Class 2 - Functions and Conditionals

MISE Summer Programming Camp 2023

Recap of Class 1

- **Print statements**
  - Printing text eg. print (“Hello World”) => ‘Hello World’ in the shell
  - Printing the value of variables eg. x = “Hello”; print(x) => ‘Hello’ in the shell
  - Doing simple math eg. print (2 + 3 * 5) => ‘17’ in the shell
- **Taking input from the user**
  - Eg. name = input() => allows the user to type in something that gets stored in the variable ‘name’ after the user hits enter.
- **Basic data types**
  - Integer, float, string and boolean.
  - *type()* function - allows the user to know the type of an expression.

Some math operations

Comment!

```
a + b  # Summation
a - b  # Subtraction
a * b  # Multiplication
a / b  # Float division
a // b # Integer division (rounds down)
a % b  # Modulus/Remainder operator
a**b   # Power operator
```

Comparison Operators

- **== (Equality)**
  - Note: Equality is == because = is used for assigning to variables
- **< (Less than)**
- **<= (Less than or equal to)**
- **> (Greater than)**
- **>= (Greater than or equal to)**
- **!= (Inequality)**

These operators compare two things and evaluate to a boolean ie. either True or False.

Demo

Learning goals:

1. Comparison operators
2. Working with Booleans

main.py

Run

Shell

```python
print(3 == 3)
print(3 == 5)
a = 18; print(a)
print(a < 21)
print("Hello" == "Hello")
print("Hello" == "HellO")
print(2+5*3 >= 20)
print(7 != 42)
print(True == False)
```

```
True
False
18
True
True
False
False
True
False
>
```

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Pop Quiz 1:

What is the output of the following program:

```
print("True" == True)
print("3+3" == 6)
print(int(False) == 0)
```

Boolean Operators (and, or, not)

Let X and Y be boolean expressions.

- *X and Y* evaluates to True if X evaluates to True and Y evaluates to True. It evaluates to False otherwise.
- *X or Y* evaluates to True if either X evaluates to True or Y evaluates to True. It evaluates to False otherwise.
- *not X* negates the value of X.

Demo

Learning goals:

1. Boolean operators
2. Using comparison and boolean operators together

main.py

```
print(True and True)
print(True and False)
print(True or False)
print(False or False)
print(not True)
print(not not True)
```

Shell

```
True
False
True
False
False
True
>
```

main.py

```
print(3 < 5 and 8 > 2)
print(10 > 2 and False)
print("Hello" == "Hell0" or 5 == 7)
print(not("10" == 10))
```

Shell

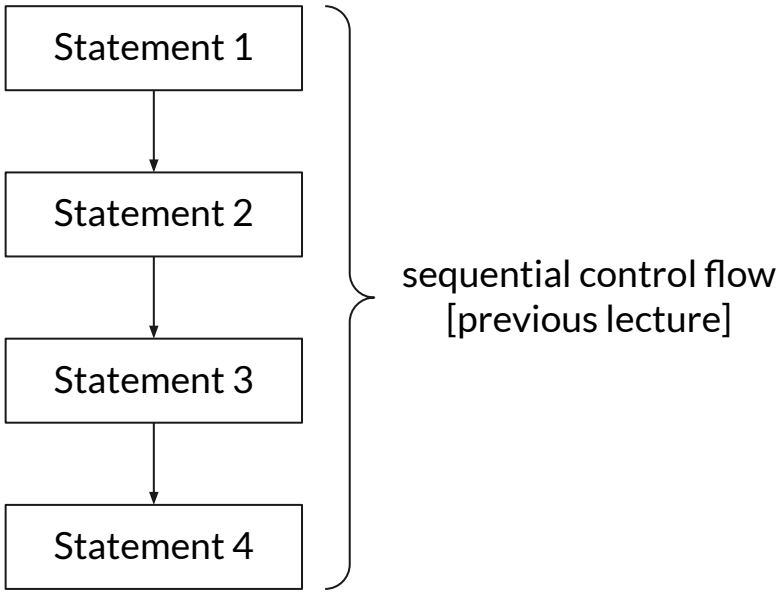
```
True
False
False
True
>
```

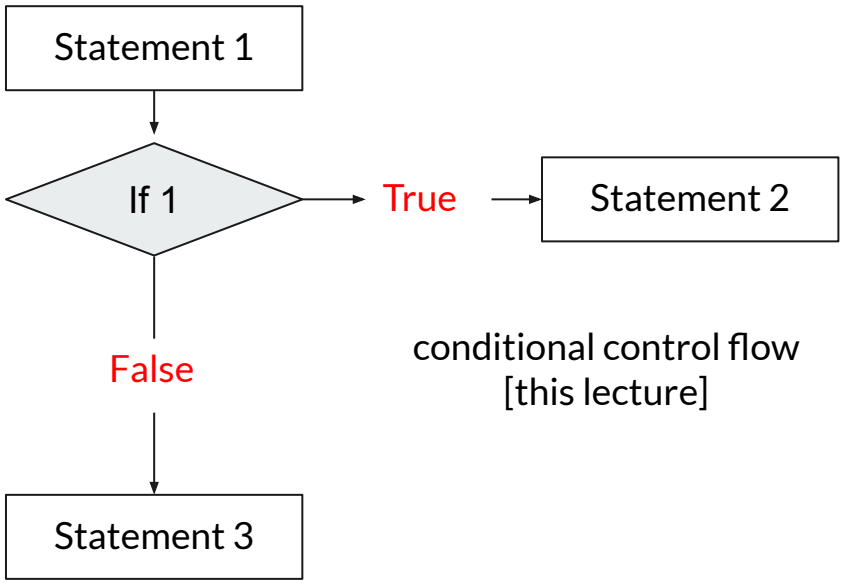
Pop Quiz 2:

