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Codeworks
2009

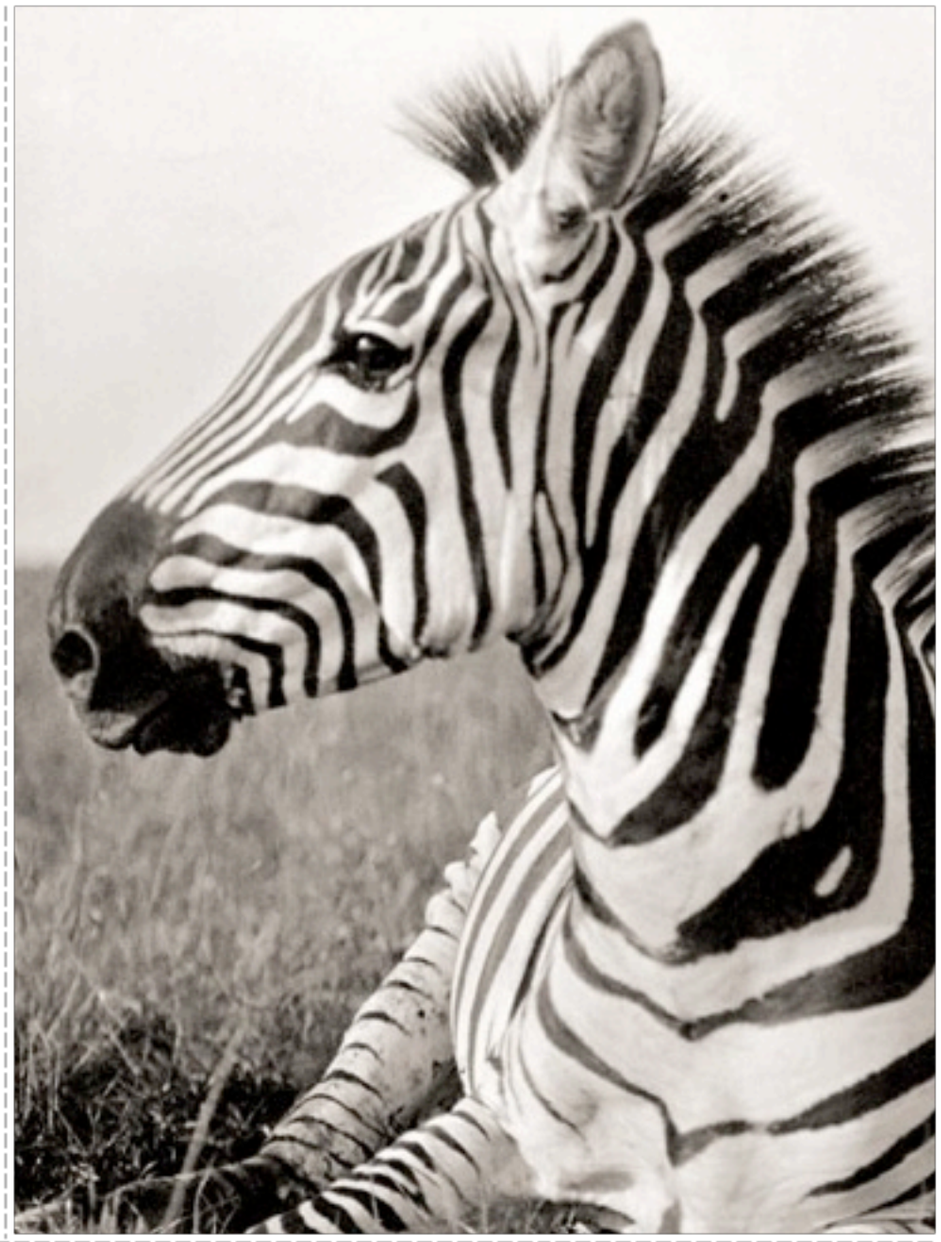
Andrei's Regex Clinic

userfriendly: line noise

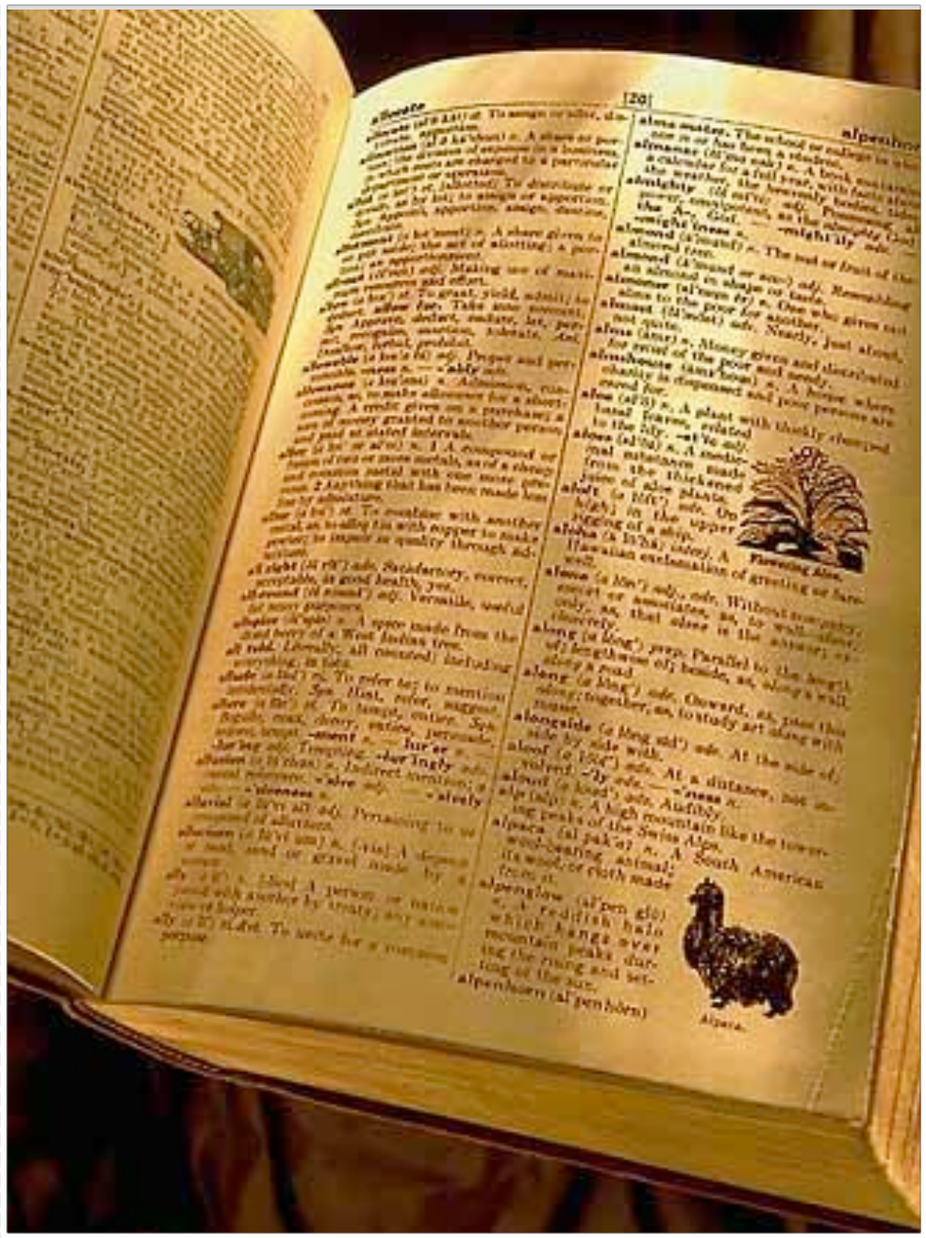
what are they good for?

- Literal string searches are fast but inflexible

- With regular expressions you can:
  - Find out whether a certain pattern occurs in the text
  - Locate strings matching a pattern and remove them or replace them with something else
  - Extract the strings matching the pattern



