

Strings: Conversions, Indexing, Slicing, Immutability.

Week 5 | Lecture 1 (5.1)

While waiting, open the Jupyter Notebook for today's lecture

Upcoming

- Lab 3 Due Friday 11:59 PM
- No Lab released Thursday
- Reflection 5 Released Friday 6:00 pm.
- Tutorial (Online), Practical, Office Hour sessions running all week.
- Looking for more practice? Check out the textbook.

if nothing else, write `#cleancode`

This Week's Content

- **Lecture 5.1**
 - **Strings: Conversions, Indexing, Slicing, and Immutability**
- **Lecture 5.2**
 - Introduction to Object-Oriented Programming and the File Object
- **Lecture 5.3**
 - Term Test 1 Review: Jeopardy!

Working with Strings

- The string (**str**) type was briefly introduced in previous weeks
- Let's take our string knowledge to the next level!
 - escape sequences ✓
 - str operations ✓
 - type conversion ✓
 - str indexing and slicing
 - str methods



Working with Strings

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 - str methods



String Indexing

- An **index** is a position within the **string**
- A particular element of the string is accessed by the index of the element surrounded by square brackets **[]**
- Positive indices count from the left-hand side, beginning with the first character at index 0, the second index 1, and so on...
- Negative indices count from the right-hand side, beginning with the last character at index -1, the second last at index -2, and so on...

```
>>> "Yolo"[0]
```

```
'Y'
```

```
>>> x = "Yolo"
```

```
>>> x[2]
```

```
'l'
```

```
>>> x = "Yolo"
```

```
>>> x[-1]
```

```
'o'
```

String Indexing

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- A particular element of the string is accessed by the index of the element surrounded by square brackets
- Positive indices count from the left-hand side, beginning with the first character at index 0, the second index 1...
- Negative indices count from the right-hand side, beginning with the last character at index -1, the second last at index -2, and so on...

```
>>> x = "I Love Cats"
```

0	1	2	3	4	5	6	7	8	9	10
I		L	o	v	e		C	a	t	s
-11	-10	-9	-8	-7	-6	-5	-4	-3	-2	-1

```
>>> x[0]
```

```
'I'
```

```
>>> x[6]
```

```
' '
```

```
>>> x[-11]
```

```
'I'
```

String Slicing

- We can extract more than one character (or substring) using **slicing**
- Uses the syntax `[start : finish]`, where:
 - **start** is the index where we start the slice
 - **finish** is the index of **one after** where we end the slice
- When either **start** or **finish** are not provided:
 - If **start** index is missing, it defaults to the beginning
 - If **finish** index is missing, it defaults to the end

```
>>> x = "Yolo"
```

```
>>> x[0:3]
```

```
'Yol'
```

```
>>> x = "Yolo"
```

```
>>> x[:3]
```

```
'Yol'
```

```
>>> x = "Yolo"
```

```
>>> x[-2:]
```

```
'lo'
```

String Slicing

- We can extract more than one character (or substring) using **slicing**
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```
>>> x = "I Love Cats"
```

0	1	2	3	4	5	6	7	8	9	10
I		L	o	v	e		C	a	t	s
-11	-10	-9	-8	-7	-6	-5	-4	-3	-2	-1

```
>>> x[2:6]
```

```
'Love'
```

```
>>> x[-9:-5]
```

```
'Love'
```

```
>>> x[-4:]
```

```
'Cats'
```

```
>>> x[:]
```

```
'I Love Cats'
```


String Length

- To obtain the length of a string you can use the built-in function **len**
- The **len** function takes a string as an argument and returns an integer indicating the length of the string
 - Note: This will always be the final index + 1

```
>>> x = "I Love Cats"
```

0	1	2	3	4	5	6	7	8	9	10
I		L	o	v	e		C	a	t	s
-11	-10	-9	-8	-7	-6	-5	-4	-3	-2	-1

```
>>> len(x)
```

```
11
```

Extended Slicing

- We can slice (select) every *n*th character by providing three arguments
- Uses the syntax [**start** : **finish** : **step**], where:
 - **start** is the index where we start the slice
 - **finish** is the index of **one after** where we end the slice
 - **step** is how much we count by between each character
- When **step** is not provided, it defaults to 1

```
>>> x = "Yolo"
```

```
>>> x[::2]
```

```
'Yl'
```

```
>>> x = "Yolo"
```

```
>>> x[::]
```

```
'Yolo'
```

Extended Slicing

- We can slice (select) every *n*th character by providing three arguments
- Uses the syntax [**start** : **finish** : **step**], where:
 - **start** is the index where we start the slice
 - **finish** is the index of **one after** where we end the slice
 - **step** is how much we count by between each character
- When **step** is not provided, it defaults to 1

```
>>> x = "I Love Cats"
```

0	1	2	3	4	5	6	7	8	9	10
I		L	o	v	e		C	a	t	s
-11	-10	-9	-8	-7	-6	-5	-4	-3	-2	-1

```
>>> x[0:6:2]
```

```
'ILv'
```

```
>>> x[::3]
```

```
'Io t'
```

```
>>> x[::-1]
```

```
'staC evoL I'
```

```
>>> x[::-2]
```

```
'sa vLI'
```

Let's Code!

- Let's take a look at how this works in Python!
 - String indexing
 - String slicing
 - String length
 - String slicing with a 'step'

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Click Link:
**2. String Indexing
and Slicing**

Modifying Strings

- The indexing and slicing operations do not modify the string they act on
 - We cannot change a string!
- Strings are **immutable**, meaning they **CANNOT** be changed

