

# Introduction to regular expressions

REGULAR EXPRESSIONS IN PYTHON



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# What is a regular expression?

REGular EXpression or regex:

*String containing a combination of normal characters and special metacharacters that describes patterns to find text or positions within a text*

`r'st\d\s\w{3,10}'`

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REGular EXpression or regex:

*String containing a combination of **normal characters** and special metacharacters that describes patterns to find text or positions within a text*

`r'st\d\s\w{3,10}'`

- Normal characters match themselves ( `st` )

# What is a regular expression?

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*String containing a combination of normal characters and **special metacharacters** that describes patterns to find text or positions within a text*

`r'st\d\s\w{3,10}'`

- Metacharacters represent types of characters ( `\d` , `\s` , `\w` ) or ideas ( `{3,10}` )

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# What is a regular expression?

REGular EXpression or regex:

*String containing a combination of normal characters and special metacharacters that describes **patterns** to find text or positions within a text*

- Pattern: a sequence of characters that maps to words or punctuation



# What is a regular expression?

REGular EXpression or regex:

*String containing a combination of normal characters and special metacharacters that describes patterns **to find text or positions within a text***

- Pattern matching usage:
  - Find and replace text
  - Validate strings
- Very powerful and fast

# The re module

```
import re
```

- Find all matches of a pattern:

```
re.findall(r"regex", string)
```

```
re.findall(r"#movies", "Love #movies! I had fun yesterday going to the #movies")
```

```
['#movies', '#movies']
```

# The re module

```
import re
```

- Split string at each match:

`re.split(r"regex", string)`

```
re.split(r"!", "Nice Place to eat! I'll come back! Excellent meat!")
```

```
['Nice Place to eat', ' I'll come back', ' Excellent meat', '']
```

# The re module

```
import re
```

- Replace one or many matches with a string:

`re.sub(r"regex", new, string)`

```
re.sub(r"yellow", "nice", "I have a yellow car and a yellow house in a yellow neighborhood")
```

```
'I have a nice car and a nice house in a nice neighborhood'
```

# Supported metacharacters

Metacharacter	Meaning
<b>\d</b>	Digit

```
re.findall(r"User\d", "The winners are: User9, UserN, User8")
```

```
['User9', 'User8']
```

Metacharacter	Meaning
<b>\D</b>	Non-digit

```
re.findall(r"User\D", "The winners are: User9, UserN, User8")
```

```
['UserN']
```

# Supported metacharacters

Metacharacter	Meaning
<b>\w</b>	Word

```
re.findall(r"User\w", "The winners are: User9, UserN, User8")
```

```
['User9', 'UserN', 'User8']
```

Metacharacter	Meaning
<b>\W</b>	Non-word

```
re.findall(r"\W\d", "This skirt is on sale, only $5 today!")
```

```
['$5']
```

# Supported metacharacters

Metacharacter	Meaning
<code>\s</code>	Whitespace

```
re.findall(r"Data\sScience", "I enjoy learning Data Science")
```

```
['Data Science']
```

Metacharacter	Meaning
<code>\S</code>	Non-Whitespace

```
re.sub(r"ice\Scream", "ice cream", "I really like ice-cream")
```

```
'I really like ice cream'
```

# Let's practice!

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# Repetitions

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# Repeated characters

Validate the following string:

**password1234**

# Repeated characters

Validate the following string:

**password1234**

# Repeated characters

Validate the following string:

**password1234**

# Repeated characters

Validate the following string:

password1234

```
import re  
password = "password1234"
```

```
re.search(r"\w\w\w\w\w\w\w\w\d\d\d\d", password)
```

```
<_sre.SRE_Match object; span=(0, 12), match='password1234'>
```

# Repeated characters

Validate the following string:

password1234

```
import re  
password = "password1234"
```

```
re.search(r"\w{8}\d{4}", password)
```

```
<_sre.SRE_Match object; span=(0, 12), match='password1234'>
```

## Quantifiers:

A metacharacter that tells the regex engine how many times to match a character immediately to its left.

