = re.match(r"(\w+)@(\w+\.\w+)",
    ↪  "login@server.com")

>>> matched.re
re.compile(’(\\w+)@(\\w+\\.\\w+)’)
>>> matched.string
’login@server.com’
>>>
```

split()

```
>>> text = "Oh, what a day. What a lovely day!"
>>> re.split("\W+", text)
[’Oh’, ’what’, ’a’, ’day’, ’What’, ’a’, ’lovely’,
    ↪ ’day’, ’’]
```

split()

```
>>> text = "Oh, what a day. What a lovely day!"
>>> re.split("\W+", text)
['Oh', 'what', 'a', 'day', 'What', 'a', 'lovely',
    ↪  'day', '']

>>> re.split("(\W+)", text)
['Oh', ', ', 'what', ' ', 'a', ' ', 'day', '. ',
    ↪  'What', ' ', 'a', ' ', 'lovely', ' ', 'day',
    ↪  '!', '']
>>>
```

Search and replace - `sub()` and `subn()`

`sub()` *is deprecated in Python 3.5 and will be removed in 3.6*

```
>>> pattern = r"\bBar\b"
>>> replacement = "Baz"
>>> string = "Foo Bar"
```

Search and replace - `sub()` and `subn()`

`sub()` *is deprecated in Python 3.5 and will be removed in 3.6*

```
>>> pattern = r"\bBar\b"
>>> replacement = "Baz"
>>> string = "Foo Bar"

>>> new_string, number_of_subs_made = re.subn(pattern,
     ↪  replacement, string)
>>> new_string, number_of_subs_made
('Foo Baz', 1)
>>>
```

```
>>> date = "10 December 2015"
>>> matched = re.match("(\d+) (\w+) (\d{4})", date)
>>> matched.groups()
(’10’, ’December’, ’2015’)
>>> matched.group(1)
’10’
>>> matched.group(2)
’December’
>>> matched.group(3)
’2015’
>>>
```

```
>>> date = "10 December 2015"
>>> matched = re.match("(?P<day>\d+) (?P<month>\w+)
    ↪  (?P<year>\d{4})", date)
>>> matched.groups()
('10', 'December', '2015')
>>> matched.group('day')
'10'
>>> matched.group('month')
'December'
>>> matched.group('year')
'2010'
{'month': 'December', 'day': '10', 'year': '2015'}
>>>
```

```
>>> m = re.search(r'(?P<quote>")(.*)(?P=quote)', 'This
    ↪  is "quote"')
>>> m
<_sre.SRE_Match object; span=(8, 15), match='"quote"'>
>>> m.groups()
('"', 'quote')
```

Positive and negative lookahead assertions

```
>>> singer = "Michael Jackson"
>>> player = "Michael Jordan"
>>> player_pattern = "Michael (?=Jordan)"
>>> non_player_pattern = "Michael (?!Jordan)"
```

Positive and negative lookahead assertions

```
>>> singer = "Michael Jackson"
>>> player = "Michael Jordan"
>>> player_pattern = "Michael (?=Jordan)"
>>> non_player_pattern = "Michael (?!Jordan)"

>>> re.match(player_pattern, player)
<_sre.SRE_Match object; span=(0, 8), match='Michael '>
>>> re.match(non_player_pattern, singer)
<_sre.SRE_Match object; span=(0, 8), match='Michael '>
```

Positive and negative lookahead assertions

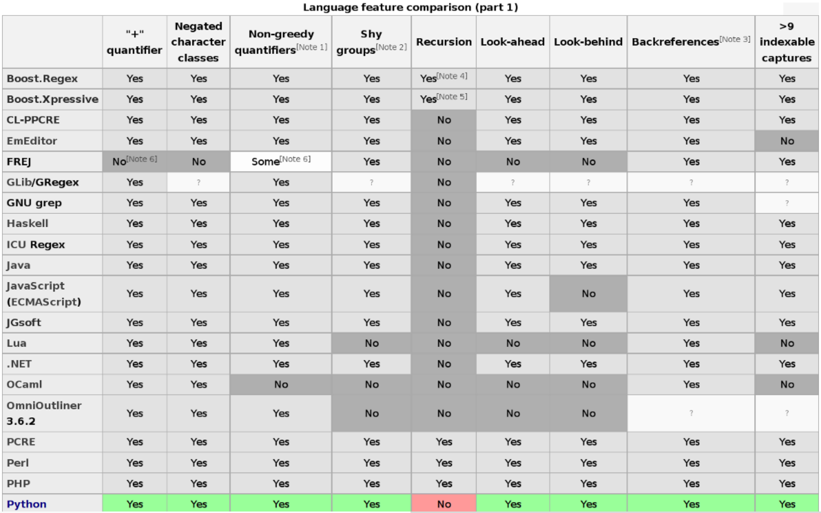
```
>>> singer = "Michael Jackson"
>>> player = "Michael Jordan"
>>> player_pattern = "Michael (?=Jordan)"
>>> non_player_pattern = "Michael (?!Jordan)"

