Lecture 5 - Manipulating strings, string methods, dot notation
Learning outcomes

At the end of this lecture, students should be able to:

- use dot notation (using string methods with string instances)
- use string methods: upper(), lower(), strip(), find(), rfind()
- use the inbuilt functions: min(), max(), round(), abs()
Recap

- From lecture 4
  - Use the len() function to calculate how many characters are in a string
  - Obtain a single character from a string
  - Slice strings
  - Concatenate strings

```python
words = " Prince Charming "
length = len(words)

letter1 = words[3]
letter2 = words[-5]
letter3 = words[len(words) - 2]

letters1 = words[3:6]
letters2 = words[:6]
letters3 = words[6:]
letters4 = words[-3:]

word = letter1 + letter2
word = word + " " + letter3

print(letters1, letters2, letters3, letters4, word)
```

```bash
inc Prince Charming inc img
```
Dot notation

Every object type, as well as storing some data, has some defined methods which can be applied to that particular type of object.

Variables which reference an object are called instances, e.g., in the following code, greeting is a string instance and number is an instance of type int.

```python
    greeting = "Hello World"
    number = 234
```

String instances have many methods which can be applied to them such as upper(), lower(), find(), strip(), isalpha(), isdigit(), rfind(), split() ... In this lecture we will look at a few of these methods.

In order to apply a method to an object we use dot notation, i.e., the variable name, followed by a dot, followed by the method name.

```
    instance_name.method_name(...)  
```

Note that, methods (like functions) use parentheses (round brackets) after the method name.
String methods - upper(), lower()

- The `upper()` method returns a new string object with all the characters converted to upper case. The `lower()` method returns a new string object with all the characters converted to lower case.

For example,

```
greeting = "Hello World"

greeting_lower = greeting.lower()
greeting_upper = greeting.upper()

print(greeting, greeting_lower, greeting_upper)
```

```
Hello World hello world HELLO WORLD
```

Notice that there is a total of three string objects.
The `find()` method is used to look for the position (index number) of the first occurrence (from the left) of some characters. If the characters are found, the `find()` method returns the index number, otherwise the `find()` method returns -1.

For example,

```python
greeting = "Hello World"
position1 = greeting.find(" ")
position2 = greeting.find("z")
position3 = greeting.find("orl")
print(position1, position2, position3)
```

5 -1 7
The **rfind() method** is used to look for the index position of the last (i.e. rightmost) occurrence of some characters. If the characters are found, the `rfind()` method returns the index number, otherwise the `rfind()` method returns -1.

For example,

```python
greeting = "Hello World"

position1 = greeting.find("o")

position2 = greeting.rfind("o")

position3 = greeting.rfind("orl")

position4 = greeting.rfind("lro")

print(position1, position2, position3, position4)
```

4 7 7 -1
String methods - strip()

- The **strip() method** returns a new string object with all white space from the beginning and end of the string removed. It does not remove spaces from inside the string.

For example,

```python
letters1 = "    H e l l o oooo    "
letters2 = letters1.strip()

length1 = len(letters1)
length2 = len(letters2)

letters1 = "***" + letters1 + "***"
letters2 = "***" + letters2 + "***"

print(length1, length2, letters1, letters2)
```

```
21 14 *** H e l l o oooo *** ***H e l l o oooo***
```

Notice that there are two string objects
Complete the following program so that it prints the initial from the first name followed by a full stop, a space and followed by the surname. Assume the full name is always two names separated by a single space.

```python
full_name = "Wystan Auden"

initialled_name = first_letter + ". " + last_name
print(initialled_name)

W. Auden
Common Python inbuilt functions

- `min()` is an inbuilt function which can be used to find the smallest number from a comma separated set of numbers and `max()` is the inbuilt function which can be used to find the largest number from a comma separated set of numbers, e.g.,

```python
num1 = 32
num2 = 16
smallest = min(num1, num2)
print(smallest)

smallest = min(32.7, 56.4, 3, -1.1, 56.99, -1.2)
print(smallest)

largest = max(num1, num2)
print(largest)

largest = max(32.7, 56.4, 3, -1.1, 56.99, -1.2)
print(largest)
```

16
-1.2
32
56.99
The **inbuilt function** `round()`, is used to round numbers to the closest whole number (or rounded to a number of digits after the decimal point), e.g.,