terminology

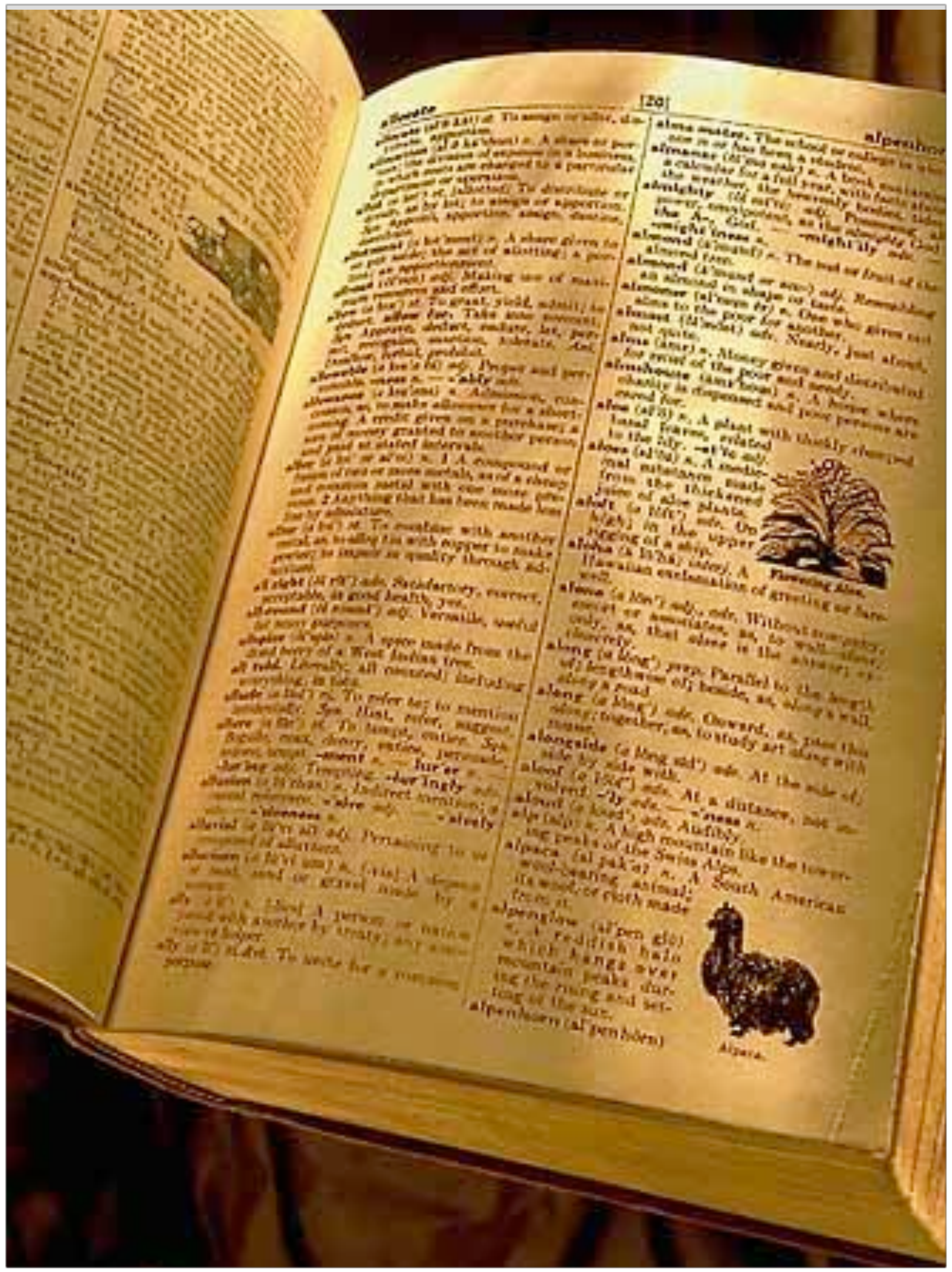


Regex

a pattern describing a set of strings

a b c d e f

terminology

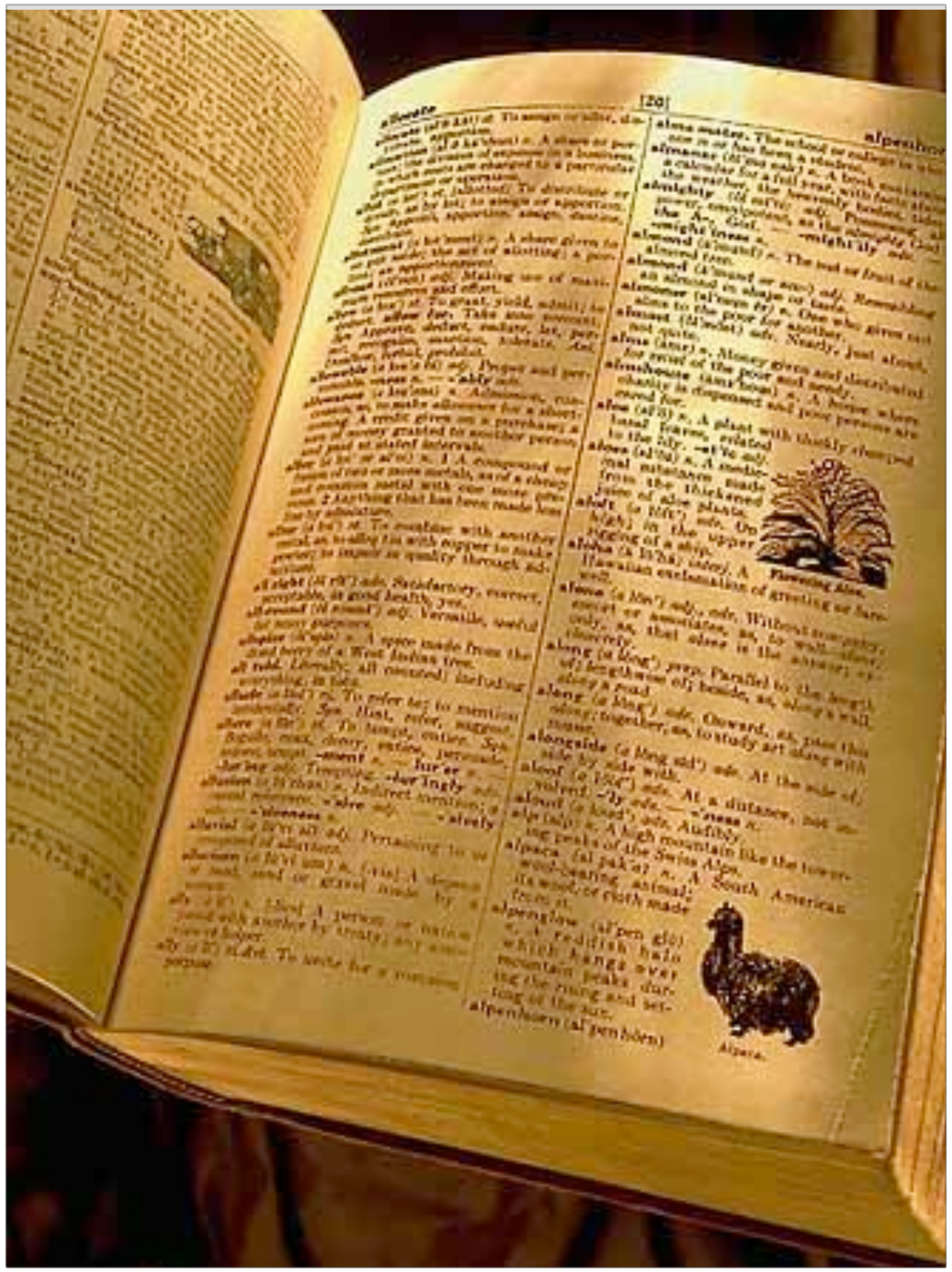


apple

Subject String

text that the regex is applied to

terminology

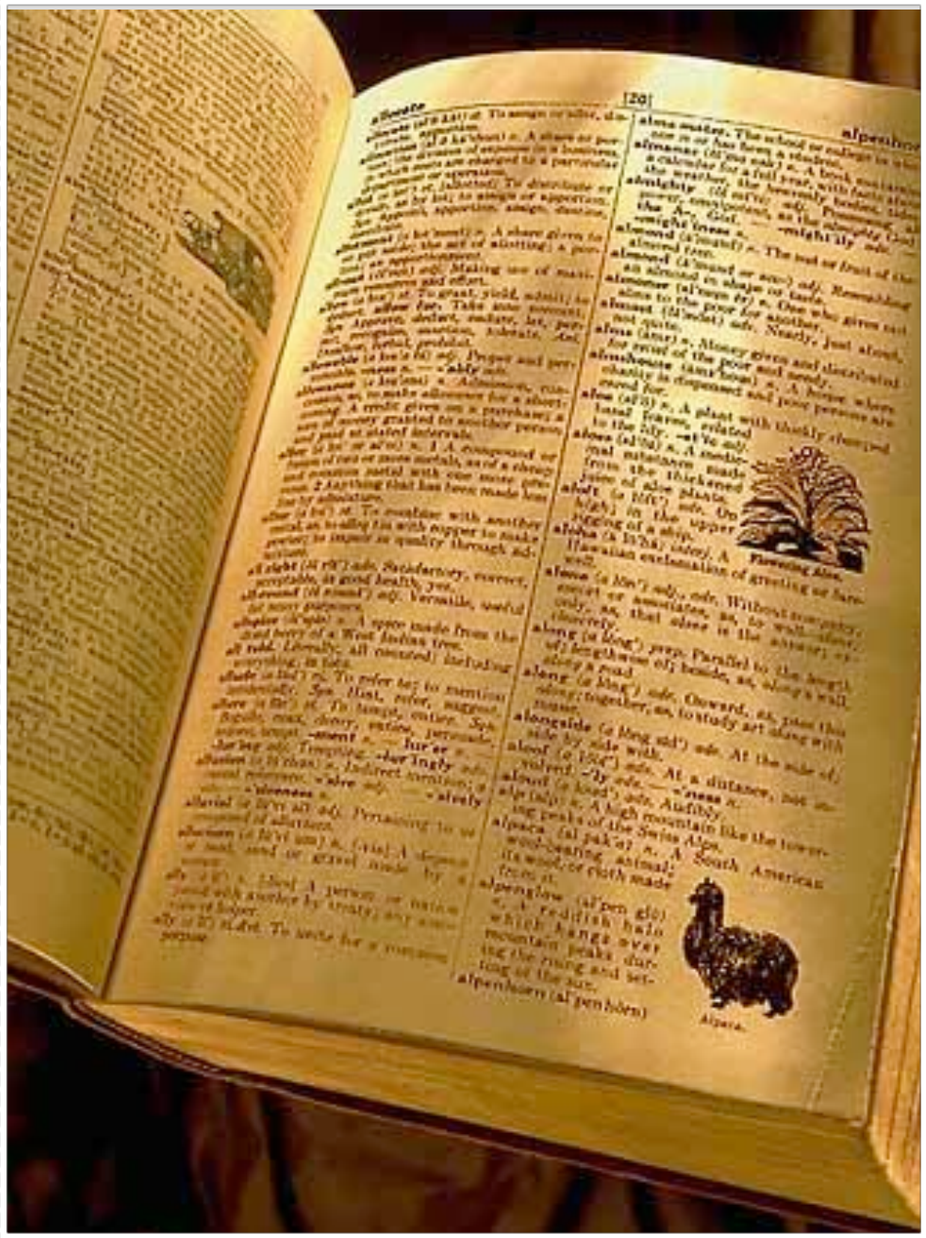


apple

Match

a portion of the string that is successfully described by the regex

terminology



Engine

A program or a library that obtains matches given a regex and a string

PCRE

how an NFA engine works

- The engine bumps along the string trying to match the regex
- Sometimes it goes back and tries again

how an NFA engine works

- Two basic things to understand about the engine
  - It will always return the earliest (leftmost) match it finds

    The topic of the day is isotopes.
  - Given a choice it always favors match over a non-match

color legend

regular expression

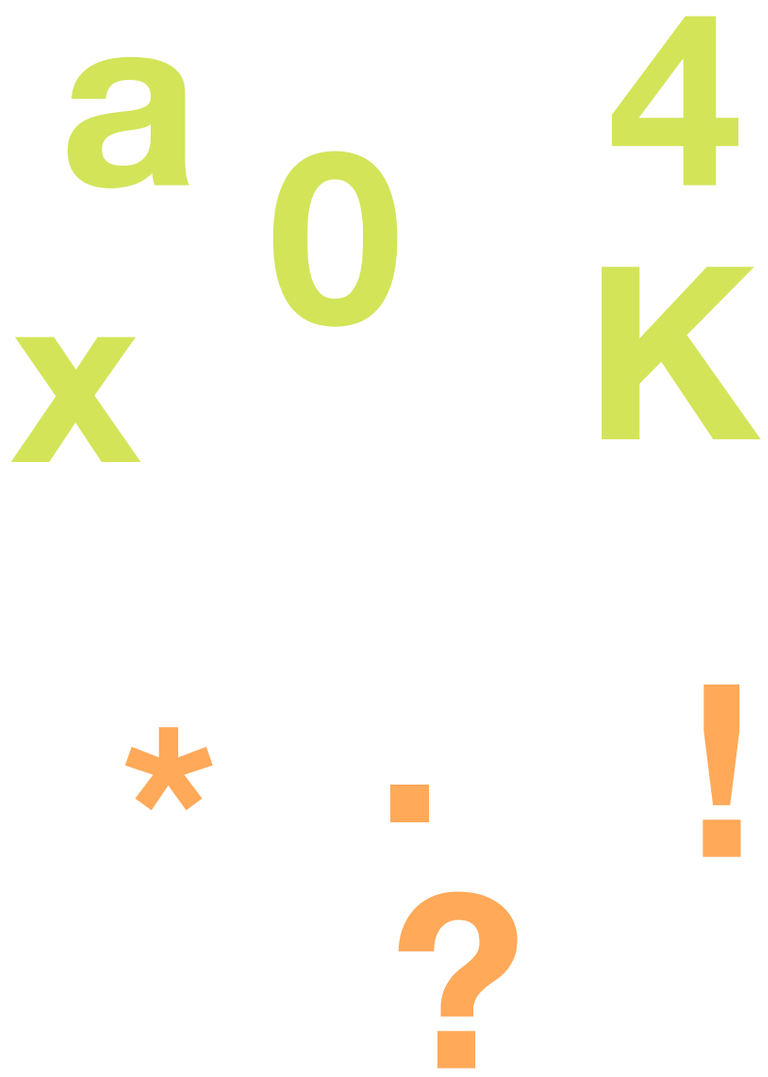
subject string

match

Syntax

characters

- Special set is a well-defined subset of ASCII
- Ordinary set consist of all characters not designated special
- Special characters are also called metacharacters



matching literals

123

- The most basic regex consists of a single ordinary character
- It matches the first occurrence of that character in the string
- Characters can be added together to form longer regexes

extended characters

- To match an extended character, use \xhh notation where hh are hexadecimal digits
- To match Unicode characters (in UTF-8 mode) mode use \x{hhh..} notation

metacharacters

To use one of these literally, escape it, that is prepend it with a backslash

\$

. [] ()

^ $

* + ?

{} |

metacharacters

To escape a sequence of characters, put them between \Q and \E

Price is \Q$12.36\E

will match

Price is $12.36

. [] ()

^ $

* + ?

{} |

metacharacters

So will the backslashed version

Price is \$12\.36

will match

Price is $12.36

. [] ()

^ $

* + ?

{} |

character classes

[ ]

- Consist of a set of characters placed inside square brackets
- Matches one and only one of the characters specified inside the class

character classes

[ ]

- matches an English vowel (lowercase)

```
[aeiou]
```

- matches surf or turf

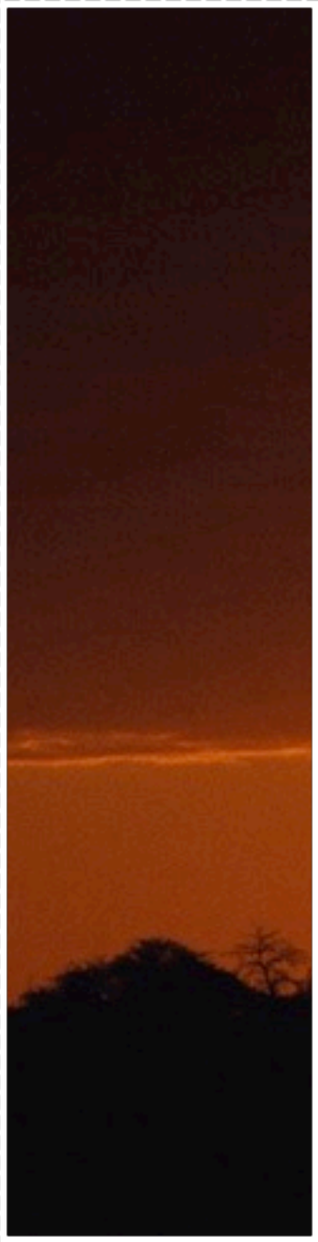
```
[st]urf
```

negated classes

[^]

- Placing a caret as the first character after the opening bracket negates the class
- Will match any character not in the class, *including newlines*
- **[^<>]** would match a character that is not left or right bracket

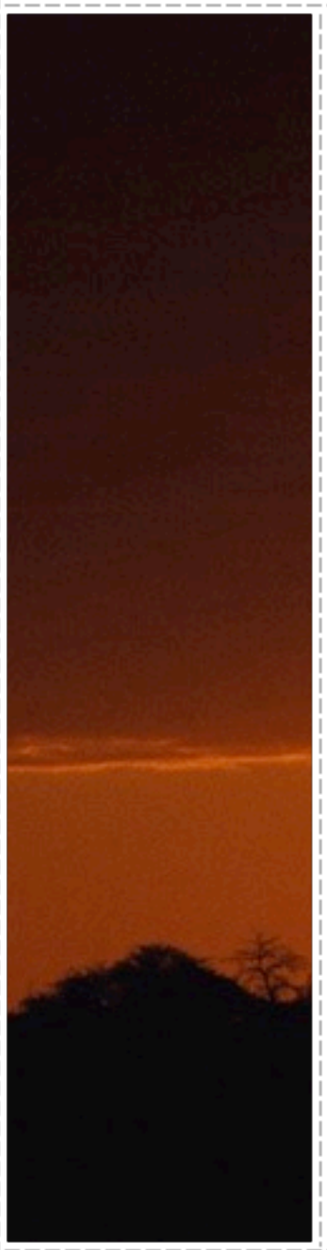
character ranges



- Placing a dash (-) between two characters creates a range from the first one to the second one
- Useful for abbreviating a list of characters

[a-z]

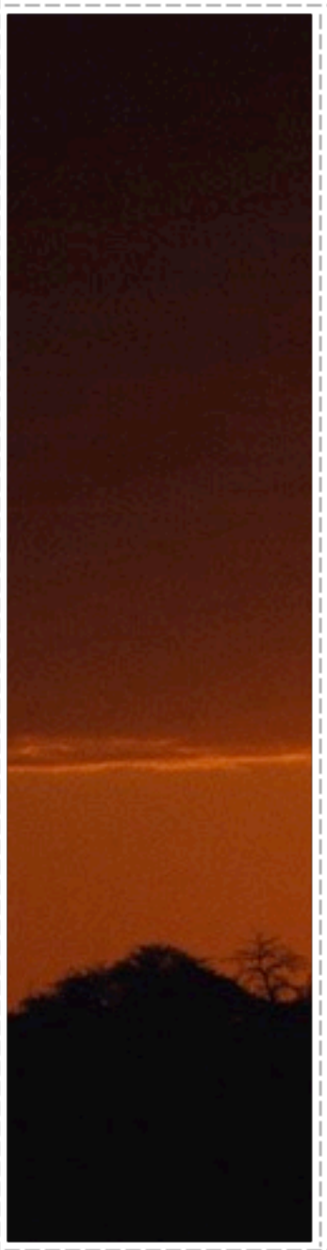
character ranges



- Ranges can be reversed

[z-a]

character ranges



- Ranges can be reversed
- A class can have more than one range and combine ranges with normal lists

```
[a-z0-9:]
```

\w	word character	[A-Za-z0-9_]
\d	decimal digit	[0-9]
\s	whitespace	[\n\r\t\f]
\W	not a word character	[^A-Za-z0-9_]
\D	not a decimal digit	[^0-9]
\S	not whitespace	[^ \n\r\t\f]

