Programming 101

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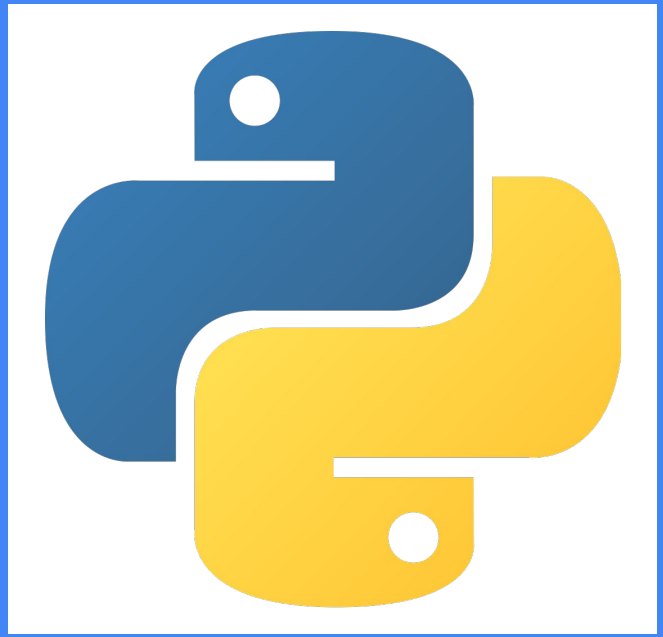


repl.it

- Go to repl.it and create an account
- This website will allow you to create and run programs online
- Multiplayer feature allows your team to collaborate on a program
- Make a new repl

Program file

- The white half of the screen labeled “main.py” is your program file
- This is where you will type all of your code
- For now we will write our first line of code

```
print(“Hello world!”)
```

- We will explain more about this command later

Console

- The console is the black half of the screen
- This is where any information that you print will appear after you run the program
- Click the green “run” button. You should see `Hello World` appear in the console

Print Statements

- The easiest way to output anything or communicate with the user is to use a print statement
- In python, we do this through the use of the **print()** function

```
print(“hi”)
```

Data Types

- **string** - a line of symbols, usually used to express words
  - Ex: “hello” ‘a’ “$ % & #” “54321”
  - Can contain symbols, numbers, spaces, letters
  - Cannot not do math with strings Ex: “5”/”3” = ERROR
- **int** - a whole number
- **float** - a decimal
- **boolean** - True or False (always capitalized)

YOU CANNOT COMBINE DIFFERENT TYPES: “4” + 3 = ERROR

Combining Strings - Concatenation

- To combine strings, you would use the **+** operator
- ‘Grand’ + “mom” equals “Grandmom”
- This is known as string concatenation

```
print(“Happy” + “Birthday”)
```

You cannot concatenate a string and a number

Operators

- Addition (+)
- Subtraction (-)
- Multiplication (*)
- Division (/)
- Integer division (//)
  - Gets rid of the remainder
- Modulus (%)
  - Gets only the remainder

```
print(5 + 2) → 7
print(5 - 2) → 3
print(5 * 2) → 10
print(5 / 2) → 2.5
print(5 //2) → 2
print(5 % 2) → 1
```

Variables

- Variables are names that store values
  - Can store any data type (string, int, etc), other variables, and more
- Giving a variable a value is known as **assignment**

```
num = 4
```

Getting input

- To get data from the user, use the **input()** command
- You can give the user a message about what they should input by putting text in between the parentheses
- You can store what the user inputs in a variable
  - Input is always stored as a string

```
name = input("Please enter your name: ")
print(name)
```

Converting variable types

- You cannot add strings and integers together
- To convert from string to int, use the **int()**
  - int(“3”) → 3
- To convert from int to string, use the **str()** command
  - str(3) → “3”

```
print(str(1) + “1”) → 11
print(1 + int(“1”)) → 2
num = int(input(“Enter a number: ”))
```