Which of the following would result in an output of "True" for this program (possible multiple answers):

```
1  print((a < b) or (b > c and a > c) or a == d)
```

Control Flow





If-Statements

If statements are responsible for allowing certain lines of code to be run only when a certain condition is met.

For example, code lines 1 and 2 will only be run when 'condition' evaluates to True.

Note: The indentation (1 tab / 4 spaces) of the code lines under the if statement is important!

Indented lines denote lines that are guarded by the if statement.

Syntax:

```
if (condition):
    Code line 1
    Code line 2
...
```

If-Else Statements

```
if (condition):
    Code line 1
else:
    Code line 2
```

If-else statements can interpreted as follows:

If condition is true, then run code line 1. Otherwise, run code line 2.

Again, indentation here is important!

main.py

Run

```
if (10 > 3):
    print("10 is bigger than 3")
if (8 < 2):
    print("8 is smaller than 2")
print("We love math")
```

Shell

```
10 is bigger than 3
We love math
>
```

main.py

Run

```python
if (5 > 4):
    print("5 is bigger than 4")
else:
    print("5 is smaller than 4")
print("We love math")

if (8 == 2):
    print("8 is 100% equal to 2")
    print("Anything is now possible")
else:
    print("Math is working as expected")
```

Shell

```
5 is bigger than 4
We love math
Math is working as expected
>
```

If-Elif-Else Statements

```
if (condition 1):
        Code line 1
elif (condition 2):
        Code line  2
else:
        Code line 3
```

If-elif-else statements can interpreted as follows:

If condition 1 is true, then run code line 1. Otherwise, if condition 2 is true, then run code line 2.

Otherwise, run code line 3

Again, indentation here is important!

Note: You can have as many elifs as you want!

main.py

Run

```python
if (4 > 4):
    print("4 must be bigger than 4")
    print("My genius frightens me sometimes")
elif (4 < 4):
    print("4 must be smaller than 4")
    print("IMO Gold medal here I come")
else:
    print("4 is equal to 4")
    print("Makes sense I guess")
print("We love math")
```

Shell

```
4 is equal to 4
Makes sense I guess
We love math
>
```

Pop Quiz 3:

Which of the following computes whether a variable *a*, which is always the integer 0, 1, 2 or 3, is even or odd:

Code 1

```
if not(a == 1 or a == 3):
    print("odd")
else:
    print("even")
```

Code 2

```
if a == 0 or a == 2:
    print("even")
else:
    print("odd")
```

Code 3

```
if a != 1 or a != 3:
    print("even")
else:
    print("odd")
```

Code 4

```
print("even" if a == 0 or a == 2 else "odd")
```

Grouping code into functions

```
1 def simpleFunction(x):
2     print(x)
3     print(x)
4
5 simpleFunction("Hello!")
```

Anatomy of a function

def *func(parameters):*

parameters are variables that will be provided when the function is called

body

return X

contains the actions (statements) that the function performs returns a value (optional)

indent

Simple example of a function

```python
def double(x):
    # This function doubles a number
    print("Doubling a number!")
    return 2 * x

print(double(4))
```

We define a function called double that takes *one* parameter and returns its double

To use the function, we use this syntax, similar to how a function in math is used

```python
def f(x, y, z):
    return x + y + z

print(f(1, 3, 2)) # Prints 6
print(f(1, 2)) # WRONG! Needs 2 parameters
```

```python
def g():
    return 42

print(g()) # Prints 42
```

```python
def h(x, y):
    if x > y:
        print("x is greater than y")
    elif y > x:
        print("y is greater than x")
    else:
        print("x and y are the same!")

h(4, 5)
h(5, 4)
h(5, 5)
```

Variable scope

```
1 def f(x):
2     y = 5
3     return x + y
4
5 print(f(4)) # Prints 9
6 print(x) # Crashes!
7 print(y) # Crashes!
```

Variables defined in the body of a function definition are only defined inside the indented block!

In the code on the left, the two last print statements will crash because we never defined a variable *x* or *y* in that scope.

Pop Quiz 4:

What is the output of the following program:

```
def max(a, b):
    if a > b:
        return b
    b = 2
    return a

a = 5
b = 10
print(2 + max(2, 3))
print(a)
```

Another example

```python
def f(x):
    print("In f, x =", x)
    x += 7
    return x - 1

def h(x):
    x += 3
    return f(x+4)

x = 5
print(x)
print(f(x))
print(h(x))
print(x)
```

What's the output of the code on the left?

Visualize here: https://shorturl.at/etNS2

What's next?

Homework will be posted on Piazza by tomorrow!

Class 3: Loops

How to write code that repeats instructions

How to iterate through the input