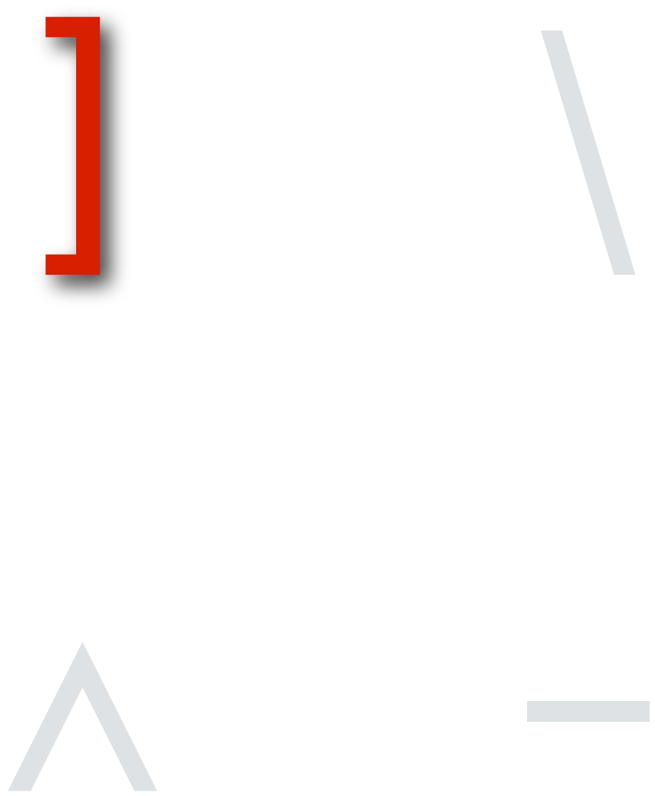
shortcuts for ranges

[-]

classes and metacharacters

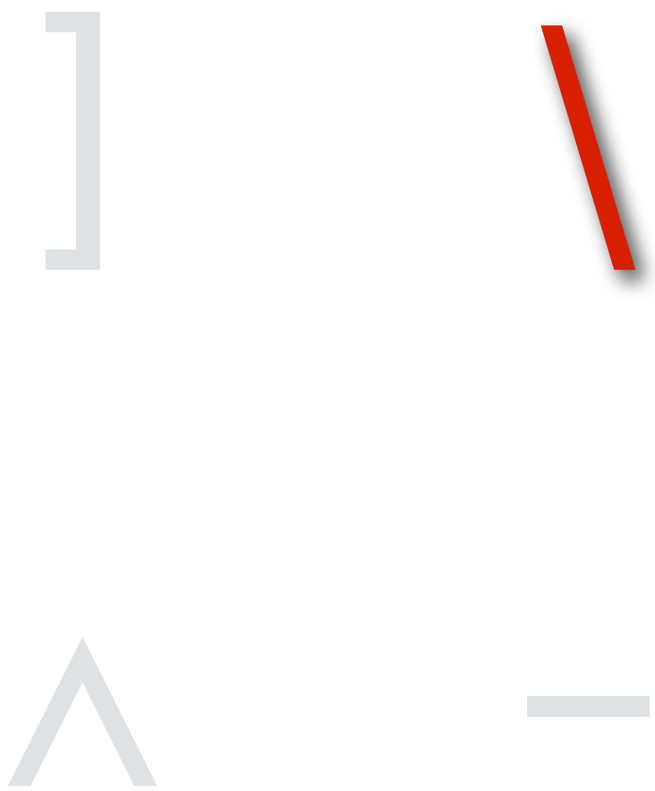
- Inside a character class, most metacharacters lose their meaning
- Exceptions are:

classes and metacharacters



- Inside a character class, most metacharacters lose their meaning
- Exceptions are:
  - closing bracket

classes and metacharacters

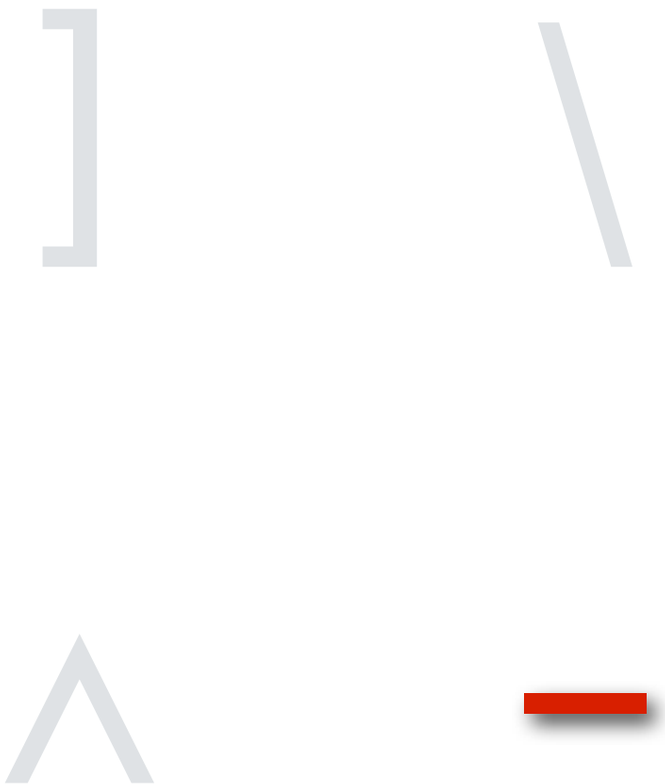


- Inside a character class, most metacharacters lose their meaning
- Exceptions are:
  - closing bracket
  - backslash

classes and metacharacters

- Inside a character class, most metacharacters lose their meaning
- Exceptions are:
  - closing bracket
  - backslash
  - caret

classes and metacharacters



- Inside a character class, most metacharacters lose their meaning
- Exceptions are:
  - closing bracket
  - backslash
  - caret
  - dash

classes and metacharacters

[ab\]]

[ab^]

[a-z-]

To use them literally, either escape them with a backslash or put them where they do not have special meaning

dot metacharacter .

- By default matches any single character

dot metacharacter .

- By default matches any single character
- Except a newline

dot metacharacter .

Is equivalent to

[^\n]

dot metacharacter .

- Use dot carefully - it might match something you did not intend
- **12.45** will match literal 12.45
- But it will also match these:

12345

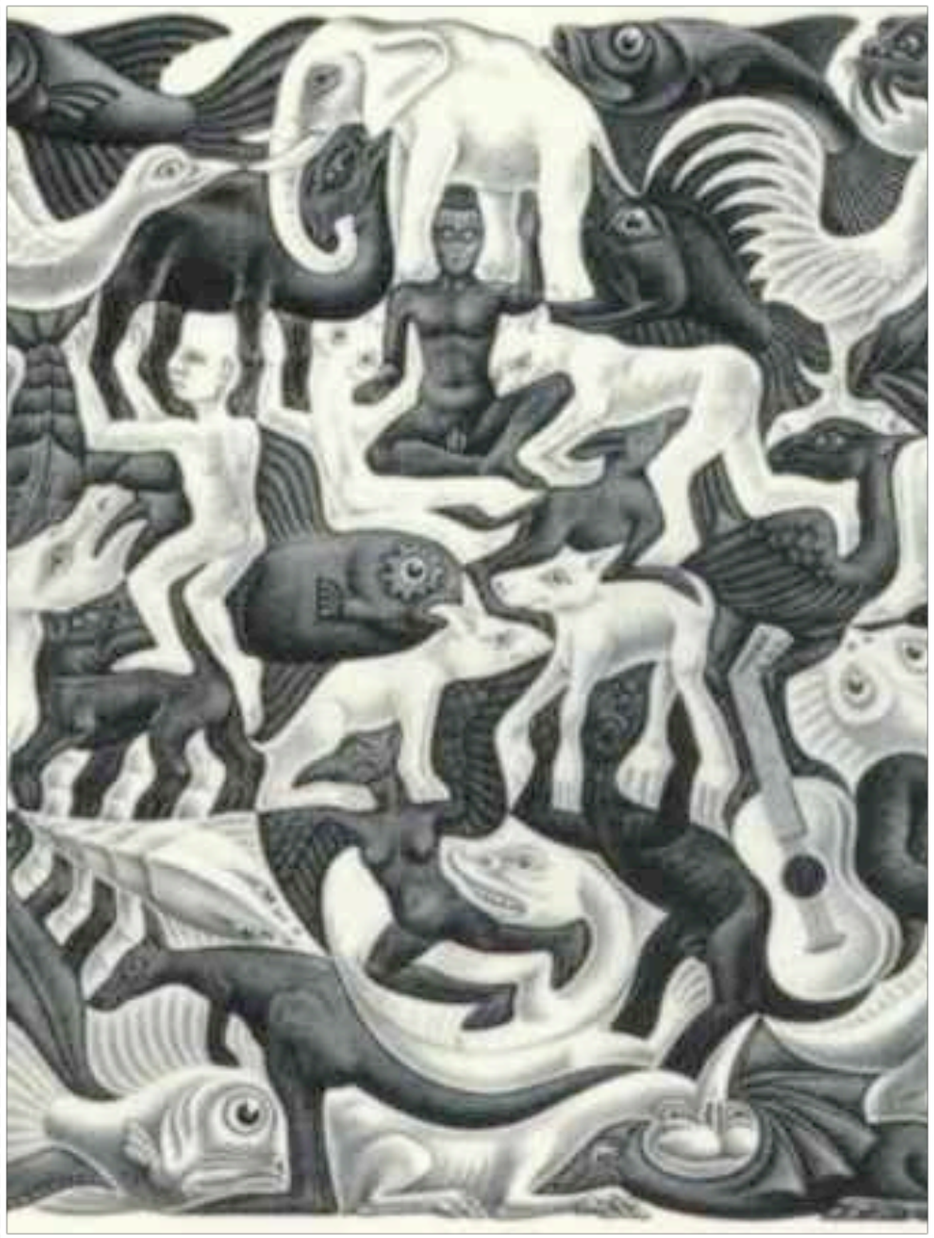
12945

12a45

12-45

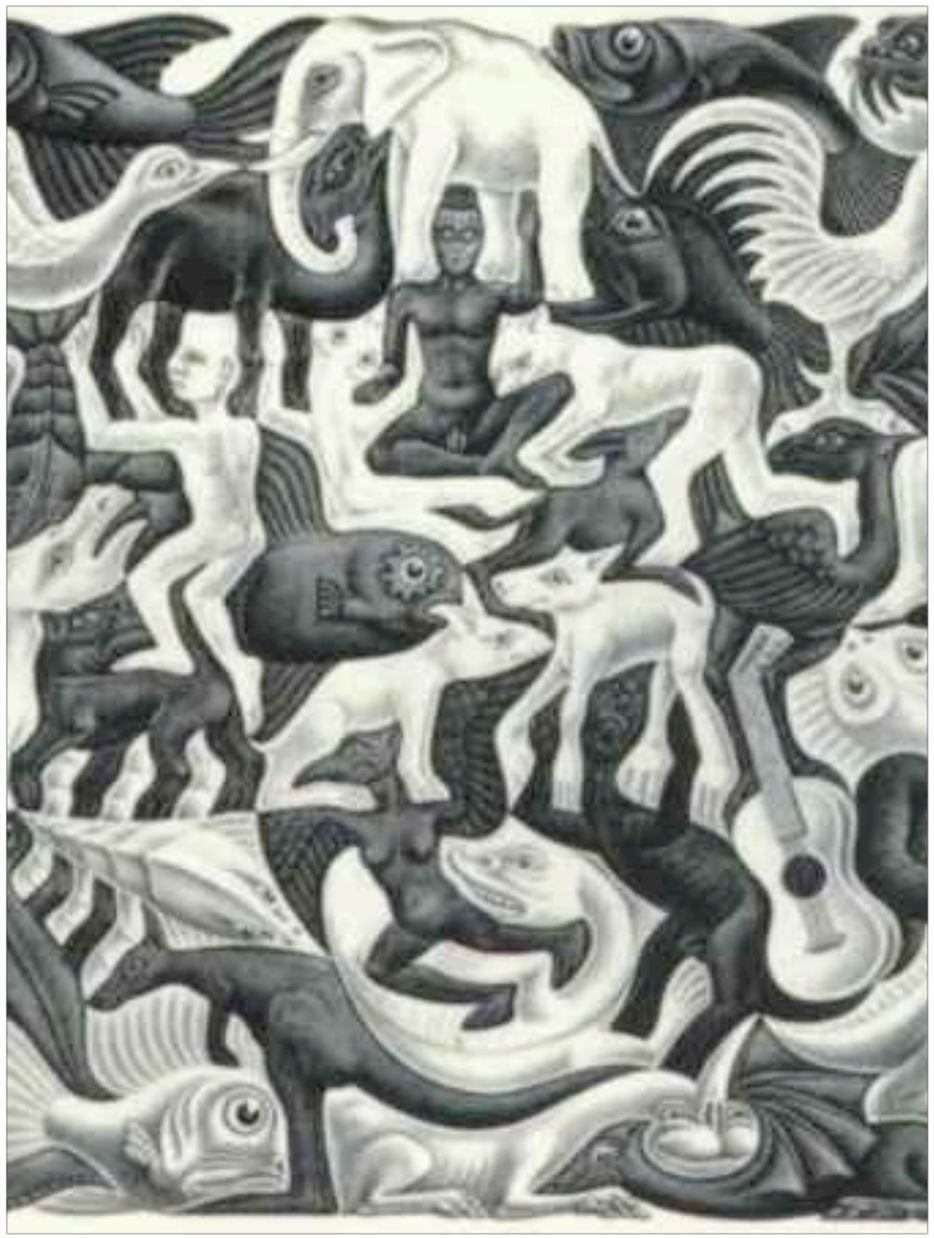
78812 45839

quantifiers



We are almost never sure about the contents of the text.

quantifiers



Quantifiers help us deal with this uncertainty

?

*

+

{ }

quantifiers

They specify how many times a regex component must repeat in order for the match to be successful

?

*

+

{ }

repeatable components

a

literal character

.

dot metacharacter

[ ]

character class

\w \d \s

\W \D \S

range shortcuts

subpattern

backreference

zero-or-one ?

