COMPSCI 101
Principles of Programming

Lecture 5 – Manipulating Strings

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()

Lecture 4 Recap

- 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[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)
```

```
inc  Princ e Charming  ng  im g
```

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:

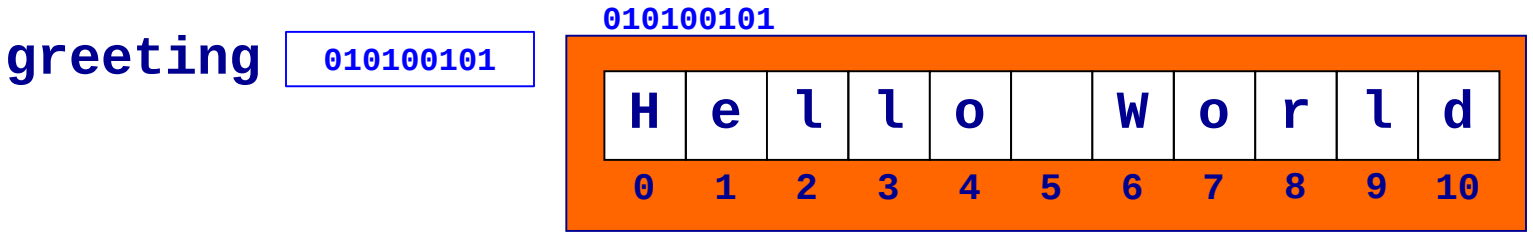
```
greeting = "Hello World"

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:



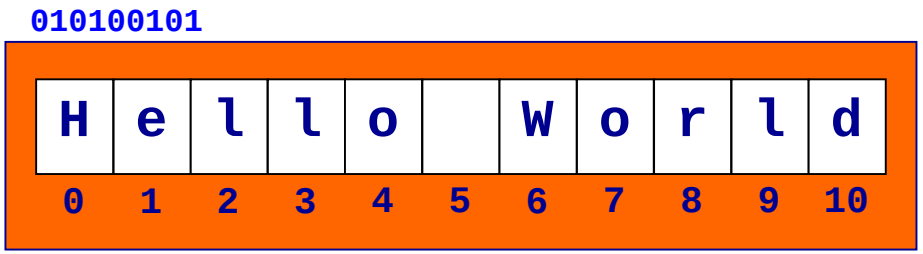

```
greeting = "Hello World"
position1 = greeting.find(" ")
position2 = greeting.find("z")
position3 = greeting.find("orl")
print(position1, position2, position3)
```

```
5 -1 7
```

String methods – rfind()

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:

greeting `010100101`




```
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:

```
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.

```
full_name = "Wystan Auden"









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

```
W. Auden
```

The min() and max() 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. For example:

```
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 round() function

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.,

```
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
```

The round() function

Note that the **round() function** with a single argument returns an int number and that rounding an int returns the int unchanged. For example:

```
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
```

round() – unexpected result

Sometimes the round() function seems to give an unexpected result:

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

```
2
2
4
```

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

```
0.0001100110011001100110011001100110011001100110011...
```

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.

The round function rounds to the nearest value with an even least significant digit.

```
round(4.235, 2) gives the number 4.24
round(4.265, 2) gives the number 4.26
```

The abs() function

The **inbuilt function**, **abs()**, is used to get the absolute value (the magnitude) of a number (int or float), e.g.,

```
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
```

Exercise

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%.

```
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
================================
```

Summary

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)
```