>>> re.match(player_pattern, player)
<_sre.SRE_Match object; span=(0, 8), match='Michael '>
>>> re.match(non_player_pattern, singer)
<_sre.SRE_Match object; span=(0, 8), match='Michael '>

>>> re.match(player_pattern, singer)
>>> re.match(non_player_pattern, player)
>>>
```

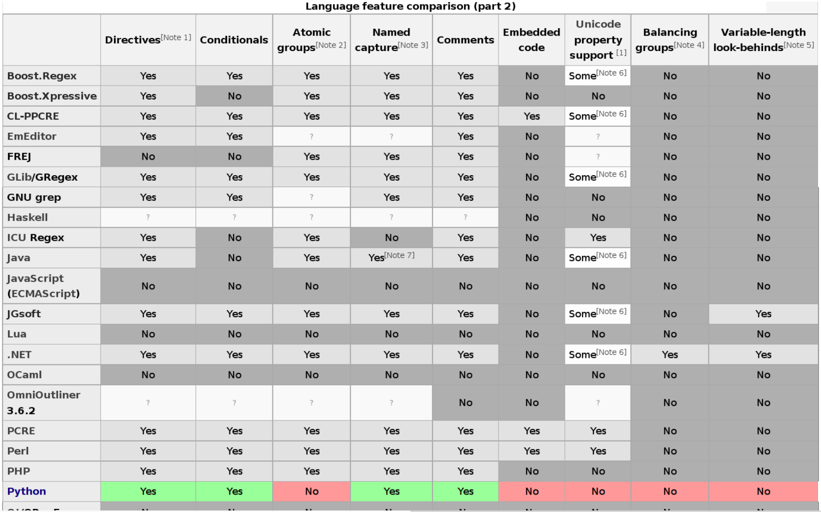
Positive and negative lookbehind assertions

