

Regex 101

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Regular expressions are:

patterns (e.g. like `kopytko`, `\w+` or `[^qwe](\d\w+)\s{3}`)

used to match **character combinations**...

...in **strings** (like in "look for `Mary` in *Mary had a little lamb...*")

RegExps are implemented in most programming languages

- Ruby (RegExp class, <https://ruby-doc.org/core-2.7.1/Regexp.html>)

```
foo = "faczynski ma malego kiutka"  
foo =~ /iutka/
```

- Java

```
String str = "some string";  
if (str.matches("^string")) { ... }
```

- JavaScript

```
'^some'.test("some string")  
'^some'.exec("some string")
```

RegExp are commonly implemented in most programming languages

- Python

```
import re
re.search('^some', "some string")
```

- Rust

```
use regex::Regex;
Regex::new("^some").unwrap().is_match("some string")
```

Example in Ruby

ruby-doc.org/core-2.7.1/Regexp.html

Excerpt from the docs:

```
/hay/ =~ 'haystack'    #=> 0  
/y/.match('haystack') #=> #<MatchData "y">
```

If a string contains the pattern it is said to match. A literal string matches itself.

Here 'haystack' does not contain the pattern 'needle', so it doesn't match:

```
/needle/.match('haystack') #=> nil
```

Here 'haystack' contains the pattern 'hay', so it matches:

```
/hay/.match('haystack')    #=> #<MatchData "hay">
```

What they can be used for?

- **validation** (e.g. check if a user input is well-formed or meets the defined criteria)
- **parsing** (e.g. to catch all URL parameters, capture text, etc.)
- **data scraping** (like in *web scraping*, find all pages that contain a certain set of keywords)
- **string replacement** (e.g. when coding - to rename a method or a variable)
- **other transformations** (e.g. to translate one form of text, like application output, to another)

Syntax: character classes

`.` matches *any* character

`\d` matches a single character that is a digit

`\w` matches a word character (alphanumeric character plus underscore)

`\s` matches a whitespace character (includes tabs and line breaks)

Negations:

`\D` is the negation of `\d`

`\W` is the negation of `\w`

`\S` is the negation of `\s`

Syntax: quantifiers (`*` , `+` , `?` and `{}`)

`abc*` matches a string that has `ab` followed by zero or more `c`'s

`abc+` matches a string that has `ab` followed by one or more `c`'s

`abc?` matches a string that has `ab` followed by zero or one `c`'s

`abc{2}` matches a string that has `ab` followed by 2 `c`'s

`abc{2,}` matches a string that has `ab` followed by 2 or more `c`'s

`abc{2,5}` matches a string that has `ab` followed by 2 up to 5 `c`'s

`a(bc)*` matches a string that has `a` followed by zero or more copies of the sequence `bc`

`a(bc){2,5}` matches a string that has `a` followed by 2 up to 5 copies of the sequence
`bc`

Syntax: anchors (`^` and `$`)

`^The` matches any string that starts with `The`

`end$` matches a string that ends with `end`

`^The end$` exact string match (starts and ends with `The end`)

`roar` matches any string that has the text `roar` in it

Syntax: *or* operator (`|` or `[]`), negation operator

`a(b|c)` matches a string that has `a` followed by `b` or `c` (and captures `b` or `c`)

`a[bc]` same as previous, but without capturing `b` or `c`

Example usages:

`[abc]` matches a string that has either an `a` or a `b` or a `c` -> is the same as `a|b|c`

`[a-c]` same as previous, but with range operator `-`

`[a-fA-F0-9]` a string that represents a single hexadecimal digit, case insensitively

`[0-9]%` a string that has a character from `0` to `9` before a `%` sign

Negation operator:

`[^a-zA-Z]` a string that has not a letter from `a` to `z` or from `A` to `Z`. In this case the `^` is used as **negation** of the expression

Syntax: flags

Most popular:

`g` - *global* - does not return after the first match, restarting the subsequent searches from the end of the previous match

`m` - *multi-line* - when enabled `^` and `$` will match the start and end of a line, instead of the whole string

`i` - *insensitive* - makes the whole expression case-insensitive (for instance `/aBc/i` would match `AbC`)

Caveat:

Flags are **language-specific**, e.g. in PHP you use `s` to enable multi-line mode.

Syntax: grouping and capturing: `()`

`a(bc)` parentheses create a capturing group with value `bc`

`a(?:bc)*` using `?:` we disable the capturing group, so here the match object will *not* contain `bc`

`a(<foo>bc)` using `<foo>` we put a name to the group

Syntax: greedy and lazy matching

The quantifiers (`*` `+` `{}`) are greedy operators – they expand the match as far as they can through the provided text.

