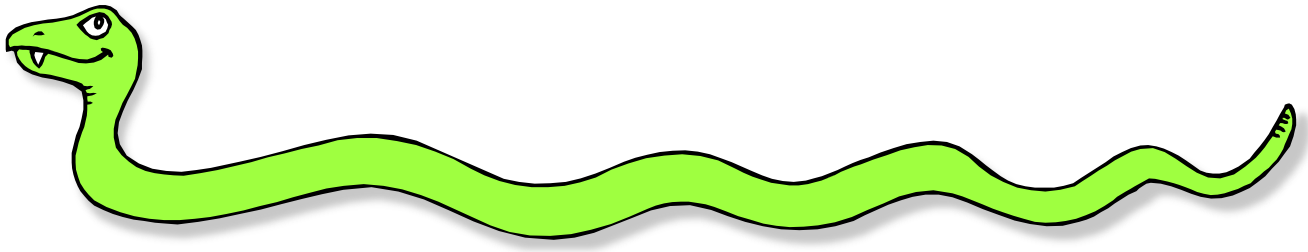
Python
regular expressions



Regular Expressions

- Regular expressions are a powerful string manipulation tool
- All modern languages have similar library packages for regular expressions
- Use regular expressions to:
  - Search a string (`search` and `match`)
  - Replace parts of a string (`sub`)
  - Break strings into smaller pieces (`split`)

Python's Regular Expression Syntax

- Most characters match themselves

  The regular expression "test" matches the string `'test'`, and only that string

- [x] matches any *one* of a list of characters

  "[abc]" matches `'a'`,`'b'`,or `'c'`

- [^x] matches any *one* character that is not included in *x*

  "[^abc]" matches any single character *except* `'a'`,`'b'`,or `'c'`

Python's Regular Expression Syntax

- "." matches any single character
- Parentheses can be used for grouping

  "(abc)+" matches `'abc', 'abcabc', 'abcabcabc',` etc.
- *x*|*y* matches *x* or *y*

  "this|that" matches `'this' and 'that',` but not `'thisthat'.`

Python'sRegular Expression Syntax

- *x** matches zero or more *x*'s

  "a*" matches `''`, `'a'`, `'aa'`, etc.

- *x*+ matches one or more *x*'s

  "a+" matches `'a'`,`'aa'`,`'aaa'`, etc.

- *x*? matches zero or one *x*'s

  "a?" matches `''` or `'a'`

- *x{m, n}* matches *i x*'s, where $m \leq i \leq n$

  "a{2,3}" matches `'aa'` or `'aaa'`

Regular Expression Syntax

- “\d” matches any digit; “\D” any non-digit
- “\s” matches any whitespace character; “\S” any non-whitespace character
- “\w” matches any alphanumeric character; “\W” any non-alphanumeric character
- “^” matches the beginning of the string; “$” the end of the string
- “\b” matches a word boundary; “\B” matches a character that is not a word boundary

Search and Match

- The two basic functions are **re.search** and **re.match**
  - Search looks for a pattern anywhere in a string
  - Match looks for a match staring at the beginning
- Both return *None* (logical false) if the pattern isn't found and a "match object" instance if it is

```
>>> import re
>>> pat = "a*b"
>>> re.search(pat,"fooaaabcde")
<_sre.SRE_Match object at 0x809c0>
>>> re.match(pat,"fooaaabcde")
>>>
```

Q: What's a match object?

- A: an instance of the match class with the details of the match result

```
>>> r1 = re.search("a*b","fooaaabcde")
>>> r1.group()  # group returns string matched
'aaab'
>>> r1.start()  # index of the match start
3
>>> r1.end()    # index of the match end
7
>>> r1.span()   # tuple of (start, end)
(3, 7)
```

What got matched?

- Here's a pattern to match simple email addresses

  \w+@(\w+\.)+(com|org|net|edu)

```
>>> pat1 = "\w+@(\w+\.)+(com|org|net|edu)"
>>> r1 = re.match(pat,"finin@cs.umbc.edu")
>>> r1.group()
'finin@cs.umbc.edu'
```

- We might want to extract the pattern parts, like the email name and host

What got matched?

- We can put parentheses around groups we want to be able to reference

```
>>> pat2 = "(\w+)@((\w+\.)+(com|org|net|edu))"
>>> r2 = re.match(pat2,"finin@cs.umbc.edu")
>>> r2.group(1)
'finin'
>>> r2.group(2)
'cs.umbc.edu'
>>> r2.groups()
r2.groups()
('finin', 'cs.umbc.edu', 'umbc.', 'edu')
```

- Note that the ‘groups’ are numbered in a preorder traversal of the forest

More re functions

- re.split() is like split but can use patterns

```
>>> re.split("\W+", “This... is a test,
  short and sweet, of split().”)
['This', 'is', 'a', 'test', 'short’,
  'and', 'sweet', 'of', 'split’, ‘’]
```

- re.sub substitutes one string for a pattern

```
>>> re.sub('(blue|white|red)', 'black', 'blue socks and red
    shoes')
'black socks and black shoes’
```

- re.findall() finds al matches

```
>>> re.findall("\d+”,"12 dogs,11 cats, 1 egg")
['12', '11', ’1’]
```

Compiling patterns

- re.complile()
- pattern for IP Address
  - ^[0-9]+\.[0-9]+\.[0-9]+\.[0-9]+$
  - ^\d+\.\d+\.\d+\.\d+$
  - ^\d{1,3}\.\d{1,3}\.\d{1,3}\.\d{1,3}$
  - ^([01]?\d\d?|2[0-4]\d|25[0-])\.
    ([01]?\d\d?|2[0-4]\d|25[0-5])\.
    ([01]?\d\d?|2[0-4]\d|25[0-5])\.
    ([01]?\d\d?|2[0-4]\d|25[0-5])$