```
>>> string = """
... def function():
...     return function()
"""
>>> re.search("(?<=def )function", string)
<_sre.SRE_Match object; span=(4, 12), match='function'>
>>> re.search("(?<!def )function", string)
<_sre.SRE_Match object; span=(27, 35), match='function'>
>>>
```



Language feature comparison (part 1)

	"+" quantifier	Negated character classes	Non-greedy quantifiers[Note 1]	Shy groups[Note 2]	Recursion	Look-ahead	Look-behind	Backreferences[Note 3]	>9 indexable captures
Boost.Regex	Yes	Yes	Yes	Yes	Yes[Note 4]	Yes	Yes	Yes	Yes
Boost.Xpressive	Yes	Yes	Yes	Yes	Yes[Note 5]	Yes	Yes	Yes	Yes
CL-PPCRE	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes
EmEditor	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes	No
FREJ	No[Note 6]	No	Some[Note 6]	Yes	No	No	No	Yes	Yes
GLib/GRegex	Yes	?	Yes	?	No	?	?	?	?
GNU grep	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes	?
Haskell	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes
ICU Regex	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes
Java	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes
JavaScript (ECMAScript)	Yes	Yes	Yes	Yes	No	Yes	No	Yes	Yes
JGsoft	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes
Lua	Yes	Yes	Yes	No	No	No	No	Yes	No
.NET	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes
OCaml	Yes	Yes	No	No	No	No	No	Yes	No
OmniOutliner 3.6.2	Yes	Yes	Yes	No	No	No	No	?	?
PCRE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Perl	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
PHP	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Python	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes



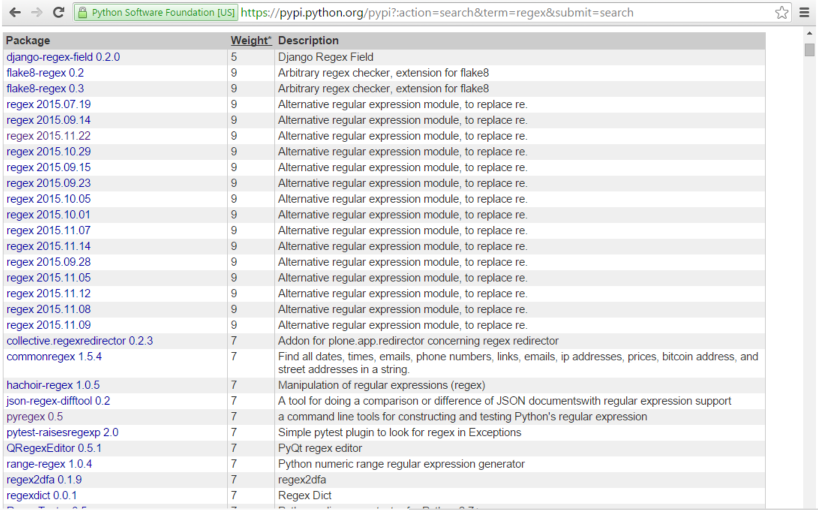
Language feature comparison (part 2)

	Directives[Note 1]	Conditionals	Atomic groups[Note 2]	Named capture[Note 3]	Comments	Embedded code	Unicode property support [1]	Balancing groups[Note 4]	Variable-length look-behinds[Note 5]
Boost.Regex	Yes	Yes	Yes	Yes	Yes	No	Some[Note 6]	No	No
Boost.Xpressive	Yes	No	Yes	Yes	Yes	No	No	No	No
CL-PPCRE	Yes	Yes	Yes	Yes	Yes	Yes	Some[Note 6]	No	No
EmEditor	Yes	Yes	?	?	Yes	No	?	No	No
FREJ	No	No	Yes	Yes	Yes	No	?	No	No
GLib/GRegex	Yes	Yes	Yes	Yes	Yes	No	Some[Note 6]	No	No
GNU grep	Yes	Yes	?	Yes	Yes	No	No	No	No
Haskell	?	?	?	?	?	No	No	No	No
ICU Regex	Yes	No	Yes	No	Yes	No	Yes	No	No
Java	Yes	No	Yes	Yes[Note 7]	Yes	No	Some[Note 6]	No	No
JavaScript (ECMAScript)	No	No	No	No	No	No	No	No	No
JGsoft	Yes	Yes	Yes	Yes	Yes	No	Some[Note 6]	No	Yes
Lua	No	No	No	No	No	No	No	No	No
.NET	Yes	Yes	Yes	Yes	Yes	No	Some[Note 6]	Yes	Yes
OCaml	No	No	No	No	No	No	No	No	No
OmniOutliner 3.6.2	?	?	?	?	No	No	?	No	No
PCRE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No
Perl	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No
PHP	Yes	Yes	Yes	Yes	Yes	No	No	No	No
Python	Yes	Yes	No	Yes	Yes	No	No	No	No

```
([a-zP]{18}) (\d{0,3}) [0-9]{4} (?P<name>[a-zA-Z]+),
    ↪  (?P=name)
```

```
def verify_regex(text):
    regex = """
    ([a-zP]{18}) # Capital "P" and a to z, repeated
        ↪  exactly 18 times, assigned to group
    \            # One whitespace
    (\d{0,3})    # Numbers, repeated 0 to 3 times
    \            # One whitespace
    [0-9]{4}     # Like above, but 4 times
    \            # One whitespace
    (?P<name>[a-zA-Z] +), # Assign to named group word
    \            # One whitespace
    (?P=name)    # reuse word, already assigned to
        ↪  group called "name"
    """
    re_compile = re.compile(regex, re.X)
    matched = re_compile.match(text)
    print(matched.groups())
```

