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()

Learning outcomes

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

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

letter1 = words[3]
letter2 = words[-5]
letter3 = words[length(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)
```

Recap

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.

```
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,

```python
    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.

String methods – find()

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)
```

```
0 1 2
```

Let's see how the `find()` method works with a string that contains white spaces.

String methods – rfind()

The **rfind()** method is used to look for the index position of the last occurrence (from the right) 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.rfind("o")
    position2 = greeting.rfind("z")
    position3 = greeting.rfind("orl")
    position4 = greeting.rfind("lro")
    print(position1, position2, position3, position4)
```

```
7 8 9 10
```

Notice that there is a total of three string objects.

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.
Exercise

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

Funeral Blues: Stop all the clocks, cut off the telephone/ Prevent the dog from barking ...

Common Python built-in functions

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))
p
```

33
16
-16

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

32.66
16.489
-16.4893

Common Python built-in 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)
```

```
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
```

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): ", round(24))
```
Common Python inbuilt functions

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 |

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 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 2.49999999999999999…99 then it is rounded to 2 (not the expected 3).

```python
num1 = 1.5
num2 = 2.5
num3 = 3.5

print(round(num1))
print(round(num2)) # surprising result
print(round(num3))
```

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 last lines of information
```

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

```python
# Examples of Python features

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)
```