Practice Program

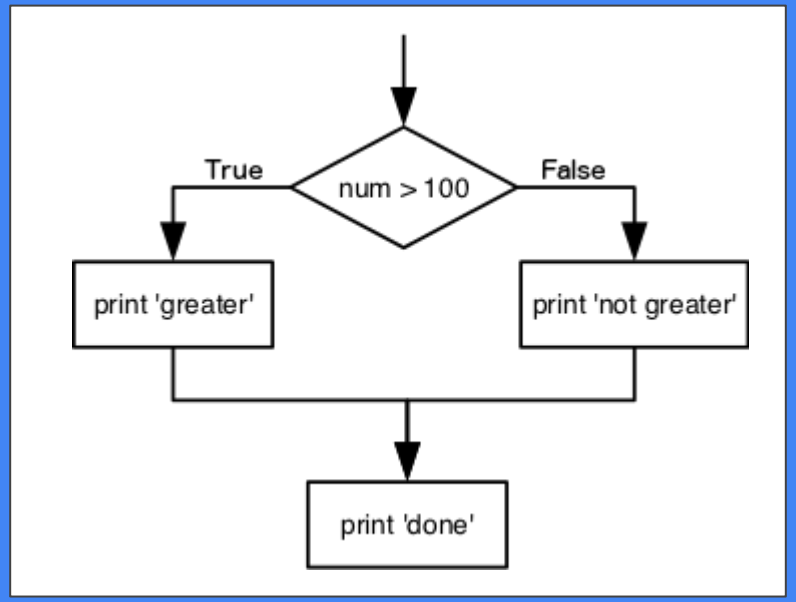
Create a program which takes input in Celsius and converts it to Fahrenheit

- Use this formula to convert
  - **1.8*Celsius + 32**

SAMPLE OUTPUT:

```
Enter the temperature (Celcius):  22
Temperature in Fahrenheit: 71.6
```

Conditionals



Boolean & Relational Operators

- Used to compare the values of two numbers or variables
  - Use **==** to check if two values are equivalent
  - Use **>**, **<**, **>=**, **<=** to compare values
  - Use **!=** to check if two values are ***not*** equal

```
x = 3
y = 4
print(x >= y) → False
```

Logical Operators

- There are 3 logical operators: **or**, **and**, **not**
- OR - requires one of the two statements to be true for the overall statement to be true

  `print(True or False)` → **True**
- AND - requires both statements to be true for the overall statement to be true

  `print(True and False)` → **False**

More Logical Operators

- NOT - makes a boolean the opposite
  - A practical application of this is checking if something is not True

    `print(not(True))` → **False**
- These logical operators are mostly used in if statements

```
if(not(guess == num) and triesLeft > 0):
   print(“HI”)
```

if statements

- 2 parts: a **condition** (in parentheses) and a **body** (indented)
  - The code in the body only runs only if the condition is TRUE
- After the condition, you need a colon(:)

```
if(bool):

    print(“It’s true”)
```

- The print statement would execute only if the variable `bool` in the parentheses is True. If `bool` is False, the block of code is skipped

If/Else Statements

- An else statement will only run if the condition is FALSE
- The `else` should match the indentation of the `if` and should also be followed by a colon

```
if(9+9 == 17):
   print(“It is true.”)
else:
   print(“It is false.”)
```

- The above statement would output “`It is false`.”

If/Elif/Else

- **Elif** (short for else if) operates similar to a second if statement
  - Executes only if first if statement is not met, so ORDER MATTERS
- An if statement can have only one else block, but it can have many elif blocks

```
if(num > 100):
    print(“Too big”)
elif(num > 50):
    print(“Just right”)
else:
    print(“Too small”)
```

- What would output if num = 70? If num = 100? If num == 30?