```python
num1 = 32.657123
num2 = 16.48926
num3 = -16.48926

print(round(num1))
print(round(num2))
print(round(num3))
print()
print(round(num1, 2))
print(round(num2, 3))
print(round(num3, 4))
```

```
33
16
-16
32.66
16.489
-16.4893
```
Note that the function, `round()` with a single argument returns an int number and that rounding an int returns the int unchanged, e.g.,

```python
print("round(32.657123, 0): ", round(32.657123, 0))
print("round(16.48926, 0): ", round(16.48926, 0))
print("round(32.657123): ", round(32.657123))
print("round(16.48926): ", round(16.48926))
print("round(24.0, 0): ", round(24.0, 0))
print("round(24.0, 1): ", round(24.0, 1))
print("round(24, 0): ", round(24, 0))
print("round(24.0): ", round(24.0))
print("round(24): ", round(24))
```

```
round(32.657123, 0): 33.0
round(16.48926, 0): 16.0
round(32.657123): 33
round(16.48926): 16
round(24.0, 0): 24.0
round(24.0, 1): 24.0
round(24, 0): 24
round(24.0): 24
round(24): 24
```
Sometimes the `round()` function seems to give an unexpected result e.g.,

```python
num1 = 1.5
num2 = 2.5
num3 = 3.5
print(round(num1))
print(round(num2))  # surprising result
print(round(num3))
```

This problem happens because floating point numbers are stored in a finite space, e.g., 0.1 has an infinite number of digits when converted to base 2

```
0.0001100110011001100110011001100110011001100110011001100110011001...
```

but, when stored in the computer memory, float numbers are assigned exactly 64 bits of space which means that some of the bits are cut off. If 2.5 is actually stored as `2.4999999999999999999999999999999999999999...`

then it is rounded to 2 (not the expected 3).

```python
round(4.235, 2) gives the number 4.24
round(4.265, 2) gives the number 4.26
```
The **inbuilt function**, `abs()`, is used to get the absolute value (the magnitude) of a number (int or float), e.g.,

```python
num1 = 32
num2 = -32
num3 = abs(16 - 23)

print("1.", abs(num1))
print("2.", abs(num2))
print("3.", num3)
print("4.", abs(-16.78))
```

1. 32
2. 32
3. 7
4. 16.78
Complete the following program so that it prints the total tax and the net pay rounded to a whole number. The first $14000 is not taxed. The next amount up to $38500 is taxed at 24% and the rest is taxed at 34%.

```python
salary = 54000
no_tax_boundary = 14000
rate1_boundary = 38500
rate1 = 0.24
rate2 = 0.34

#Print the output
print("Salary: $", salary, sep="")
print("Amount to be taxed at: 24%: ", rate1_amount, sep="")
print("Tax at rate 1: ", tax_rate1, sep="")
print("Amount to be taxed at: 34%: ", rate2_amount, sep="")
print("Tax at rate 2: ", tax_rate2, sep="")
print("" )
print("Total tax: ", total_tax, sep = "")
print("" )
print("Net pay: ", net_pay, sep = "")
print("

Salary: $54000
Amount to be taxed at: 24%: $24500
Tax at rate 1: $5880
Amount to be taxed at: 34%: $15500
Tax at rate 2: $5270
Total tax: $11150
Net pay: $42850
"
In Python:

- use dot notation when using string methods with string instances
- the string methods: upper(), lower(), strip(), find(), rfind() can be used with string instances
- Some Python inbuilt functions are: min(), max(), round()
Examples of Python features used in this lecture

greeting = "Hello World"
position1 = greeting.find("o")
position2 = greeting.rfind("o")
position3 = words.find("Z")
position4 = words.rfind("o W")

greeting_lower = greeting.lower()
greeting_upper = greeting.upper()

smallest = min(32.7, 56.4, 3, -1.1, 56.99, -1.2)
largest = max(32.7, 56.4, 3, -1.1, 56.99, -1.2)

num1 = 32.657123
print(round(num1))
print(round(num1, 2))

num2 = abs(20 - num1)
print(num2)