- Indicates that the preceding component is optional
- Regex **welcome!?** will match either **welcome** or **welcome!**
- Regex **super\s?strong** means that **super** and **strong** may have an optional whitespace character between them
- Regex **hello[!?]?** Will match **hello**, **hello!**, or **hello?**

- Indicates that the preceding component has to appear once or more
- Regex **a+h** will match **ah**, **aah**, **aaah**, etc
- Regex **-\d+** will match negative integers, such as **-33**
- Regex **[^"]+** means to match a sequence (more than one) of characters until the next quote

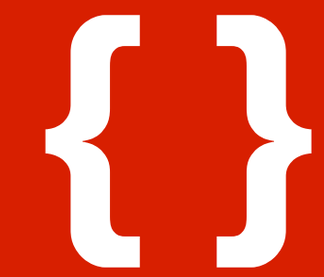
one-or-more

+

zero-or-more *

- Indicates that the preceding component can match zero or more times
- Regex **\d+\.\d*** will match **2.**, **3.1**, **0.001**
- Regex **<[a-z][a-z0-9]*>** will match an opening HTML tag with no attributes, such as **<b>** or **<h2>**, but not **<>** or **</i>**

general repetition



- Specifies the minimum and the maximum number of times a component has to match
- Regex **ha{1,3}** matches **ha**, **haa**, **haaa**
- Regex **\d{8}** matches exactly 8 digits
- If second number is omitted, no upper range is set
- Regex **go{2,}al** matches **gooal**, **goooal**, **gooooal**, etc

general repetition {}

{0,1} = ?

{1,} = +

{0,} = *

greediness

- matching as much as possible, up to a limit

greediness

PHP 5?

PHP 5 is better than Perl 6

\d{2,4}

10/26/2004

greediness

- Quantifiers try to grab as much as possible by default

- Applying <.+> to greediness matches the whole string rather than just

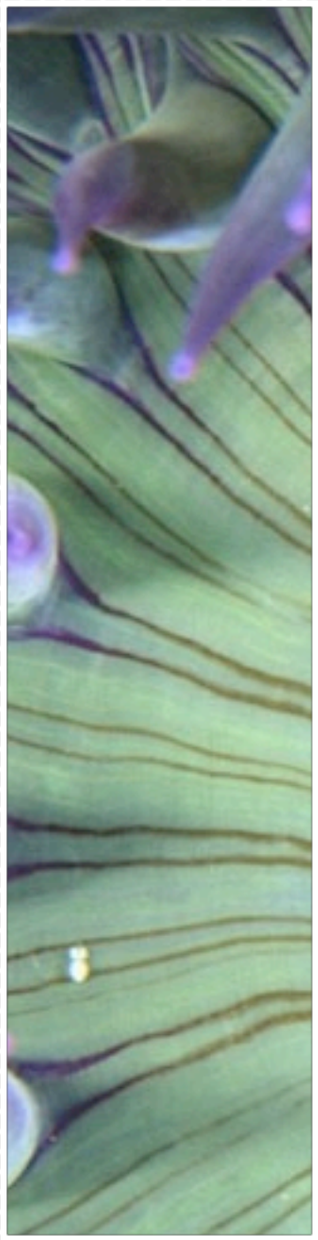
greediness

- If the entire match fails because they consumed too much, then they are forced to give up as much as needed to make the rest of regex succeed

greediness

- To find words ending in **ness**, you will probably use **\w+ness**
- On the first run **\w+** takes the whole word
- But since **ness** still has to match, it gives up the last 4 characters and the match succeeds

overcoming greediness



- The simplest solution is to make the repetition operators non-greedy, or **lazy**
- Lazy quantifiers grab as little as possible
- If the overall match fails, they grab a little more and the match is tried again

overcoming greediness

*?

+?

{ , }?

??

- To make a greedy quantifier lazy, append **?**
- Note that this use of the question mark is different from its use as a regular quantifier

overcoming greediness

*?

+?

{ , }?

??

Applying <.+?>

to greediness

gets us

overcoming greediness

- Another option is to use negated character classes
- More efficient and clearer than lazy repetition

overcoming greediness

- <.+?> can be turned into <[^>]+>
- Note that the second version will match tags spanning multiple lines
- Single-line version: <[^>\r\n]+>

assertions and anchors

- An assertion is a regex operator that
  - expresses a statement about the current matching point
  - consumes no characters

assertions and anchors

- The most common type of an assertion is an anchor
- Anchor matches a certain position in the subject string

caret

^F

- Caret, or circumflex, is an anchor that matches at the beginning of the subject string
- ^F basically means that the subject string has to start with an F

Fandango

dollar sign

$

- Dollar sign is an anchor that matches at the end of the subject string or right before the string-ending newline
- \d$ means that the subject string has to end with a digit
- The string may be top 10 or top 10\n, but either one will match

\d$

top 10

multiline matching

- Often subject strings consist of multiple lines
- If the multiline option is set:
  - Caret (^) also matches immediately after any newlines
  - Dollar sign ($) also matches immediately before any newlines

^t.+

one
two
three

absolute start/end

- Sometimes you really want to match the absolute start or end of the subject string when in the multiline mode
- These assertions are always valid:
  - \A matches only at the very beginning
  - \z matches only at the very end
  - \Z matches like $ used in single-line mode

\At.+

three
tasty
truffles

word boundaries

\b \B

\bto\b

right |to| vote

- A word boundary is a position in the string with a word character (\w) on one side and a non-word character (or string boundary) on the other
- \b matches when the current position is a word boundary
- \B matches when the current position is not a word boundary

word boundaries

\b \B

\B2\B

doc2html

- A word boundary is a position in the string with a word character (\w) on one side and a non-word character (or string boundary) on the other
- \b matches when the current position is a word boundary
- \B matches when the current position is not a word boundary

subpatterns

( )

- Parentheses can be used group a part of the regex together, creating a subpattern
- You can apply regex operators to a subpattern as a whole

grouping ( )

- Regex **is(land)?** matches both **is** and **island**
- Regex **(\d\d,)*\d\d** will match a comma-separated list of double-digit numbers

capturing subpatterns ( )

- All subpatterns by default are capturing
- A capturing subpattern stores the corresponding matched portion of the subject string in memory for later use

capturing subpatterns ( )

- Subpatterns are numbered by counting their opening parentheses from left to right
- Regex **(\d\d-(\w+)-\d{4})** has two subpatterns

(\d\d-(\w+)-\d{4})

12-May-2004

capturing subpatterns ( )

- Subpatterns are numbered by counting their opening parentheses from left to right
- Regex (\d\d-(\w+)-\d{4}) has two subpatterns
- When run against 12-May-2004 the second subpattern will capture May

(\d\d-(\w+)-\d{4})

12-May-2004

non-capturing subpatterns

- The capturing aspect of subpatterns is not always necessary
- It requires more memory and more processing time

non-capturing subpatterns

- Using **?:** after the opening parenthesis makes a subpattern be a purely grouping one
- Regex **box(?:ers)?** will match **boxers** but will not capture anything
- The **(?:)** subpatterns are not included in the subpattern numbering

named subpatterns

- It can be hard to keep track of subpattern numbers in a complicated regex
- Using **?P<name>** after the opening parenthesis creates a *named* subpattern
- Named subpatterns are still assigned numbers
- Pattern **(?P<number>\d+)** will match and capture **99** into subpattern named **number** when run against **99 bottles**

- Alternation operator allows testing several sub-expressions at a given point
- The branches are tried in order, from left to right, until one succeeds
- Empty alternatives are permitted
- Regex sailing|cruising will match either sailing or cruising

alternation |

- Since alternation has the lowest precedence, grouping is often necessary
- **sixth|seventh sense** will match the word **sixth** or the phrase **seventh sense**
- **(sixth|seventh) sense** will match **sixth sense** or **seventh sense**

alternation |

- Remember that the regex engine is eager
- It will return a match as soon as it finds one
- camel|came|camera will only match came when run against camera
- Put more likely pattern as the first alternative

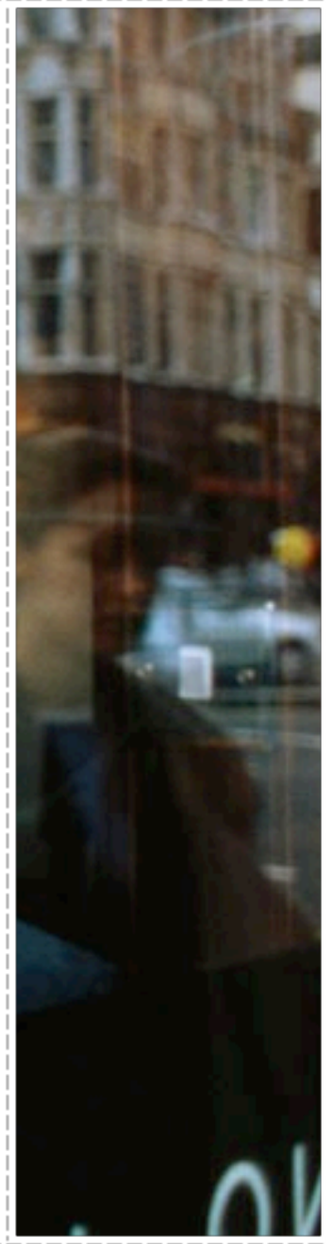
alternation |

- Applying **?** to assertions is not permitted but..
- The branches may contain assertions, such as anchors for example
- **(^|my|your) friend** will match **friend** at the beginning of the string and after **my** or **your**

alternation |

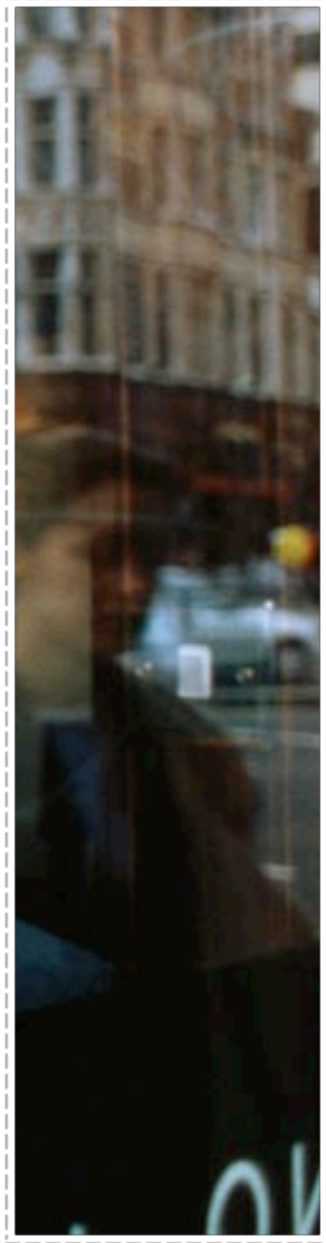
backtracking

- Also known as “if at first you don’t succeed, try, try again”
- When faced with several options it could try to achieve a match, the engine picks one and remembers the others



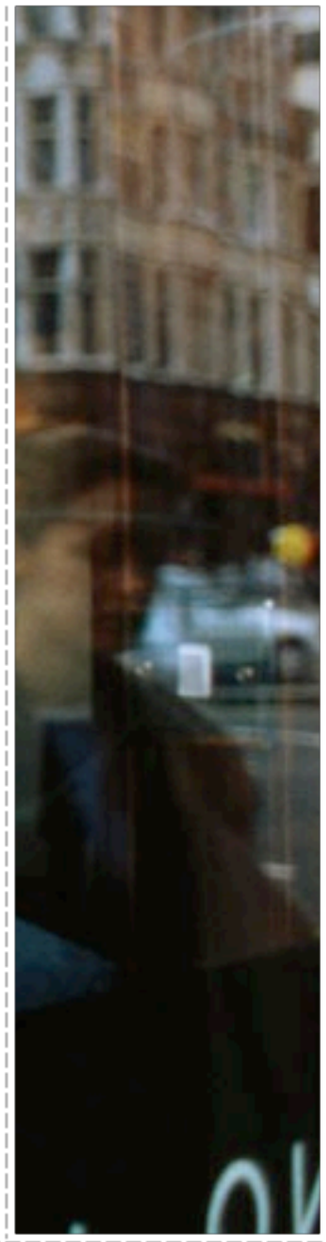
backtracking

- If the picked option does not lead to an overall successful match, the engine backtracks to the decision point and tries another option



backtracking

- This continues until an overall match succeeds or all the options are exhausted
- The decision points include quantifiers and alternation



backtracking

Two important rules to remember

- With greedy quantifiers the engine always attempts the match, and with lazy ones it delays the match
- If there were several decision points, the engine always goes back to the most recent one