Nested If Statements

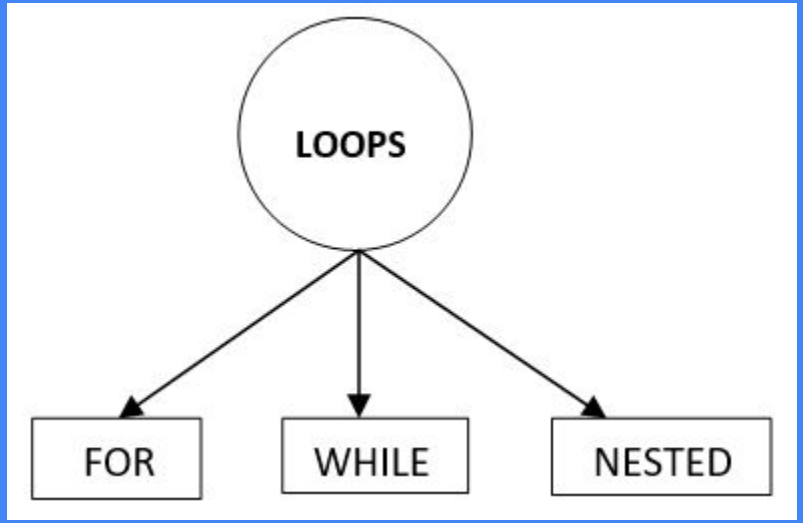
- Putting an if statement inside another if statement is known as a nested if statement

```
if(condition1):
    if(condition2):
        print(“Hi”)
```

- The code would output `Hi` only if condition1 and condition2 were true
- Alternatively , you could use a statement with **and** to do the same

```
if(condition1 and condition2):
```

Loops and Lists



Advanced Operators

- The increment operator is commonly used in loops
- The operator += will increment a variable
  - `x += 2` is equivalent to `x = x + 2`

```
num = 3
num+=1
print(num) → 4
```

- You can also use `-=`, `*=`, and `/=`

Intro to Loops

- Loops will run the same block of code multiple times
- Two basic types of loops: **while** loops and **for** loops

- While loops are **indefinite** loops - no set number of repeats
- For loops are known as **definite** loops - you specify how many times the code will repeat

While loops

- While loops work in a similar way to an if statement
- The body will continue to run and repeat itself until the condition is false
- Don’t forget to increment `i` or the code will run forever!

```
num = 0
choice = “n”
while choice == “n”:
    choice = input(“Enter n to keep incrementing: “)
    num+=1
```

For Loops

- To get your loop to run a certain number of times, use the **range()** function
  - This code will run 10 times

```
for i in range(10):
```

- Don't forget the **:** and the indent on the next line, just like an if statement
- `i` is the iterator - a number that will start at 0 and end at **one less than** the number in the parentheses

```
for i in range(10):
    print(i)
```

→ **0, 1, 2, 3, 4, 5, 6, 7, 8, 9**

- Notice that the for loop **increments automatically**

Lists

- A list is a type of variable that can store multiple values
  - A list can store ints, strings, and even other lists
- You can initialize an empty list or a list with predetermined values

```
fruits = []
fruits = [“apple”, “orange”, “grape”]
```

- Lists also have indices similar to string

`print(fruits[0])` → **“apple”**

List functions

- `Replace myList with the name of your list!`
- **`len`**`(myList)` - returns the number of items in myList
- `myList.`**`append`**`(val)` - adds val to the end of the list
- **`min`**`(myList)` - returns the minimum value in a list
- **`max`**`(myList)` - returns the maximum value in a list
- **`sort`**`(myList)` - sorts the values in the list (lowest to highest)
- **`insert`**`(index, val)` - inserts val into myList at the specified index

For-Each loops

- You can use a For loop to loop through each element in a list (using `in`)

```
fruitBowl = [“apple”, “orange”, “grape”]
for fruit in fruitBowl:
    print(fruit) →
```

apple
orange
grape

- `fruit` (in this case) represents each element in the list during one run of the code in the loop, so the loop will print out each item in the list. You can rename it to whatever seems appropriate.