# Quantifiers

- Once or more: `+`

```
text = "Date of start: 4-3. Date of registration: 10-04."
```

```
re.findall(r"      ", text)
```

# Quantifiers

- Once or more: `+`

```
text = "Date of start: 4-3. Date of registration: 10-04."
```

```
re.findall(r"\d+-", text)
```



# Quantifiers

- Once or more: `+`

```
text = "Date of start: 4-3. Date of registration: 10-04."
```

```
re.findall(r"\d+-\d+", text)
```

```
['4-3', '10-04']
```

# Quantifiers

- Zero times or more: \*

```
my_string = "The concert was amazing! @ameli!a @joh&&n @mary90"  
re.findall(r"@\\w+\\W*\\w+", my_string)
```

```
['@ameli!a', '@joh&&n', '@mary90']
```

# Quantifiers

- Zero times or once: `?`

```
text = "The color of this image is amazing. However, the colour blue could be brighter."  
re.findall(r"colou?r", text)
```

```
['color', 'colour']
```

# Quantifiers

- n times at least, m times at most : `{n, m}`

```
phone_number = "John: 1-966-847-3131 Michelle: 54-908-42-42424"
```

```
re.findall(r"          ", phone_number)
```

# Quantifiers

- n times at least, m times at most : `{n, m}`

```
phone_number = "John: 1-966-847-3131 Michelle: 54-908-42-42424"
```

```
re.findall(r"\d{1,2}-", phone_number)
```

# Quantifiers

- n times at least, m times at most : `{n, m}`

```
phone_number = "John: 1-966-847-3131 Michelle: 54-908-42-42424"
```

```
re.findall(r"\d{1,2}-\d{3}-", phone_number)
```

# Quantifiers

- n times at least, m times at most : `{n, m}`

```
phone_number = "John: 1-966-847-3131 Michelle: 54-908-42-42424"
```

```
re.findall(r"\d{1,2}-\d{3}-\d{2,3}-\d{4,}", phone_number)
```

```
['1-966-847-3131', '54-908-42-42424']
```

# Quantifiers

- *Immediately to the left*
  - `r"apple+"` : `+` applies to `e` and not to `apple`



# Let's practice!

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# Regex metacharacters

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# Looking for patterns

Two different operations to find a match:

**re.search(r"regex", string)**

```
re.search(r"\d{4}", "4506 people attend the show")
```

```
<_sre.SRE_Match object; span=(0, 4), match='4506'>
```

```
re.search(r"\d+", "Yesterday, I saw 3 shows")
```

```
<_sre.SRE_Match object; span=(17, 18), match='3'>
```

**re.match(r"regex", string)**

```
re.match(r"\d{4}", "4506 people attend the show")
```

```
<_sre.SRE_Match object; span=(0, 4), match='4506'>
```

```
re.match(r"\d+", "Yesterday, I saw 3 shows")
```

```
None
```

# Special characters

- Match any character (except newline): `.`

`www.domain.com`

```
my_links = "Just check out this link: www.amazingpics.com. It has amazing photos!"  
re.findall(r"www .com", my_links)
```

# Special characters

- Match any character (except newline): `.`

www.domain.com

```
my_links = "Just check out this link: www.amazingpics.com. It has amazing photos!"  
re.findall(r"www.+com", my_links)
```

```
['www.amazingpics.com']
```

# Special characters

- Start of the string: `^`

```
my_string = "the 80s music was much better that the 90s"
```

```
re.findall(r"the\s\d+s", my_string)
```

```
['the 80s', 'the 90s']
```

```
re.findall(r"^the\s\d+s", my_string)
```

```
['the 80s']
```

# Special characters

- End of the string: `$`

```
my_string = "the 80s music hits were much better than the 90s"
```

```
re.findall(r"the\s\d+s$", my_string)
```

```
['the 90s']
```