backtracking example

\d+00

12300

start

backtracking example

\d+00

12300

add 1

backtracking example

\d+00

12300

add 2

backtracking example

\d+00

12300

add 3

backtracking example

\d+00

12300

add 0

backtracking example

\d+00

12300

add 0

backtracking example

\d+00

12300

string exhausted
still need to match 00

backtracking example

\d+00

12300

give up 0

backtracking example

\d+00

12300

give up 0

backtracking example

\d+00

12300

add 00

backtracking example

\d+00

12300

success

backtracking example

\d+ff

123dd

start

backtracking example

\d+ff

123dd

add 1

backtracking example

\d+ff

123dd

add 2

backtracking example

\d+ff

123dd

add 3

backtracking example

\d+ff

123dd

cannot match f here

backtracking example

\d+ff

123dd

give up 3

still cannot match f

backtracking example

\d+ff

123dd

give up 2

still cannot match f

backtracking example

\d+ff

123dd

cannot give up more
because of +

backtracking example

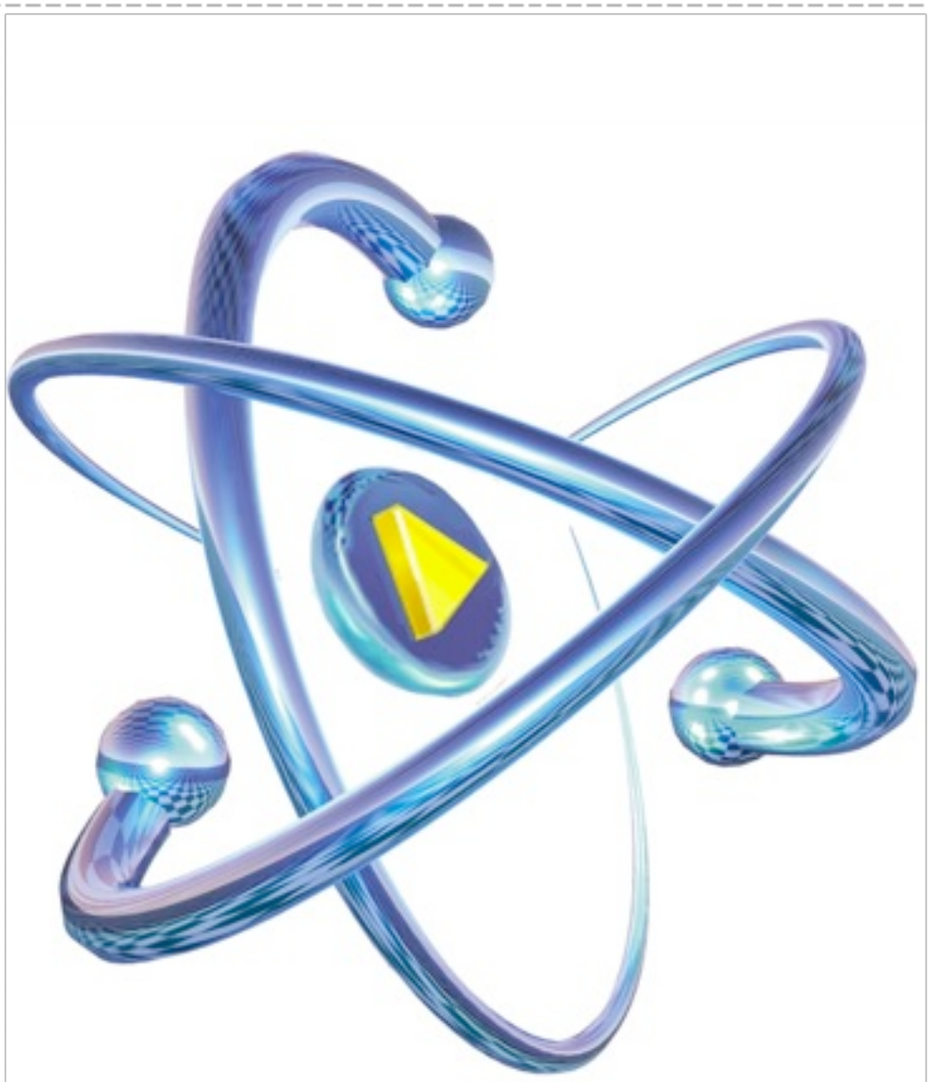
\d+ff

123dd

failure

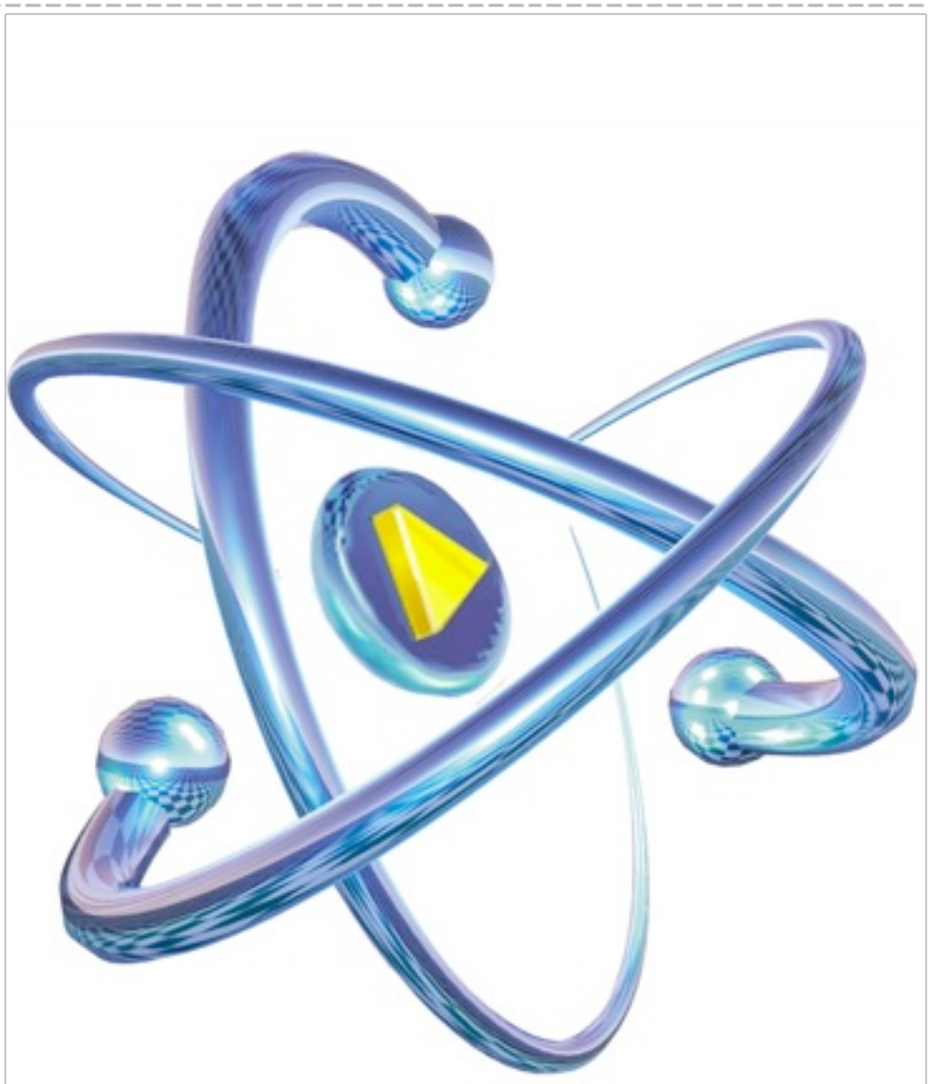
atomic grouping

- Disabling backtracking can be useful
- The main goal is to speed up failed matches, especially with nested quantifiers



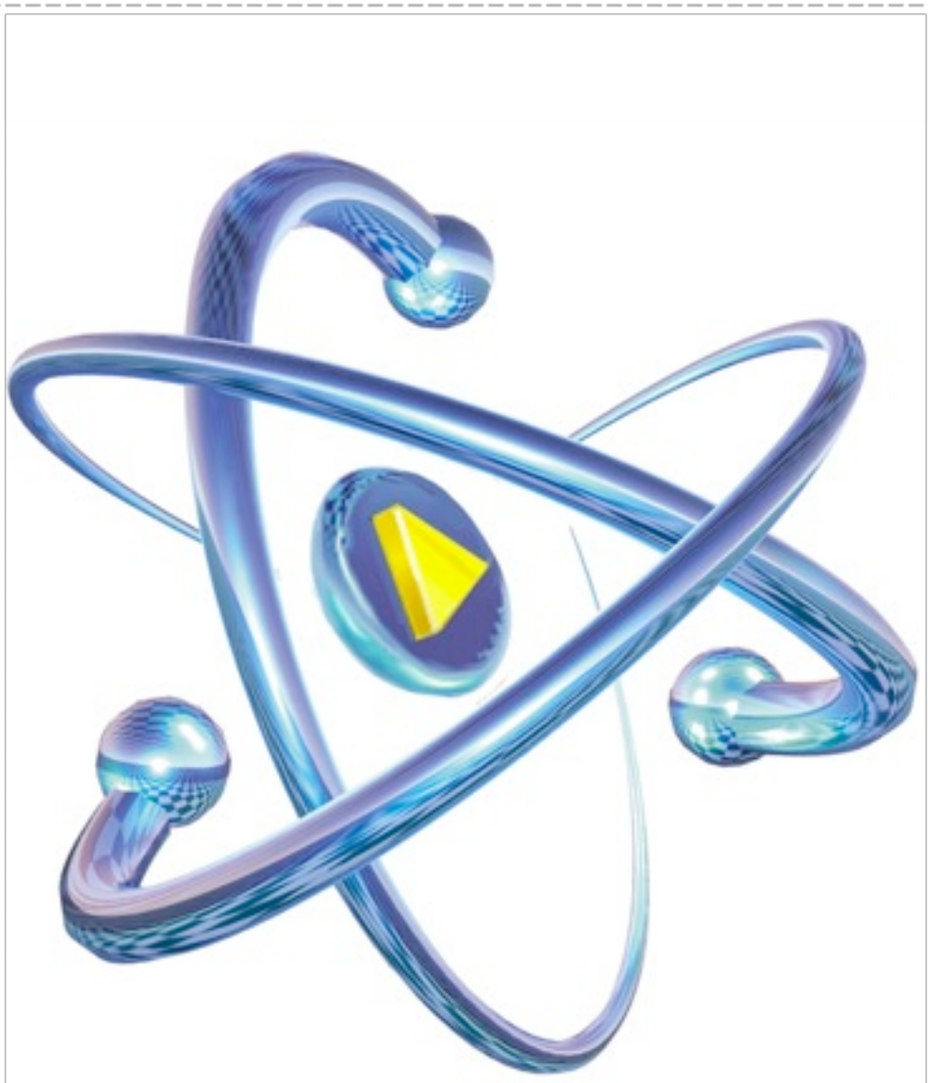
atomic grouping

- **(?>*regex*)** will treat **regex** as a single atomic token, no backtracking will occur inside it
- All the saved states are forgotten



atomic grouping

- **(?>\d+)ff** will lock up all available digits and fail right away if the next two characters are not **ff**
- Atomic groups are not capturing



possessive quantifiers

- Atomic groups can be arbitrarily complex and nested
- Possessive quantifiers are simpler and apply to a single repeated item

possessive quantifiers

- To make a quantifier possessive append a single **+**
- **\d++ff** is equivalent to **(?>\d+)ff**

possessive quantifiers

- Other ones are *+, ?+, and {m,n}+
- Possessive quantifiers are always greedy

do not over-optimize

- Keep in mind that atomic grouping and possessive quantifiers can change the outcome of the match
- When run against string abcdef
  - \w+d will match abcd
  - \w++d will not match at all
  - \w+ will match the whole string

backreferences \n

- A backreference is an alias to a capturing subpattern
- It matches whatever the referent capturing subpattern has matched

backreferences

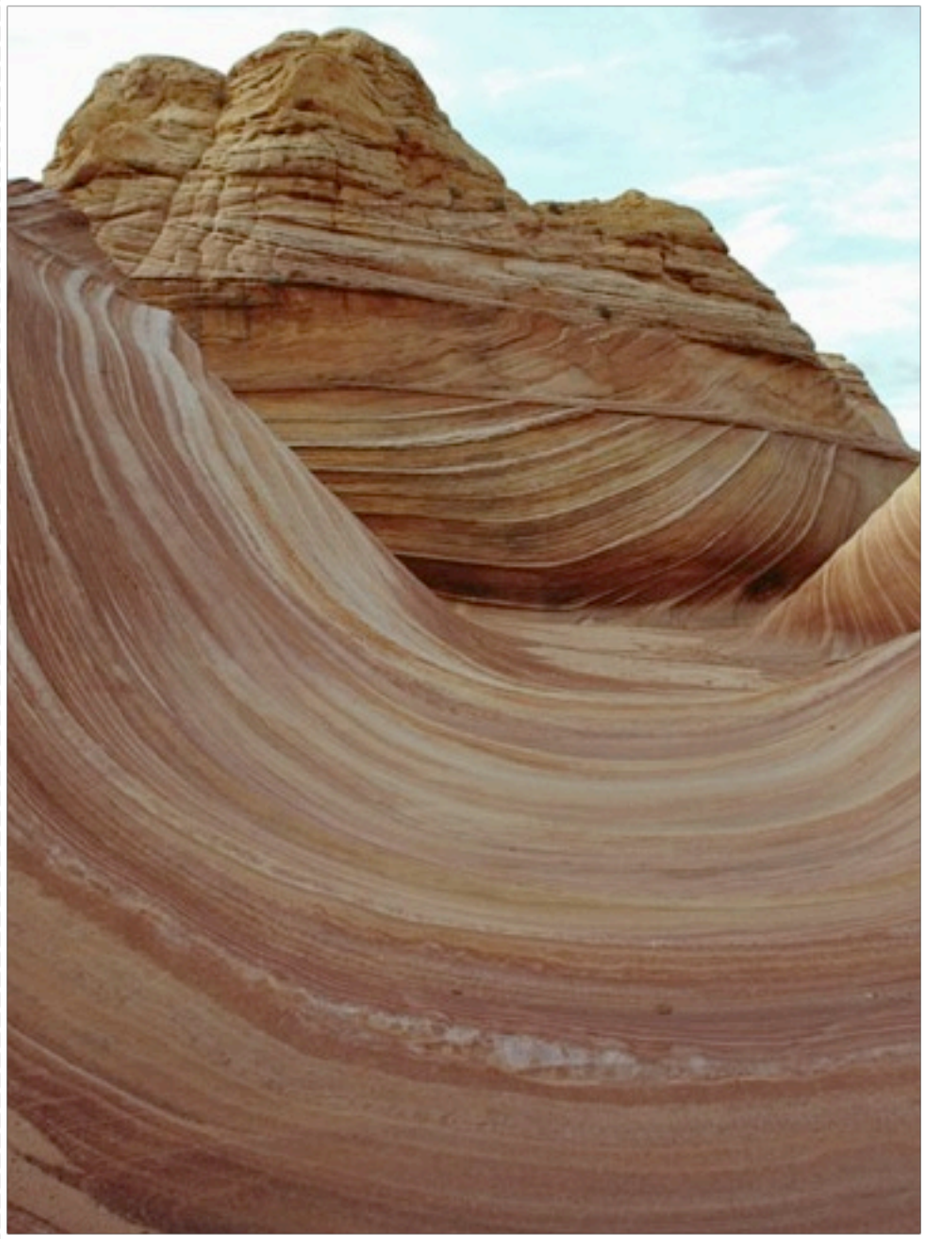
\n

- **(re|le)\w+\1** matches words that start with **re** or **le** and end with the same thing
- For example, retire and legible, but not revocable or lecture
- Reference to a named subpattern can be made with **(?P=name)**

lookaround

- Assertions that test whether the characters before or after the current point match the given regex
- Consume no characters
- Do not capture anything
- Includes lookahead and lookbehind

positive lookahead (?=)



- Tests whether the characters after the current point match the given regex
- (\w+)(?=:)(.*) matches surfing: a sport but colon ends up in the second subpattern

negative lookahead (?!)

- Tests whether the characters after the current point do not match the given regex
- **fish(?!ing)** matches **fish** not followed by ing
- Will match **fisherman** and **fished**

negative lookahead (?!)