E.g. `<.+>` matches `<div>simple div</div>` in `This is a <div> simple div</div> test .`

In order to catch only the div tag we can use a `?` to make it lazy:

`<. +?>` matches any character one or more times included inside `<` and `>`, expanding as needed

<https://regex101.com/r/cO8lqs/24>

Syntax: boundaries - `\b` and `\B`

`\babc\b` performs a "whole words only" search (here it won't match `aabcd` in "abc aabcd")

`\Babc\B` matches only if the pattern is fully surrounded by word characters (here it won't match `abc` in "abc aabcd")

Syntax: back-references - `\1` (`\2` and so on)

`([abc])\1` using `\1` it matches the same text that was matched by the first capturing group

`([abc]) ([de])\2\1` we can use `\2` (`\3`, `\4` etc.) to identify the same text that was matched by the second (third, fourth, etc.) capturing group

`(?<foo> [abc])\k<foo>` we add the name `foo` to the group and we reference it later (`\k<foo>`).

The result is the same as in the first regex.

Syntax: look-ahead, look-behind — `(?=)` and `(?<=)`

`d(=r)` matches a `d` only if is followed by `r`, but `r` will not be part of the overall regex match

`(?<=r)d` matches a `d` only if is preceded by an `r`, but `r` will not be part of the overall regex match

Example - email validation

- it ain't easy if you apply RFC822 strictly...

<https://stackoverflow.com/questions/201323/how-to-validate-an-email-address-using-a-regular-expression>

```
(?:[a-z0-9!$%&*+^_~`{|}~]+(?:\.[a-z0-9!$%&*+^_~`{|}~]+)*)|(?:[x|X]|y|Y|[0-9]|_|[a-zA-Z]{2}|[a-zA-Z]{3}){1,6}(?![a-zA-Z]{4})
```

- ...but can be quite simple if you're not paranoid

<https://regex101.com/r/70ARRh/3>

 regex-email

Examples from AH repo:

- Webapp: validation of bank details provided by PAX

https://github.com/AirHelp/ah-webapp/blob/88dae720285026a9465f41a3f05bd91abe5ebaeb/app/services/validate_free_bank_transfer_details.rb

regexps taken from private Ruby gem

<https://github.com/AirHelp/ah-payments-reference-data/blob/8c35f6133b55e2064ae2d20313e4aac3438bc6f3/lib/ah/payments/reference/data/fields.json>

Examples from AH repo:

- Midass: validation of bank details provided by PAX
https://github.com/AirHelp/ah-midass/blob/89b20280f782e68a2445d2fe966012fa0558365c/app/services/dlocal/validate_bank_transfer_details.rb

Examples from AH repo:

- Skynet: parsing Boarding Pass scan from mobile app
https://github.com/AlrHelp/ah-skynet/blob/e8afa9087b19dce5a4596eb41c9d24c073400233/app/services/parse_boarding_pass.rb

Can be used in IDE to search & replace

IDE will highlight matches so you can test if your regex works as expected.

 regex-db-output

Can be used in sed

Here we use 2 sed commands: *replace* and *delete*; also we apply *g* flag to apply to *all* occurrences in line

```
# redirect output of one gsed operation to another until desired effect is reached
gsed 's/|/,/g' db-output.txt | \ # replace pipes with commas in db-output.txt
gsed 's/\s\+/,/g' | \ # replace spaces followed by comma with comma
gsed 's/, \s\+/,/g' | \ # replace comma followed by spaces with comma
gsed 's/^\s\+//' | \ # delete (replace by nothing) spaces at the beginning of line
gsed '/--/d' # delete lines with '--'
```

```
# or use multiple gsed commands joined with semicolons in one invocation
gsed 's/|/,/g; s/\s\+/,/g; s/, \s\+/,/g; s/^\s\+//; /--/d' db-output.txt
```

```
# the same as above but split to multiple lines for readability
gsed -e 's/|/,/g' \
      -e 's/\s\+/,/g' \
      -e 's/, \s\+/,/g' \
      -e 's/^\s\+//' \
      -e '/--/d' \
db-output.txt
```

sed - caveats

- GNU sed & BSD/POSIX sed differ

Rule of thumb: use the modern one, i.e. *GNU* sed

```
brew install gsed # on OSX
```

- there are some syntactic differences programming language regex and GNU sed regexes
 - sed uses POSIX syntax (basic regular expressions), so some escape sequences (eg. `\|` , `\+` , `\?`) are not defined
 - see *Regex syntax clashes* at <http://www.gnu.org/software/sed/manual/sed.html>
 - some macros/character classes don't work in sed
 - eg. `\d` , <https://stackoverflow.com/questions/14671293/why-doesnt-d-work-in-regular-expressions-in-sed>)

Final notes

- try to *keep it simple* (for better performance & understandability)
- sometimes it's easier to use *or* operator (`|`) than creating more general regular expression
- read the *language documentation*
- (especially when re-using a regexp written in one programming language in a different language)

References:

- **The Stack Overflow Regular Expressions FAQ**
<https://stackoverflow.com/questions/22937618/reference-what-does-this-regex-mean/22944075#22944075>
- **MDN Regular Expressions (JavaScript)**
https://developer.mozilla.org/en-US/docs/Web/JavaScript/Guide/Regular_Expressions
- **Lots of examples with explanations (kudos to Jonny Fox, I used lots of them in this presentation)**
<https://medium.com/factory-mind/regex-tutorial-a-simple-cheatsheet-by-examples-649dc1c3f285>
- **Examples in various programming languages**
http://rosettacode.org/wiki/Regular_expressions