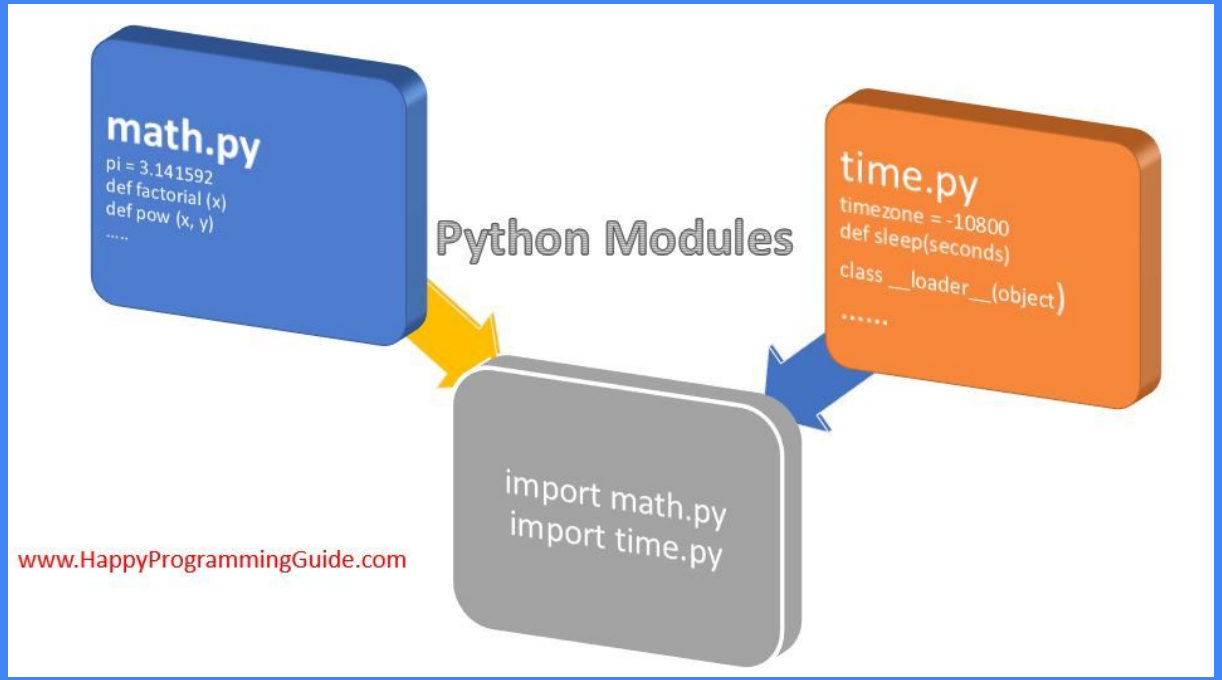
Practice Program: Small Shop

Use a loop to make a small shop program that sells two items

- Loop while user does not enter -1
- Add product if they type 1 or 2
- Do nothing if they type another number

```
--Welcome to Fruit Shop--
We sell:
1. Apples - 1.26 ($)
2. Oranges - 1.51 ($)
-----
Product number: 1
Added one apple to your cart
Product number: 2
Added one orange to your cart
Product number: 3
Product number: -1
Your total is: 2.52 ($)
```

Importing Modules



Importing Modules

- Python does not have more advanced mathematics built into it
- To access them, you can import libraries or **modules** of additional information
  - Two of the most common are **math** and **random**
- Importing is usually done at the top of the program and looks like this:

```
import math, random
```

The Random Module

- The random module allows your program to generate random numbers
  - Random number - **random.randint(min, max)**
  - Random choice from list - **random.choice(myList)**
- To access these functions and variables, you have to type the name of the module (random), then a period followed by the name of the function (.choice())

Project 0: Guess the Number

Write a program where the computer generates a random number between 1-50 and the user will try and guess what the number is. The program should output whether their guess is correct, too high, or too low.

SAMPLE OUTPUT:

```
Guess a number between 1 and 50:  17
    Too low. Try again.
Guess a number between 17 and 50:  36
    Too high. Try again.
Guess a number between 17 and 36:  24
    Correct! Great job!
```

Bonus step: Give the user a limited number of guesses

Project 1: Rock, Paper, Scissors

Write a program where the user plays versus a computer. The computer will randomly generate either Rock, Papers, or Scissors, and the program will ask the user which option they will pick.

SAMPLE OUTPUT:

```
Rock, Paper, Scissors, SHOOT!
     What do you pick? scissors


Cpu: Paper        You: Scissors
- - - - - You Win! - - - - - -
```

Bonus Step: Allow the user to play again when finished.