- Difficult to do with character classes
- **fish[^i][^n][^g]** might work but will consume more than needed and fail on subjects shorter than 7 letters
- Character classes are no help at all with something like **fish(?!hook|ing)**

positive lookbehind (?<=)

- Tests whether the characters immediately preceding the current point match the given regex
- The regex must be of fixed size, but branches are allowed
  - **(?<=foo)bar** matches **bar** only if preceded by **foo**, e.g. **my foobar**

negative lookbehind (?<!)

- Tests whether the characters immediately preceding the current point do not match the given regex
- Once again, regex must be of fixed size
- (?<!foo)bar matches bar only if not preceded by foo, e.g. in the bar but not my foobar

conditionals

- Conditionals let you apply a regex selectively or to choose between two regexes depending on a previous match

  (?(condition)yes-regex)

  (?(condition)yes-regex|no-regex)

- There are 3 kinds of conditions
  - Subpattern match
  - Lookaround assertion
  - Recursive call (not discussed here)

subpattern conditions (?(n))

- This condition is satisfied if the capturing subpattern number **n** has previously matched
- **(“)? \b\w+\b (?(1)”)** matches words optionally enclosed by quotes
- There is a difference between **(“)?** and **(“?)** in this case: the second one will always capture

assertion conditions

- This type of condition relies on lookaround assertions to choose one path or the other

href=(? (?=[“”]) ([“’])\S+\1 | \S+)

- Matches **href=**, then
- If the next character is single or double quote match a sequence of non-whitespace inside the matching quotes
- Otherwise just match it without quotes

inline options

The matching can be modified by options you put in the regular expression

(?i)	enables case-insensitive mode
(?m)	enables multiline matching for ^ and $
(?s)	makes dot metacharacter match newline also
(?x)	ignores literal whitespace
(?U)	makes quantifiers ungreedy (lazy) by default

inline options

(?i)

(?m)

(?s)

(?x)

(?U)

- Options can be combined and unset

  (?im-sx)

- At top level, apply to the whole pattern
- Localized inside subpatterns

  (a(?i)b)c

comments ?#

Here’s a regex I wrote when working on Smarty templating engine

```
^\$\w+(?>(\[(\d+|\$\w+|\w+(\.\w+)?)\])|((\.|->)\$?\w+))*(?>\|@?\w+(:(?>"[^"\\\\]*(?:\\\\.[^"\\\\]*)*"|\'[^\'\\\\]*(?\\\\.[^\'\\\\]*) *\'|[^|]+))*)*$
```

comments ?#

Let me blow that up for you

```
^\$\w+(?>(\[(\d+|\$\w+|\w+(\.\w+)?)\])|
((\.|->)\$?\w+))*(?>\|@?\w+(:(?>"[^"\\\\]*
    (?:\\\\.[^"\\\\]*)*"|\'[^\'\\\\]*
    (?\\\\.[^\'\\\\]*)*\'|[^|]+))*)*$
```

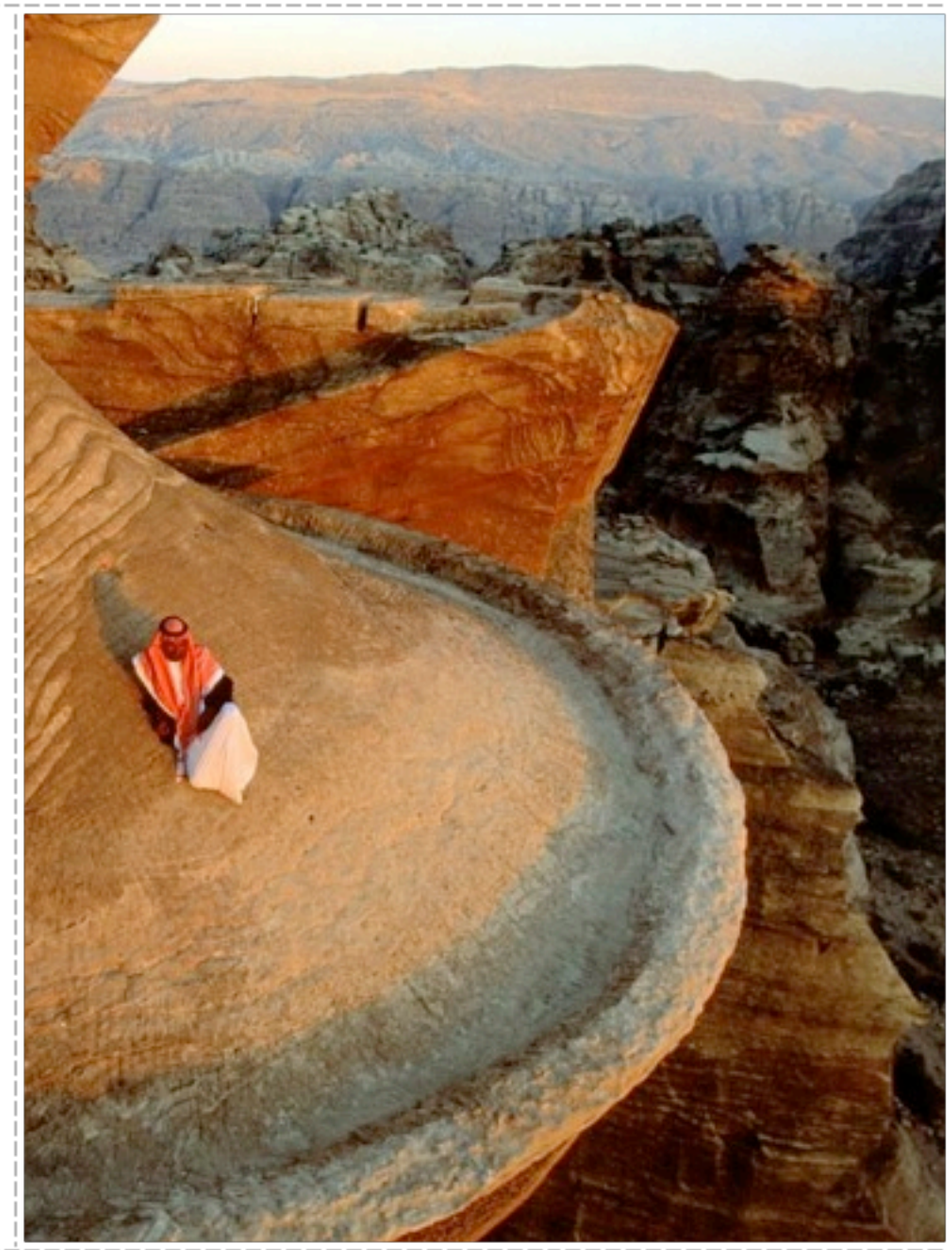
Would you like some comments with that?

comments

?#

- Most regexes could definitely use some comments
- **(?#...)** specifies a comment

```
\d+(?# match some digits)
```

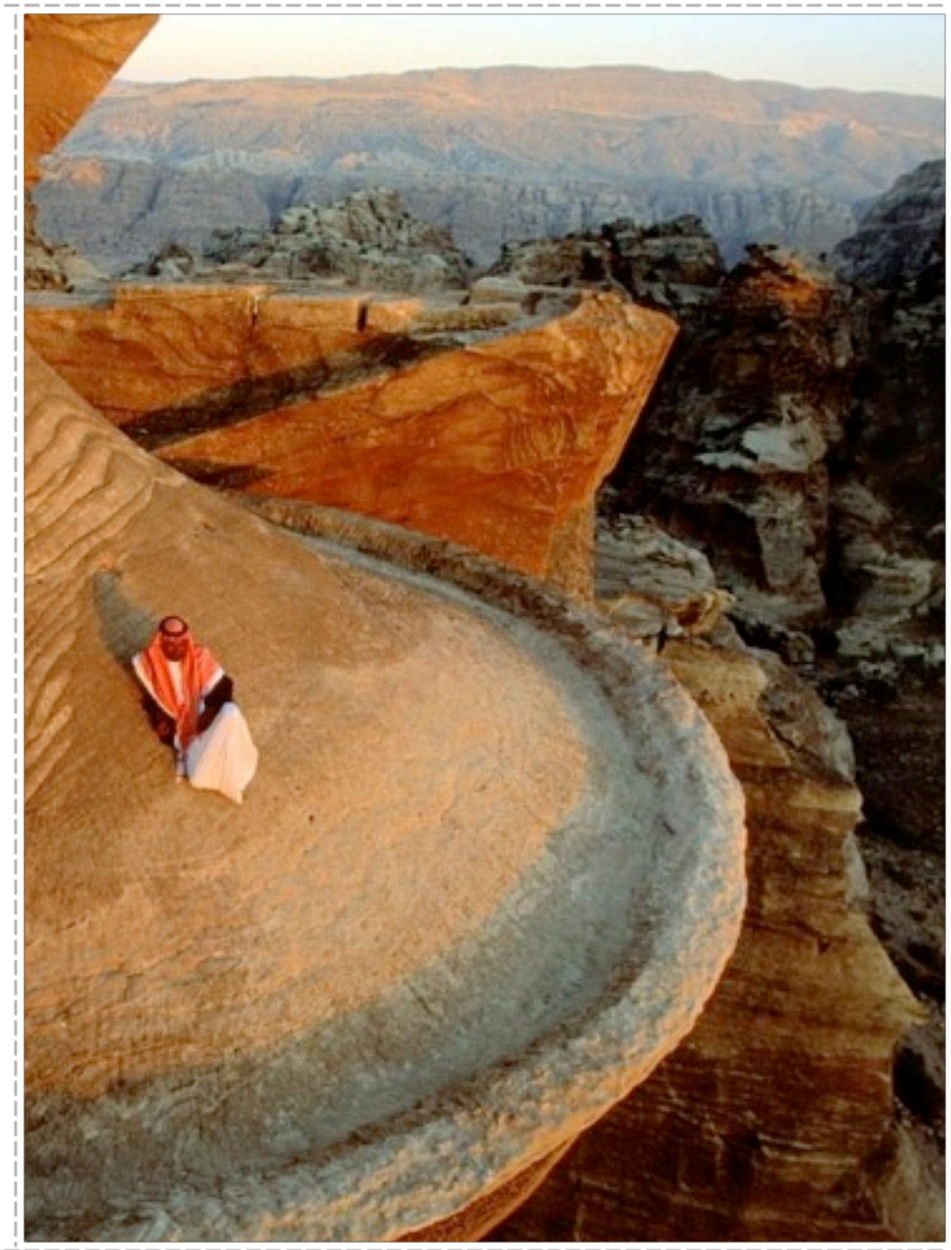


comments

?#

- If (?x) option is set, anything after # outside a character class and up to the next newline is considered a comment
- To match literal whitespace, escape it

```
(?x) \w+  # start with word characters
     [?!]    # and end with ? or !
```



Regex API

Regex API

- Perl-compatible regex API (PCRE) was introduced in PHP 3.0.9
- Starting with PHP 4.2.0 the API is enabled by default
- Uses consistent pattern syntax
- All functions start with `preg_` prefix

pattern syntax

‘/[abc]+/’

“/[abc]+/”

‘([abc]+)’

- The regex must be enclosed in delimiters and passed as a single- or double-quoted string
- Could also use matching parentheses as delimiters

pattern syntax

z[abc]+z

NO!

- The regex must be enclosed in delimiters and passed as a single- or double-quoted string
- Delimiter character cannot be alphanumeric or backslash

pattern syntax

```
/<\/i>/
```

- The regex must be enclosed in delimiters and passed as a single- or double-quoted string
- Delimiter character cannot be alphanumeric or backslash
- If the delimiter character has to be used in the regex, escape it with a backslash

pattern syntax

/<a.+?>/is

- The regex must be enclosed in delimiters and passed as a single- or double-quoted string
- Delimiter character cannot be alphanumeric or backslash
- If the delimiter character has to be used in the regex, escape it with a backslash
- The ending delimiter may optionally be followed by pattern modifiers

pattern modifiers

The first five should be already familiar

/i	enables case-insensitive mode
/m	enables multiline matching for ^ and $
/s	makes dot metacharacter match newline also
/x	ignores literal whitespace and allows # comments
/U	makes quantifiers ungreedy (lazy) by default

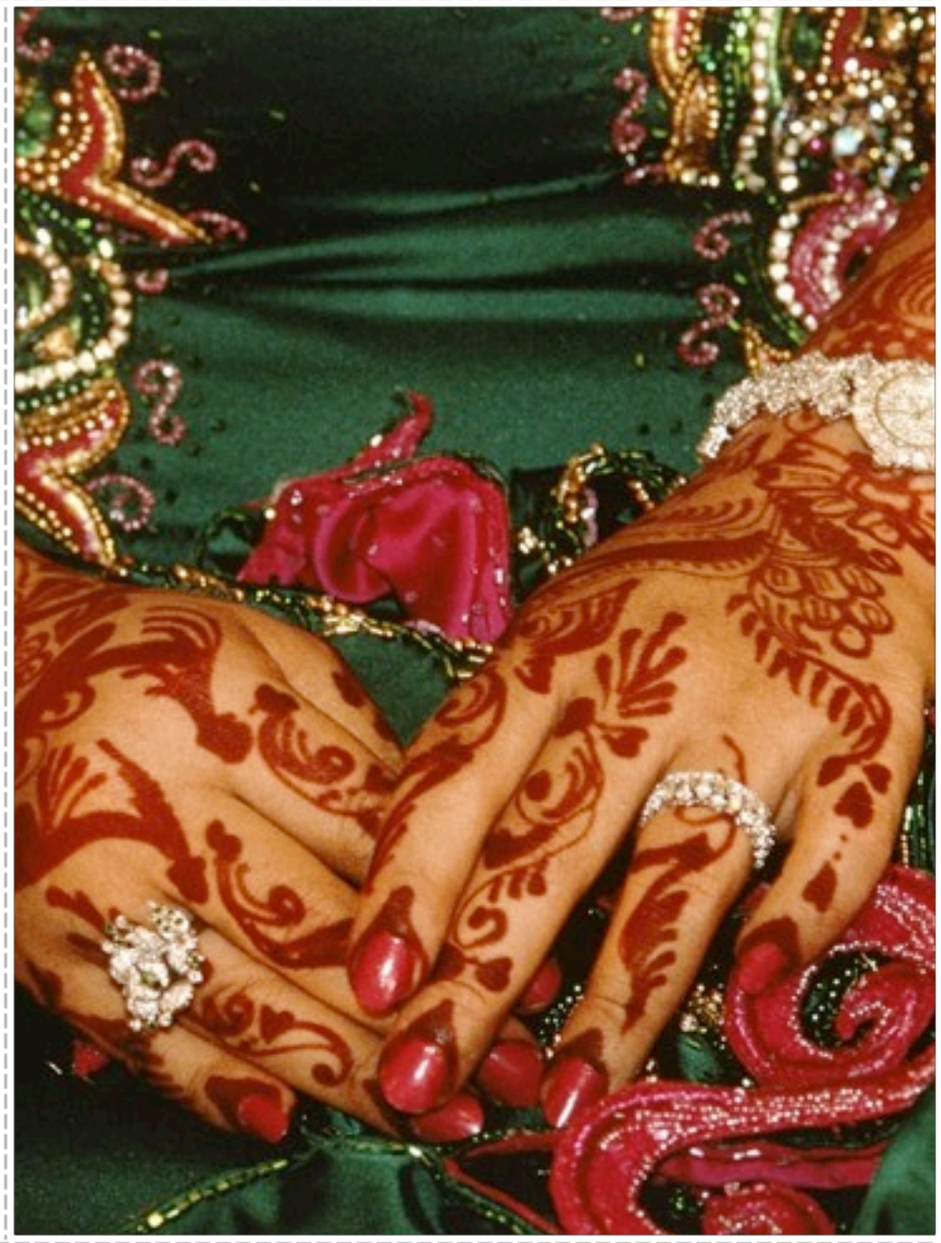
pattern modifiers

But there are some more

/A	anchors the pattern at the beginning of string (similar to \A assertion)
/S	performs additional analysis on the pattern
/u	enables UTF-8 mode
/e	explained in `preg_replace()` section

