# Introduction to Regular Expressions

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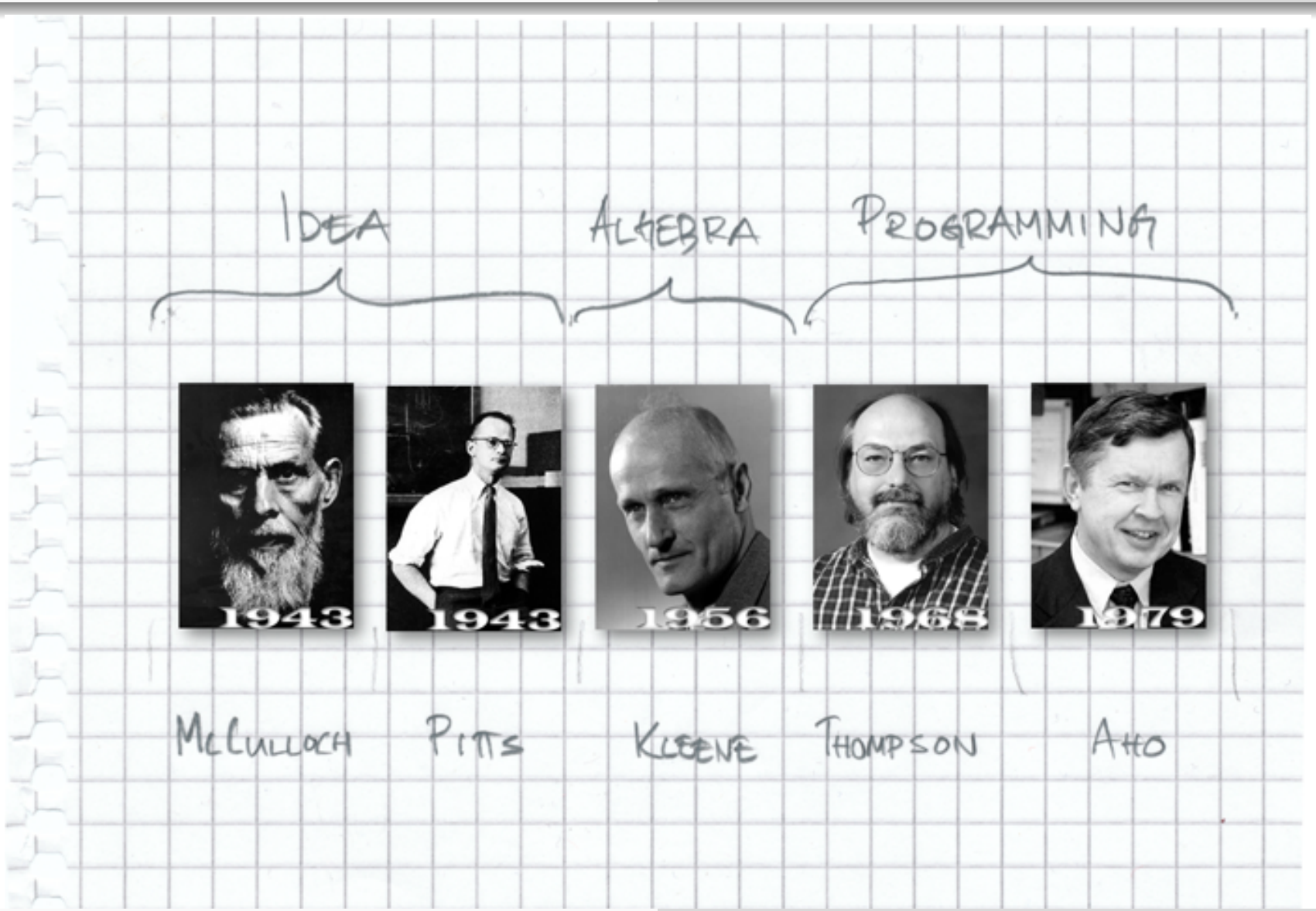
IDEA
ALGEBRA
PROGRAMMING
1943
1943
1956
1968
1979
McCULLOCH
PITTS
KLEENE
THOMPSON
AHO

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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- ‘regex‘ finally removed in Python 2.5 (September 19, 2006)

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- "Is there a match for the pattern anywhere in this string?"
- Replace part of it
- Split into pieces

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

```
([0-9]+) (\w+ \w+)\n(?P<city>[\w ]+), ([A-Z]{2})
    ↪  (?P<zip>\d{5})
```

```
>>> 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*

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

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

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

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```
>>> 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)

# Equivalents

```
{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).