```
>>> text = "Pfingstweidstrasse 60 8005 Zurich, Zurich"
>>> verify_regex(text)
(’Pfingstweidstrasse’, ’60’, ’Zurich’)
>>>
```



https://pypi.python.org/pypi?:action=search&term=regex&submit=search

Package	Weight*	Description
django-regex-field 0.2.0	5	Django Regex Field
flake8-regex 0.2	9	Arbitrary regex checker, extension for flake8
flake8-regex 0.3	9	Arbitrary regex checker, extension for flake8
regex 2015.07.19	9	Alternative regular expression module, to replace re.
regex 2015.09.14	9	Alternative regular expression module, to replace re.
regex 2015.11.22	9	Alternative regular expression module, to replace re.
regex 2015.10.29	9	Alternative regular expression module, to replace re.
regex 2015.09.15	9	Alternative regular expression module, to replace re.
regex 2015.09.23	9	Alternative regular expression module, to replace re.
regex 2015.10.05	9	Alternative regular expression module, to replace re.
regex 2015.10.01	9	Alternative regular expression module, to replace re.
regex 2015.11.07	9	Alternative regular expression module, to replace re.
regex 2015.11.14	9	Alternative regular expression module, to replace re.
regex 2015.09.28	9	Alternative regular expression module, to replace re.
regex 2015.11.05	9	Alternative regular expression module, to replace re.
regex 2015.11.12	9	Alternative regular expression module, to replace re.
regex 2015.11.08	9	Alternative regular expression module, to replace re.
regex 2015.11.09	9	Alternative regular expression module, to replace re.
collective.regexredirector 0.2.3	7	Addon for plone.app.redirector concerning regex redirector
commonregex 1.5.4	7	Find all dates, times, emails, phone numbers, links, emails, ip addresses, prices, bitcoin address, and street addresses in a string.
hachoir-regex 1.0.5	7	Manipulation of regular expressions (regex)
json-regex-difftool 0.2	7	A tool for doing a comparison or difference of JSON documentswith regular expression support
pyregex 0.5	7	a command line tools for constructing and testing Python's regular expression
pytest-raisesregexp 2.0	7	Simple pytest plugin to look for regex in Exceptions
QRegexEditor 0.5.1	7	PyQt regex editor
range-regex 1.0.4	7	Python numeric range regular expression generator
regex2dfa 0.1.9	7	regex2dfa
regexdict 0.0.1	7	Regex Dict

Wrapper for Google RE2 engine
Prerequisites for re2 in Python:

- RE2 library from Google
- Python development headers
- build environment with g++

Released in April 2015. In development since 2010.

Features

- `fullmatch` works like `match` but anchors the match at both the start and the end
- `test_(search|match|fullmatch)` methods that work like `(search|match|fullmatch)` but only returns `True` or `False`

Missing Features

- no substitution methods
- no flags
- no `split`, `findall`, `finditer`
- no top-level functions like `search` or `match`; just use compile
- no compile cache
- no `lastindex` or `lastgroup` on `Match` objects

Initially fork of Facebook version, later rewritten from scratch.

Features

- Backward compatibility

```
try:
    import re2 as re
except ImportError:
    import re
```

`re2` will automatically fall back to the original `re` module if there is a regex that it cannot handle: `re2` doesn't handle lookahead assertions `(?=...)`.

Missing Features/Flaws

- Unicode support: module supports UTF8, so automatically encodes and decodes any unicode string.

Total runs: 100

Test	`re` time (s)	`re2` time (s)	% time
Findall URI or Emails	348.380	8.139	2.34%
Replace wikilinks	3.659	0.812	22.19%
Remove wikilinks	3.553	0.273	7.70%

src: `https://github.com/axiak/pyre2/blob/master/tests/performance.py`

- Regular Expression HOWTO: `https://docs.python.org/2/howto/regex.html`
- Python Docs: Library re: `https://docs.python.org/2/library/re.html`
- Google for Education. Python Regular Expressions: `https://developers.google.com/edu/python/regular-expressions?hl=en`
- Regex Debugger: `https://regex101.com/`
- Debuggex: `https://www.debuggex.com/`
- Core Python Applications programming: Regular expressions: `http://www.informit.com/articles/article.aspx?p=1707750&seqNum=2`
- Brief history by Staffan Noteberg: `http://blog.staffannoteberg.com/`

- Google RE2: `https://github.com/google/re2`
- Facebook re2: `https://github.com/facebook/pyre2`
- Axiak re2: `https://github.com/axiak/pyre2`
- re2 on PyPI: `https://pypi.python.org/pypi/re2`

Thank you

Questions?

re.DEBUG