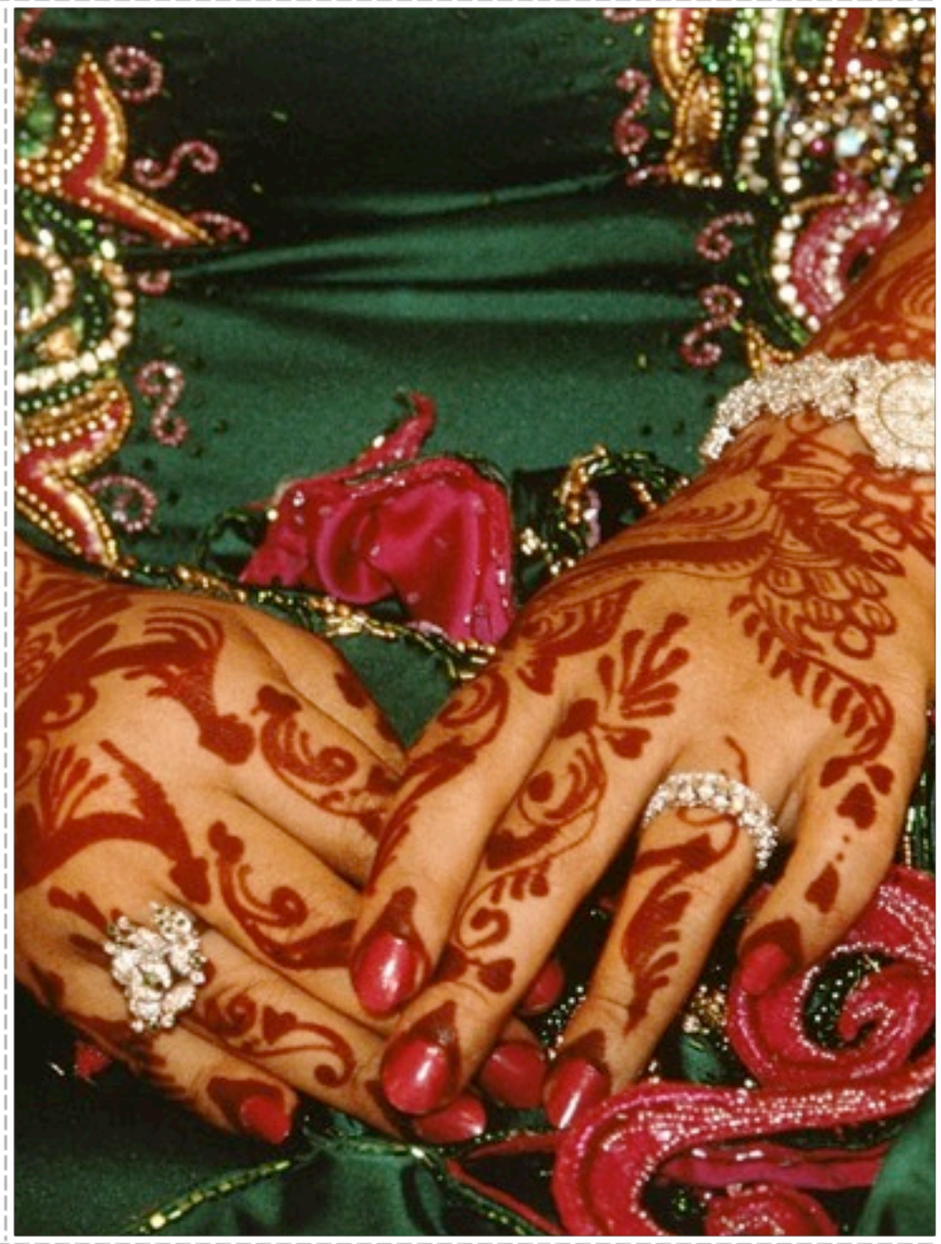
pattern examples

- Valid:
  - /\d{4}-\d\d(-\d\d)?/
  - /<(h\d)>.*?<\/\1>/iU
  - !^From: .* rasmus@!xm



pattern examples

- Invalid:
  - **!/.+$** - missing end delimiter
  - **/ab(c|d)/J** – unknown modifier J
  - **/\s?*/** - compilation failure, misapplied quantifier *



PHP metacharacter issues

- PHP can interpret regex metacharacters as its own
- To avoid confusion:
  - Backslash the common metacharacters
  - Use single quotes to make life easier

PHP metacharacter issues

- Even with single quotes, the “leaning toothpick” syndrome may occur
- To match a single backslash, one has to use ‘/\\\\/’

‘/\\\\/’

PHP metacharacter issues

- Even with single quotes, the “leaning toothpick” syndrome may occur
- To match a single backslash, one has to use ‘/\\\\/’
  - First, PHP interprets it as ‘/\\/’

‘/\\/’

PHP metacharacter issues

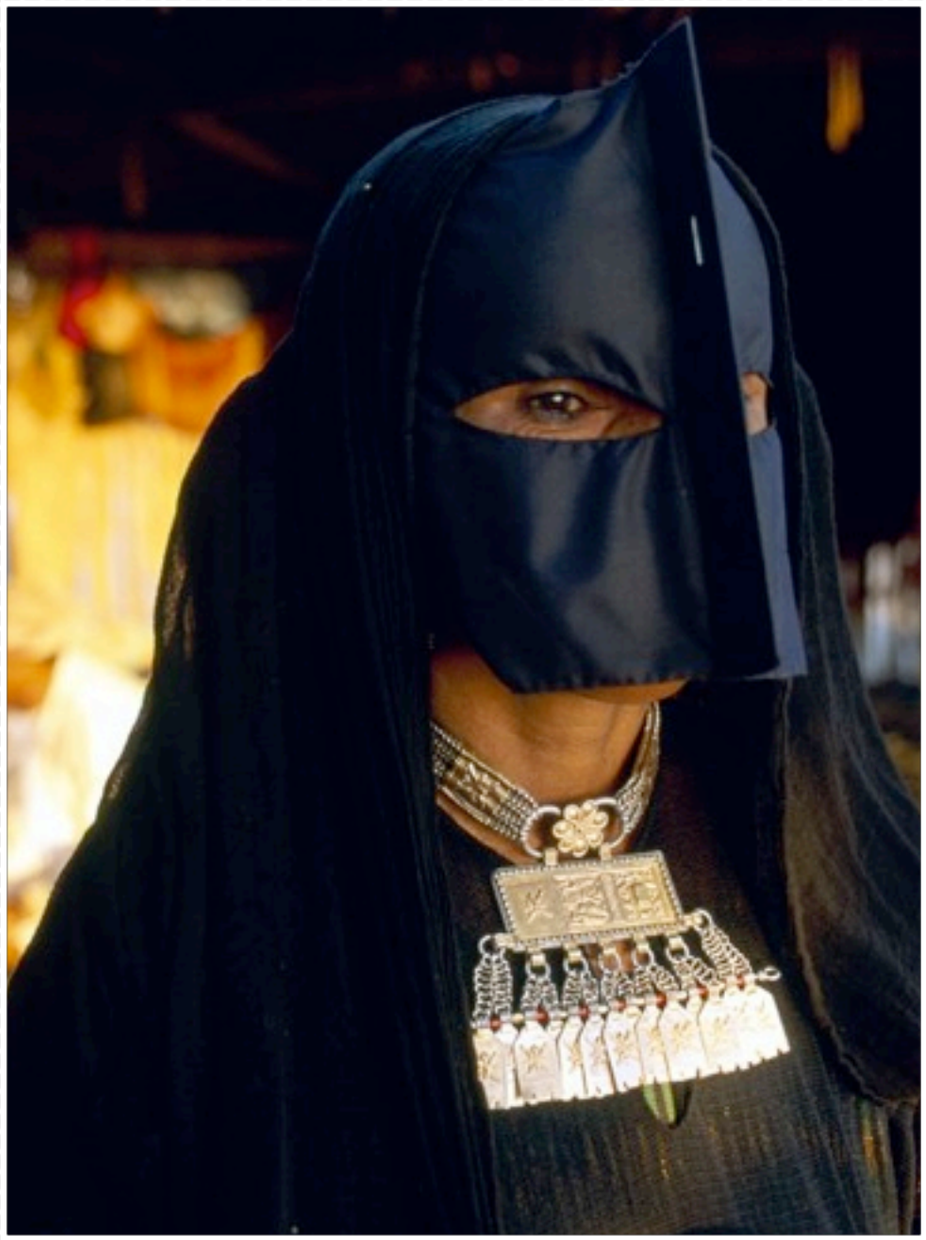
- Even with single quotes, the “leaning toothpick” syndrome may occur
- To match a single backslash, one has to use ‘/\\\\/’
  - First, PHP interprets it as ‘/\\/’
  - Then, regex engine sees it as an escaped backslash metacharacter

\ \

locales

- Caseless matching and character class determination are affected by the current locale
- The locale can be changed via PHP's `setlocale()` function
- For example, `set_locale('fr_FR')` will set the French locale which will be used by the engine for `\w` for example

to save time...



Since all PCRE functions are described in the manual in exquisite detail, we'll just have a brief look at them...

preg_match(string regex, string subject, *array matches, int flags, int offset*)

- Tries to find the first occurrence of a pattern described by **regex** in the **string**
- Returns 0 or 1 (FALSE on error)
- If **matches** is provided, it is filled with the match results
- Stops after the first successful match
- Best used for validation

preg_match(string regex, string subject, *array matches, int flags, int offset*)

```
preg_match('!\w+!', 'a(bc)d'); = 1
preg_match('!\w+!', '**--**'); = 0

preg_match('!\b\d+(\.\d+)?\b!',
           'price: $3.14 for 2', $match); = 1
  $match[0] = '3.14'
  $match[1] = '.14'

preg_match('!\b\d+(?P<cents>\.\d+)?\b!',
           'price: $3.14 for 2', $match); = 1
  $match[0] = '3.14'
  $match[1] = '.14'
  $match['cents'] = '.14'
```

preg_match_all(string regex, string subject, array matches, *int flags, int offset*)

- Tries to find all patterns described by **regex** in the **string**
- Matching continues from the end of the last match
- Return number of successful matches or FALSE on error

```
preg_match_all('!\b\d+(\.\d+)?\b!',
                '12.2 times 2 is 24.4', $match); = 3
  $matches[0] = array('12.2', '2', '24.4')
  $matches[1] = array(  '.2', '',    '.4')
```

preg_replace(mixed regex, mixed replacement, mixed subject, *int limit*)

- Applies **regex** to **subject** and replaces matches with **replacement**
- **limit** specifies how many matches to replace, -1 means no limit (the default)
- Returns modified subject if matches are found
- **regex**, **subject**, and **replacement** can be one-dimensional arrays
- Allows for multiple searches and replacements on multiple strings at once

preg_replace(mixed regex, mixed replacement, mixed subject, *int limit*)

- **replacement** may contain references of the form \\n or $n (the preferred syntax)
- Such reference will be replaced by the text matched by the n'th capturing subpattern

```
preg_replace('!by (\w+) (\w+)!', '- $2, $1',
        'Xdebug by Derick Rethans');
        = 'Xdebug - Rethans, Derick'
```

preg_replace(mixed regex, mixed replacement, mixed subject, *int limit*)

- **/e** modifier on regex treats replacement as PHP code
- The references are resolved, the code is evaluated, and the result is used as the replacement
- If the resulting PHP code is invalid, a parse error will be issued

```
preg_replace('!\d+!e', '($0+1)', '2 is less than 3');
                    = '3 is less than 4'
```

preg_replace_callback(mixed regex, mixed callback, mixed subject, *int limit*)

- Identical to `preg_replace()` except that the replacement is specified by a callback function
- For each match the **callback** is invoked with the match info and is supposed to return the replacement string

preg_split(string regex, string subject, *int limit, int flags*)

- Splits **subject** along boundaries matched by **regex**
- Returns an array of split pieces
- **limit** determines the maximum number of pieces, -1 means no limit (the default)
- The type of splitting can be controlled by **flags**

```
preg_split('/[?¿,.\s]+/', '¿Donde esta... nearest bar?');
 = array('', 'Donde', 'esta', 'nearest', 'bar', '')

preg_split('/[?¿,.\s]+/', '¿Donde esta... nearest bar?',
           3, PREG_SPLIT_NO_EMPTY);
 = array('Donde', 'esta', 'nearest bar?')
```

preg_grep(string regex, array input, *int flags*)

- Applies **regex** to each element of **input** array
- Return a new array consisting only of elements that matched
- If **flags** if PREG_GREP_INVERT, only the elements that did not match will be returned

Regex Toolkit

regex toolkit

- In your day-to-day development, you will frequently find yourself running into situations calling for regular expressions
- It is useful to have a toolkit from which you can quickly draw the solution
- It is also important to know how to avoid problems in the regexes themselves

matching vs. validation

- In matching (extraction) the regex must account for boundary conditions
- In validation your boundary conditions are known – the whole string

matching vs. validation

- Matching an English word starting with a capital letter

```
\b[A-Z][a-zA-Z'-]*\b
```

- Validating that a string fulfills the same condition

```
^[A-Z][a-zA-Z'-]*$
```

- Do not forget ^ and $ anchors for validation!

using dot properly

- One of the most used operators
- One of the most misused
- Remember - dot is a shortcut for [^\n]
- May match more than you really want
- <.> will match <b> but also <!>, < >, etc
- Be explicit about what you want
- <[a-z]> is better

using dot properly

- When dot is combined with quantifiers it becomes greedy
- **<.+>** will consume any characters between the first bracket in the line and the last one
- Including any other brackets!

using dot properly

- It's better to use negated character class instead

  <[^>]+> if bracketed expression spans lines

  <[^>\r\n]+> otherwise

- Lazy quantifiers can be used, but they are not as efficient, due to backtracking

optimizing unlimited repeats

- One of the most common problems is combining an inner repetition with an outer one
- If the initial match fails, the number of ways to split the string between the quantifiers grows exponentially
- The problem gets worse when the inner regex contains a dot, because it can match anything!