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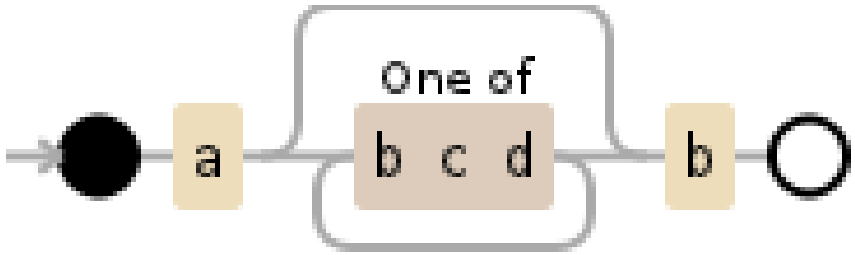
`a[bcd]*b` - matches `a`, zero or more letters from `bcd`, and ends with `b`




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

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

- matches `a`

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```

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

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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`

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- matches `abc`, so `[bcd]*` matches only `bc`

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

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```
>>> 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 []")
['[]']
```

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

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

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

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- one of `re` metacharacters is \

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- 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 |

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

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|---|---|
| `\section` | Text string to be matched |
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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+"` |

## 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)
>>>
```

```
>>> 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')
'2015'
>>> matched.groupdict()
{'month': 'December', 'day': '10', 'year': '2015'}
>>>
```

**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 |
| Qt/QRegExp | Yes | Yes | Yes | Yes | No | Yes | No | Yes | Yes |
| R[Note 7] | 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 |
| **Qt/QRegExp** | No | No | No | No | No | No | No | No | No |
| **RE2** | Yes | No | ? | Yes | No | No | Some[Note 6] | No | No |

```
([0-9]+) (\w+\ \w+)\n(?P<city>[\w ]+), ([A-Z]{2})
    ↪  (?P<zip>\d{5})
```

```
def verify_regex(text):
    regex = """
    ([0-9]+)      # Match any recurring numbers
    \             # One whitespace
    (\w+ \w+)     # Match street
    \n            # New line
    (?P<city>[\w ]+) # Named group for City
    ,             # Comma :)
    \             # One whitespace
    ([A-Z]{2})    # Two capital letters, matching state
    \             # One whitespace
    (?P<zip>\d{5}) # Named group for matching ZIP code
    """
    re_compile = re.compile(regex, re.X)
    matched = re_compile.match(text)
    print(matched.groups())
```