```
>>> import re
>>> regex = re.compile(’[a−z]’, re.DEBUG)
in
  range (97, 122)
>>>
```

`re.ASCII, re.A`

`\xa0` - non-breaking space

```
>>> import re
>>> regex = re.compile("\s+")
>>> regex.findall("\xa0 ha")
[’\xa0 ’]
```

re.ASCII, re.A

\xa0 - non-breaking space

```
>>> import re
>>> regex = re.compile("\s+")
>>> regex.findall("\xa0 ha")
[’\xa0 ’]

>>> ascii_regex = re.compile("\s+", re.ASCII)
>>> ascii_regex.findall("\xa0 ha")
[’ ’]
>>>
```

re.IGNORECASE, re.I

```
>>> import re
>>> text = "CamelCase CAPITAL and lower WoRd"
>>> regex = re.compile("[a-z]+")
>>> regex.findall(text)
['amel', 'ase', 'and', 'lower', 'o', 'd']
```

re.IGNORECASE, re.I

```
>>> import re
>>> text = "CamelCase CAPITAL and lower WoRd"
>>> regex = re.compile("[a-z]+")
>>> regex.findall(text)
[’amel’, ’ase’, ’and’, ’lower’, ’o’, ’d’]

>>> ignorecase_regex = re.compile("[a-z]+", re.I)
>>> ignorecase_regex.findall(text)
[’CamelCase’, ’CAPITAL’, ’and’, ’lower’, ’WoRd’]
>>>
```

re.MULTILINE, re.M

```
>>> import re
>>> text = """From the beginning,
... in the middle,
... and at the end."""
```

re.MULTILINE, re.M

```
>>> import re
>>> text = """From the beginning,
... in the middle,
... and at the end."""

>>> regex = re.compile("^[a-zA-Z]+")
>>> regex.findall(text)
[’From’]
```

re.MULTILINE, re.M

```
>>> import re
>>> text = """From the beginning,
... in the middle,
... and at the end."""

>>> regex = re.compile("^[a-zA-Z]+")
>>> regex.findall(text)
[’From’]

>>> multiline_regex = re.compile("^[a-zA-Z]+", re.M)
>>> multiline_regex.findall(text)
[’From’, ’in’, ’and’]
>>>
```

re.DOTALL, re.S

```
>>> import re
>>> text = """From the beginning,
... in the middle,
... and at the end."""
```

re.DOTALL, re.S

```
>>> import re
>>> text = """From the beginning,
... in the middle,
... and at the end."""

>>> regex = re.compile(".+")
>>> regex.findall(text)
['From the beginning,', 'in the middle,', 'and at the
    ↪  end.']
```

re.DOTALL, re.S

```
>>> import re
>>> text = """From the beginning,
... in the middle,
... and at the end."""

>>> regex = re.compile(".+")
>>> regex.findall(text)
['From the beginning,', 'in the middle,', 'and at the
     ↪  end.']

>>> dotall_regex = re.compile(".+", re.S)
>>> dotall_regex.findall(text)
['From the beginning,\nin the middle,\nand at the end.']
>>>
```

re.VERBOSE, re.X

```
>>> import re
>>> numbers = "127.2, 15.30, 73"
>>> regex = re.compile(r"\d+\.?\d*")
>>> regex.findall(numbers)
[’127.2’, ’15.30’, ’73’]
```

re.VERBOSE, re.X

```
>>> import re
>>> numbers = "127.2, 15.30, 73"
>>> regex = re.compile(r"\d+\.?\d*")
>>> regex.findall(numbers)
[’127.2’, ’15.30’, ’73’]

>>> verbose_regex = re.compile(r"""
        \d +   # the integral part
        \. ?   # the decimal point
        \d *   # some fractional digits""", re.X)
>>> verbose_regex.findall(numbers)
[’127.2’, ’15.30’, ’73’]
>>>
```

`re.LOCALE, re.L`

Make `\w`, `\W`, `\b`, and `\B`, dependent on the current locale instead of the Unicode database.

Do not use.

Deprecated in Python 3.5, will be removed in version 3.6