```
>>> x = "I Love Cats"
```

0	1	2	3	4	5	6	7	8	9	10
I		L	o	v	e		C	a	t	s
-11	-10	-9	-8	-7	-6	-5	-4	-3	-2	-1

```
>>> x[7] = 'B'
```

```
TypeError: 'str' object does not support item assignment
```

Modifying Strings

- To “modify” a string, we must create a new one
 - Let’s change this to “I Love Dogs”

```
>>> x = "I Love Cats"
```

0	1	2	3	4	5	6	7	8	9	10
I		L	o	v	e		C	a	t	s
-11	-10	-9	-8	-7	-6	-5	-4	-3	-2	-1

```
>>> x_new = x[:7] + 'Dogs'      #x_new points to the new string object
```

```
>>> x = x_new                  #x points to the new object
```

```
>>> print(x)
```

```
'I Love Dogs'
```

Let's Code!

- Let's take a look at how this works in Python!
 - Modifying strings
 - String immutability

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Click Link:
**3. Modifying
Strings**

Working with Strings

- The string (**str**) type was briefly introduced in previous weeks
- Let's take our string knowledge to the next level!
 - escape sequences ✓
 - str operations ✓
 - type conversion ✓
 - str indexing and slicing ✓
 - **str methods**



String Methods

- Strings are objects and just like other objects, the **str** type has associated methods that are only valid for strings
- To find out which methods are associated with objects, use the built-in function **dir**

```
>>> dir(str)
```

```
['__add__', '__class__', '__contains__', '__delattr__', '__dir__', '__doc__',  
 '__eq__', '__format__', '__ge__', '__getattribute__', '__getitem__',  
 '__getnewargs__', '__gt__', '__hash__', '__init__', '__init_subclass__',  
 '__iter__', '__le__', '__len__', '__lt__', '__mod__', '__mul__', '__ne__',  
 '__new__', '__reduce__', '__reduce_ex__', '__repr__', '__rmod__', '__rmul__',  
 '__setattr__', '__sizeof__', '__str__', '__subclasshook__', 'capitalize',  
 'casefold', 'center', 'count', 'encode', 'endswith', 'expandtabs', 'find',  
 'format', 'format_map', 'index', 'isalnum', 'isalpha', 'isascii', 'isdecimal',  
 'isdigit', 'isidentifier', 'islower', 'isnumeric', 'isprintable', 'isspace',  
 'istitle', 'isupper', 'join', 'ljust', 'lower', 'lstrip', 'maketrans',  
 'partition', 'replace', 'rfind', 'rindex', 'rjust', 'rpartition', 'rsplit',  
 'rstrip', 'split', 'splitlines', 'startswith', 'strip', 'swapcase', 'title',  
 'translate', 'upper', 'zfill']
```

String Method: `upper`

- `upper` is a string method that generates a new string that has all upper case characters

```
>>> white_rabbit = "I'm late! I'm late! For a very important date!"
```

```
>>> white_rabbit.upper()
```

```
"I'M LATE! I'M LATE! FOR A VERY IMPORTANT DATE!"
```

```
>>> white_rabbit
```

```
"I'm late! I'm late! For a very important date!"
```



String Method: **lower**

- **lower** is a string method that generates a new string that has all lower case characters

```
>>> white_rabbit = "I'm late! I'm late! For a very important date!"
```

```
>>> white_rabbit.lower()
```

```
"i'm late! i'm late! for a very important date!"
```

```
>>> white_rabbit
```

```
"I'm late! I'm late! For a very important date!"
```



String Method: `find` (and `rfind`)

- The method `find` returns first index where a substring is found
- The method `rfind` returns the last index where a substring is found
- Returns -1 if no such substring exists

```
>>> white_rabbit = "I'm late! I'm late! For a very important date!"
```

```
>>> white_rabbit.find('late')
```

```
4
```

```
>>> white_rabbit.rfind('late')
```

```
14
```



String Method: `replace`

- The method `replace(old, new)` returns a copy of the string in which the occurrences of `old` have been replaced with `new`.

```
>>> white_rabbit = "I'm late! I'm late! For a very important date!"
```

```
>>> white_rabbit.replace('late', 'early')
```

```
"I'm early! I'm early! For a very important date!"
```



Chaining Methods

- How would you replace the word "forward" with "backward"?

```
>>> s = 'Forward, forward we must go, for there is no other way to go!'
```

- Methods can be chained together
 - Perform first operation, which returns an object
 - Use the returned object for the next method

```
>>> s.lower().replace('forward','backward')  
'backward, backward we must go, for there is no other way to go!'  
>>> s.lower().replace('forward','backward').capitalize()  
'Backward, backward we must go, for there is no other way to go!'
```

More String Methods

- There are many more string methods available which you will explore in lab assignments and tutorials

- `str.islower()`
- `str.count(sub)`
- `str.ljust(width)`
- `str.lstrip()`
- `str.split()`
- `str.strip()`

Do not need to memorize all of the string methods!

Should know:

`str.lower`

`str.upper`

`str.find`

`str.rfind`

`str.replace`

`str.capitalize`

(any others will be indicated in the review)

Let's Code!

- Let's take a look at how this works in Python!
 - String methods
 - capitalize
 - upper
 - lower
 - find
 - rfind
 - And more...



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4. String Methods

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