U.S. DEPARTMENT OF ENERGY'S
CYBERFORCE® PROGRAM

CyberForce® 101

Python

October 2023

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Python 101

Data Types

There are 5 main data types that Python uses for variables. These are Integer, Float, Double, Boolean and String.

Data Type	Meaning	Example
int	An Integer in python is the same as it is in math, a whole number.	`Num= 5`
Float	Floats are numbers that can have decimal points that take less storage than Doubles because they can only have 7 digits and 32 bits.	`Num= 1.23456`
Double	Doubles take up more storage than Floats because they are numbers that can have decimals, but they can have 15 digits and 64 bits.	`Num= 1.23456789`
Boolean	Booleans are binary so they can only represent one of two values, True and False.	`Var= True`
str	Strings are the default variable because any of the previous data types can be type cast as a string. They mainly consist of alphabetical characters and words.	`Var= "Hello World"`

Print and Input

Showing users information (printing) is done by using the print function.

```
print("Hello World")
```

Getting information from the user is done by using the input function.

```
Var= input("Enter a character: ")
```

The input function automatically categorizes the user input as a string, so it is important to type cast the variable.

```
Num= int input("Enter an integer: ")
```

If/Else Statements

If statements follow a formula of the word “if” followed by a Boolean qualifier and a block of code.

```
if 5<10:
   print(“5<10”)
```

The statement “5<10” is a Boolean qualifier because it can only be True or False. Since this statement is true, the computer will execute the indented code that follows it. However, if the qualified statement was false, the rest of the statements would be ignored.

If there is an else statement and the initial if statement is false, the code in that else statement is carried out.

```
if 5>10:
   print(“5>10”)
else:
   print(“5<10”)
```

The else acts as a catch all for if the previous statements. If they are all false, then the code in the else statement is executed.

An elif statement can also be added. If the initial if statement is false then the system moves to the first elif statement (there can be multiple). If that condition is true, the elif code is carried out. If not, the system moves to the next statement (elif, else or the end of the loop).

```
if 5>10:
   print(“5>10”)
elif 5<10:
   print(“5<10”)
else:
   print(“5=10”)
```

The statement “5>10” is false, so the system moves to the elif statement. Since the statement “5<10” is true, the system executes that code and skips the else statement. If the elif statement was false, the system would skip that section of code and execute the else statement.

Loops

There are 2 main loops that are used in Python: For loops and While Loops.

For loops repeat a piece of code a set number of times. This loop automatically increments by one to avoid an infinite loop. The format is the word “for”, a variable name, the word “in” and a range of numbers.

```
for I in range(0,10):
  print(“Hello World!”)
```

While loops repeat a section of code while a condition is true. It is important to increment the variable in the condition to avoid the creation of an infinite loop. The standard format is the word “while” followed by a qualified statement similar to an “if statement".

```
while i<10:
  print(“Hello World!)
  i+=1
```

Arrays: lists and tuples

An array is a collection of values in one variable. There are two main types of arrays: lists and tuples. The main difference between them is that tuples are immutable. This means that once a tuple is defined it cannot be significantly changed. They can be sorted, but no values can be added or deleted. However, lists are mutable. They can have values added, deleted and moved.

To create a list is similar to the creation of any other variable. The values are inside brackets and separated by commas.

```
Words= [“Hello”, “World”, “Nice”, “To”, “Meet”, “You”]
```

There are several inbuilt functions that can make it easier to manipulate “lists”. Some of these are append(), del, sort(), reverse().

```
Words.append(“!”)
del Words[6]
Words.sort()
Words.reverse()
```

To create a tuple, it is the same as a list, but the values are inside parenthesis instead of brackets.

```
Colors= ("Red”, “Blue”, “Green”, “Yellow”)
```

It is also important to remember that Python, like most programing languages, begins indexes at 0.

Files

Files are an important part of programing. The 3 most important functions when working with files are open(), write() and close(). To work with a file, it must be opened. This function can take up to two parameters. The first is the name of the file and the second is the mode the file will be in. If no mode is specified, the default is ‘r’ (reading mode). It is also very important to close the file before running the program to avoid corruption.

The syntax for the 3 functions is:

```
fileName= open(“File.txt”, “w”)
fileName.write(“Hello World!”)
fileName.Close()
```

This is a chart of the main modes.

Mode	Function
r	Read the file
w	Write to the file (edit/change the contents) and overwrites what was previously in it. If the file does not already exist, it creates a new one.
r+	Reads and writes to a file.
w+	Writes and reads to the file (edit/change the contents) and overwrites what was previously in it. If the file does not already exist, it creates a new one.
a	The appends to a file (the same as writing but it doesn't overwrite the contents and cannot create a new file)

Sources

- https://www.python.org/about/gettingstarted/
- https://www.w3schools.com/python/python_conditions.asp