(regex1|regex2|..)*

(regex*)+

(regex+)*

(.*?bar)*

optimizing unlimited repeats

- PCRE has an optimization that helps in certain cases, and also has a hardcoded limit for the backtracking
- The best way to solve this is to prevent unnecessary backtracking in the first place via atomic grouping or possessive quantifiers

(regex1|regex2|..)*

(regex*)+

(regex+)*

(.*?bar)*

optimizing unlimited repeats

- Consider the expression that is supposed to match a sequence of words or spaces inside a quoted string

  `["']([\w+|\s{1,2})*["']`

- When applied to the string "aaaaaaaaaa" (with final quote), it matches quickly

- When applied to the string "aaaaaaaaaa (no final quote), it runs 35 times slower!

optimizing unlimited repeats

- We can prevent backtracking from going back to the matched portion by adding a possessive quantifier:

  `["']([\w+|\s{1,2}])*+["']`

- With nested unlimited repeats, you should lock up as much of the string as possible right away

extracting markup

- Possible to use `preg_match_all()` for grabbing marked up portions
- But for tokenizing approach, `preg_split()` is better

```
$s = 'a <b><I>test</I></b> of <br /> markup';
$tokens = preg_split(
     '!( < /? [a-zA-Z][a-zA-Z0-9]* [^/>]* /? > ) !x', $s, -1,
     PREG_SPLIT_NO_EMPTY | PREG_SPLIT_DELIM_CAPTURE);

result is array('a','<b>','<I>','test','</I>',
                '</b>','of','<br />','markup')
```

restricting markup

- Suppose you want to strip all markup except for some allowed subset. What are your possible approaches?
  - Use `strip_tags()` - which has limited functionality
  - Multiple invocations of `str_replace()` or `preg_replace()` to remove script blocks, etc
  - Custom tokenizer and processor, or..

restricting markup

```
$s = preg_replace_callback(
     '! < (/?) ([a-zA-Z][a-zA-Z0-9]*) ([^/>]*) (/?) > !x',
     'my_strip', $s);

function my_strip($match) {
    static $allowed_tags = array('b', 'i', 'p', 'br', 'a');
    $tag = $match[2];
    $attrs = $match[3];
    if (!in_array($tag, $allowed_tags)) return ‘’;
    if (!empty($match[1])) return "</$tag>";
    /* strip evil attributes here */
    if ($tag == 'a') { $attrs = ''; }
    /* any other kind of processing here */
    return "<$tag$attrs$match[4]>";
}
```

matching numbers

- Integers are easy: `\b\d+\b`
- Floating point numbers:

  `integer.fractional`

  `.fractional`

- Can be covered by `(\b\d+|\B)?\.\d+\b`

matching numbers

- To match both integers and floating point numbers, either combine them with alternation or use:
  ((\b\d+)?\.)?\b\d+\b

- **[+-]?** can be prepended to any of these, if sign matching is needed

- **\b** can be substituted by more appropriate assertions based on the required delimiters

matching quoted strings

- A simple case is a string that does not contain escaped quotes inside it
- Matching a quoted string that spans lines:

  “[^”]*”

- Matching a quoted string that does not span lines:

  “[^”\r\n]*”

matching quoted strings

Matching a string with escaped quotes inside

“([^”]+|(?<=\\\\)”)*+”

“

opening quote

(

a component that is

[^”]+

a segment without any quotes

|

or

(?<=\\\\)”

a quote preceded by a backslash

)*+

component repeated zero or more times without backtracking

“

closing quote

matching e-mail addresses

- Yeah, right
- The complete regex is about as long as a book page in 10-point type
- Buy a copy of Jeffrey Friedl's book and steal it from there

matching phone numbers

- Assuming we want to match US/Canada-style phone numbers

```
800-555-1212      1-800-555-1212
800.555.1212      1.800.555.1212
(800) 555-1212    1 (800) 555-1212
```

- How would we do it?

matching phone numbers

- The simplistic approach could be:

```
(1[ .–])? \(? \d{3} \)? [ .–] \d{3} [.–] \d{4}
```

- But this would result in a lot of false positives:

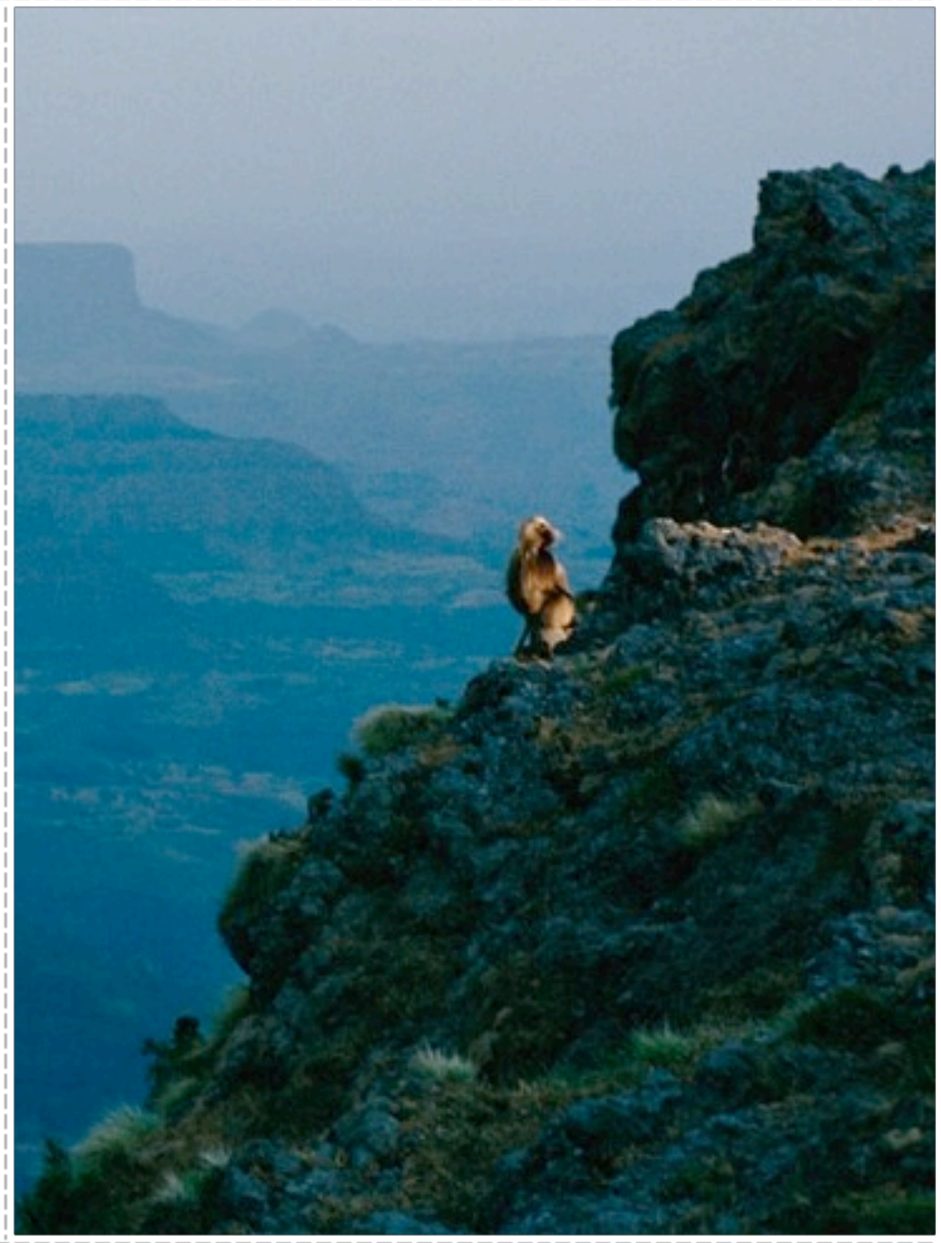
```
1.(800)-555 1212   800).555-1212

1-800 555-1212     (800 555-1212
```

matching phone numbers

^(?:	anchor to the start of the string
(?:1([.–]))?	may have 1. or 1- (remember the separator)
\d{3}	three digits
((?(1)	if we had a separator
\1 |	match the same (and remember), otherwise
[.–]))	match . or - as a separator (and remember)
\d{3}	another three digits
\2	same separator as before
\d{4}	final four digits
|	or
1[ ]?\(\d{3}\)[ ]\d{3}–\d{4}	just match the third format
)$	anchor to the end of the string

tips

- Don’t do everything in regex – a lot of tasks are best left to PHP
- Use string functions for simple tasks
- Make sure you know how backtracking works

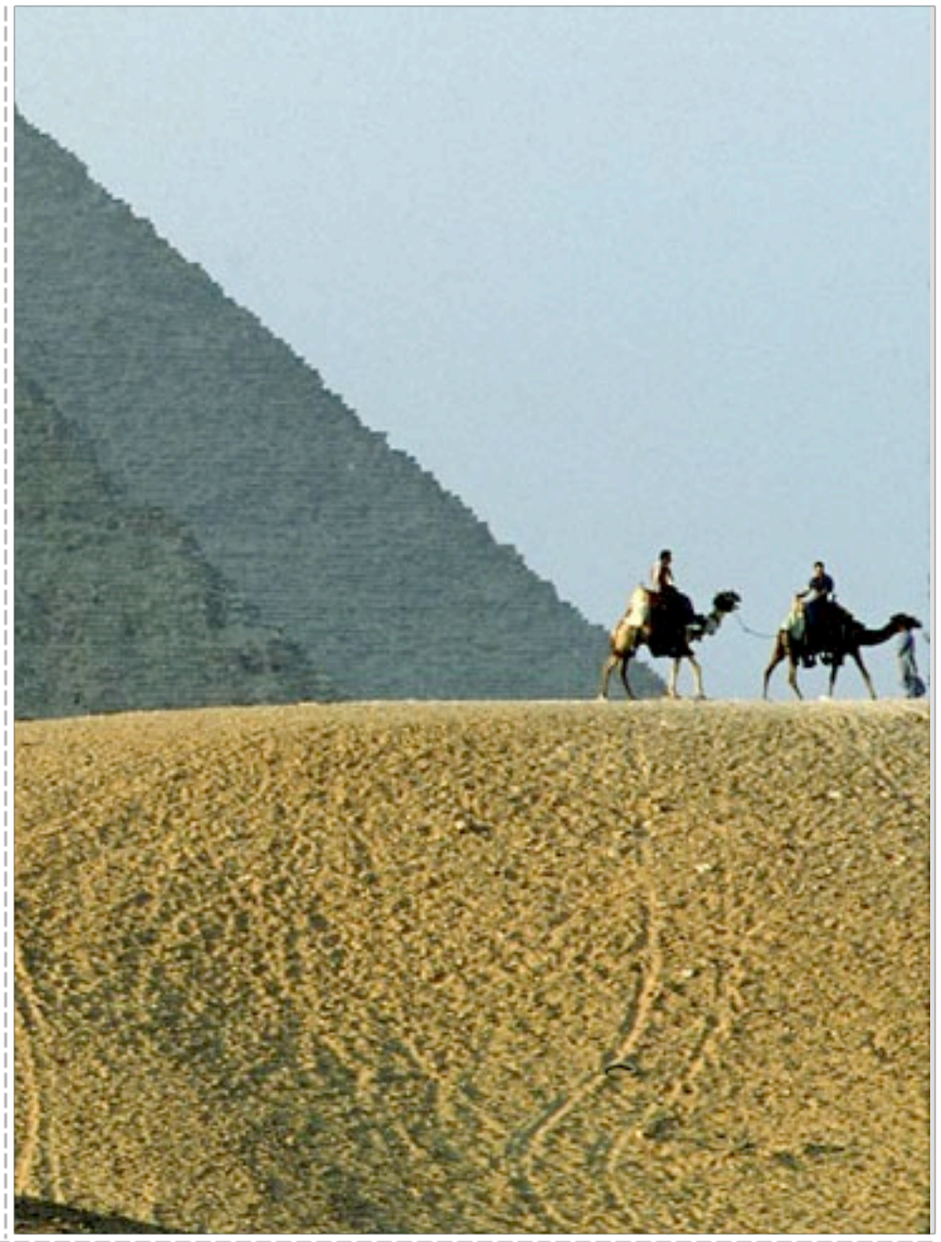


tips

- Be aware of the context
- Capture only what you intend to use
- Don’t use single-character classes

tips

- Lazy vs. greedy, be specific
- Put most likely alternative first in the alternation list
- Think!



regex tools

- Rubular.com
- Regex buddy
- Komodo Regex tester (Rx toolkit)
- Reggy (reggyapp.com)
- RegExr (http://www.gskinner.com/RegExr/)
- http://www.spaweditor.com/scripts/regex/index.php
- http://regex.larsolavtorvik.com/

Thank You!

Questions?

http://zmievski.org/talks