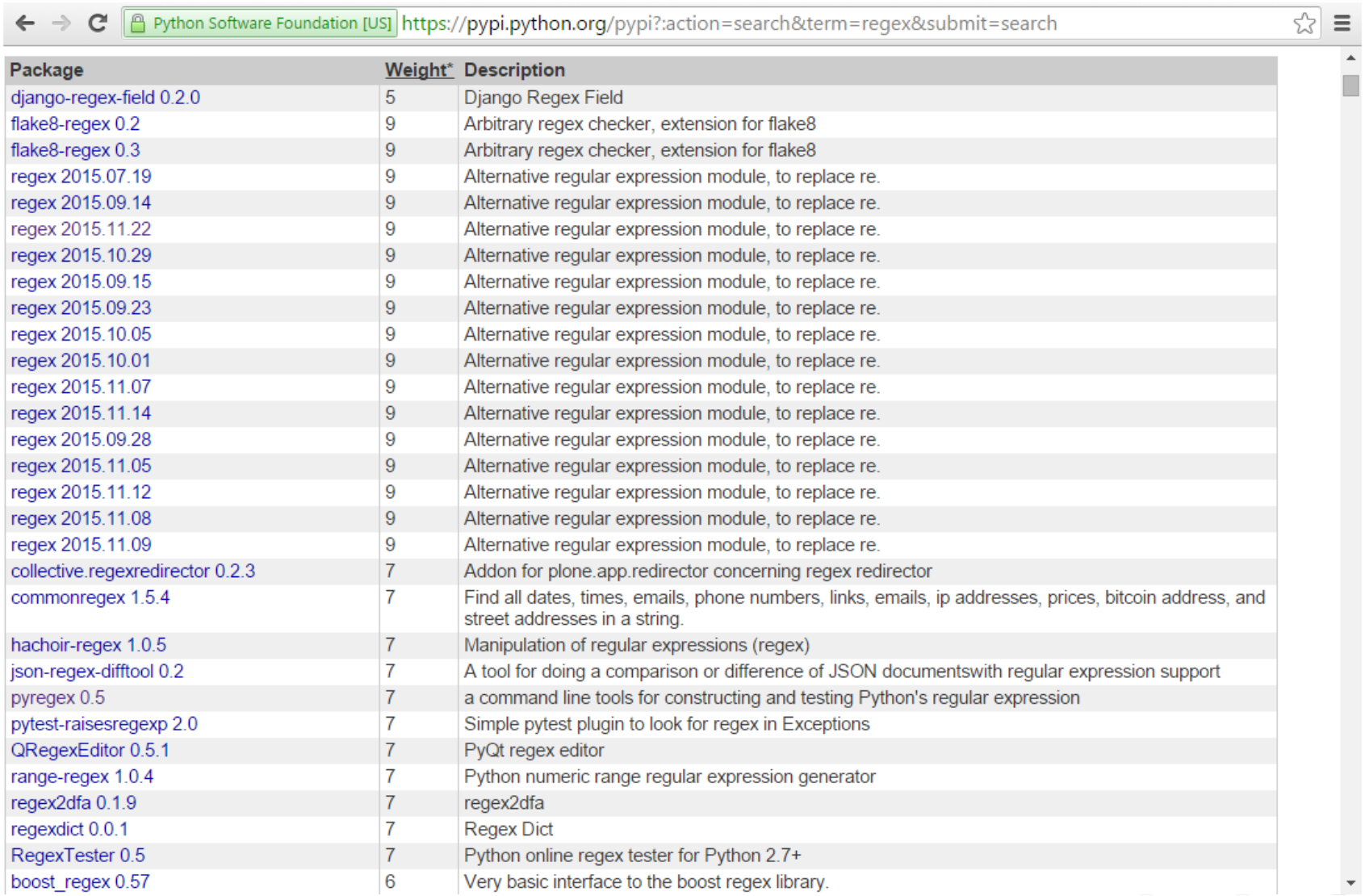
```
>>> address = """1 Fanatical Place
San Antonio, TX 78218"""
>>> verify_regex(address)
('1', 'Fanatical Place', 'San Antonio', 'TX', '78218')
>>>
```

```
def parse_volume_type_from_filename(self,
    ↪  emcConfigFile):
    """Parse the volume type from the file (if it
        ↪  exists).

    :param emcConfigFile: the EMC configuration file
    :returns: volumeTypeName - the volume type name
    """
    volumeTypeName = None

    m =
        ↪  re.search('/etc/cinder/cinder_emc_config_(.+?).xml
        ↪  emcConfigFile)
    if m:
        volumeTypeName = m.group(1)

    return volumeTypeName
"cinder/cinder/volume/drivers/emc/emc_vmax_utils.py"
```




| 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 |
| RegexTester 0.5 | 7 | Python online regex tester for Python 2.7+ |
| boost_regex 0.57 | 6 | Very basic interface to the boost regex library. |

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/
- Regular Expression Matching Can Be Simple And Fast https://swtch.com/~rsc/regexp/regexp1.html

- 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?