# Special characters

- Escape special characters: \

```
my_string = "I love the music of Mr.Go. However, the sound was too loud."
```

```
print(re.split(r"\s", my_string))
```

```
['', 'lov', 'th', 'musi', 'o', 'Mr.Go', 'However', 'th', 'soun', 'wa', 'to', 'loud.']
```

```
print(re.split(r"\.\s", my_string))
```

```
['I love the music of Mr.Go', 'However, the sound was too loud.']
```



# OR operator

- Character: `|`

```
my_string = "Elephants are the world's largest land animal! I would love to see an elephant one day"
```

```
re.findall(r"Elephant|elephant", my_string)
```

```
['Elephant', 'elephant']
```

# OR operator

- Set of characters: `[ ]`

```
my_string = "Yesterday I spent my afternoon with my friends: MaryJohn2 Clary3"
```

```
re.findall(r"[a-zA-Z]+\d", my_string)
```

```
['MaryJohn2', 'Clary3']
```

# OR operator

- Set of characters: `[ ]`

```
my_string = "My&name&is#John Smith. I%live$in#London."
```

```
re.sub(r"[$%&]", " ", my_string)
```

```
'My name is John Smith. I live in London.'
```

# OR operand

- Set of characters: `[ ]`
  - `^` transforms the expression to negative

```
my_links = "Bad website: www.99.com. Favorite site: www.hola.com"  
re.findall(r"www[^0-9]+com", my_links)
```

```
['www.hola.com']
```

# Let's practice!

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# Greedy vs. non-greedy matching

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# Greedy vs. non-greedy matching

- Two types of matching methods:
  - Greedy
  - Non-greedy or lazy
- Standard quantifiers are greedy by default: `*` , `+` , `?` , `{num, num}`

# Greedy matching

- **Greedy:** match as many characters as possible
- Return the *longest match*

```
import re  
re.match(r"\d+", "12345bcada")
```

```
<_sre.SRE_Match object; span=(0, 5), match='12345'>
```

\d+

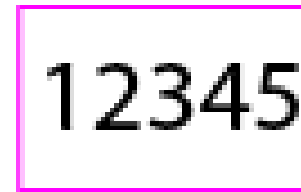


12345abcde

\d+



12345abcde



12345abcde

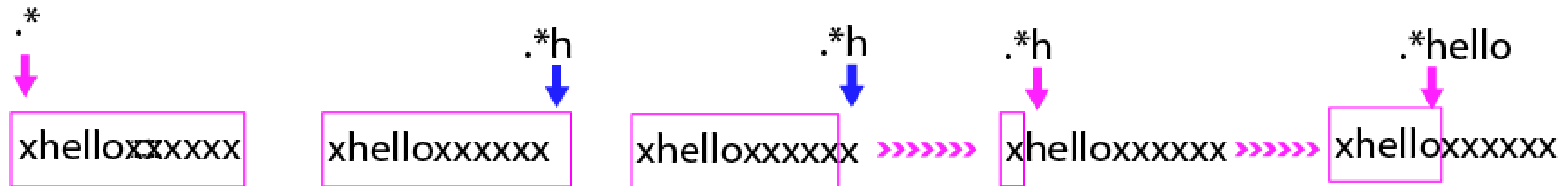


# Greedy matching

- Backtracks when too many character matched
- Gives up characters one at a time

```
import re
re.match(r".*hello", "xhelloxxxxx")
```

```
<_sre.SRE_Match object; span=(0, 6), match='xhello'>
```



# Non-greedy matching

- **Lazy:** match as few characters as needed
- Returns *the shortest match*
- Append `?` to greedy quantifiers

```
import re  
re.match(r"\d+?", "12345bcada")
```

```
<_sre.SRE_Match object; span=(0, 1), match='1'>
```

`\d+`



12345abcde

`\d+?`



12345abcde

# Non-greedy matching

- Backtracks when too few characters matched
- Expands characters one a time

```
import re
re.match(r".*?hello", "xhelloxxxxx")
```

```
<_sre.SRE_Match object; span=(0, 6), match='xhello'>
```



# Let's practice!

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