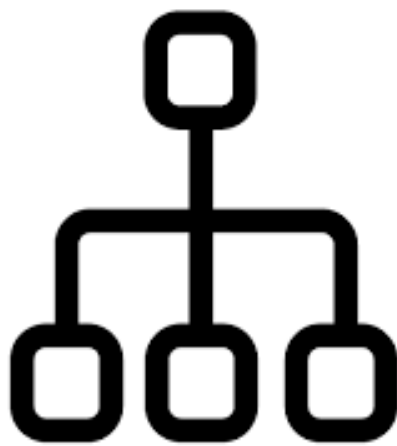


# Computer Science Programming Fundamentals

## Control Flow



# 💡 Control Flow Intro

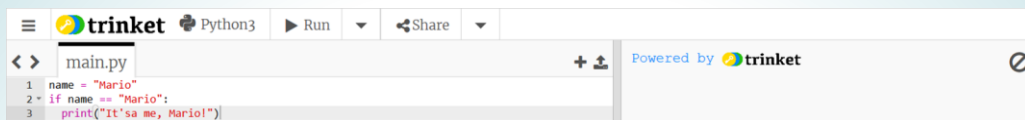
An umbrella is a nice thing to have, but do you use an umbrella every time you go outside? Of course not! If it's raining, you'll most likely want to use it. Otherwise, you don't need to.

Some parts of computer programs are like umbrellas. We only use them when we need them. How do we tell Python when to run what?

In this lesson, we'll learn how to use if statements to decide whether to run certain parts of the code.

# Control Flow pt 1

- Run the code in the example.



```
1 name = "Mario"
2 if name == "Mario":
3     print("It's a me, Mario!")
```

Right now, the code outputs a message. But what if we change the value of name to "Luigi?"

- Change the variable like so, then run the code again:

```
name = "Luigi"
```

**Q: Why wasn't there any message?**

**A:** Because we used an if statement. In this code, Python tests the variable `name` and only prints a message if its value is "Mario."

# Control Flow pt 2

What if we want a different message to appear if name is not "Mario"?

- Run:

```
name = "Luigi"
if name == "Mario":
    print("It'sa me,
Mario!")
else:
    print("I'm not Mario
;_;" )
```

Now, the green code will only run if name is "Mario." If name is anything else, the blue code will run.

When we are testing something, for example `name == "Mario"`, we use TWO equal signs. When we **assign** a value to a variable, we only use one equal sign.

# Control Flow pt 3

Indentation tells Python if a line of code is inside an if statement or not.

- Run:

```
num = 1
```

```
if num == 2:
```

```
    print("That's 2 many! Get it?")
```

```
    print("... I'll show myself out.")
```

- Now, change the code so that the second print statement is flush with the if statement, like so:

- Run:

```
num = 1
```

```
if num == 2:
```

```
    print("That's 2 many! Get it?")
```

```
print("... I'll show myself out.")
```

# Control Flow pt 4

This code runs the second print statement every time because it is outside the if statement.

You can put if statements inside other if statements.

- Run:

```
first_name = "John"
```

```
last_name = "Baker"
```

```
if first_name == "John":
```

```
    if last_name == "Lennon":
```

```
        print("You are a music legend.")
```



# Control Flow pt 5

You can also link tests together with the words `and` and `or`. `and` requires both tests to be true for the test to be true. `or` requires only one to be true. These words are called **logical operators**.

- Run:

```
first_name = "John"
```

```
last_name = "Williams"
```

```
if first_name == "John":
```

```
    if last_name == "Lennon" or  
    "Williams":
```

```
        print("You are a music  
legend.")
```

- Run:

```
first_name = "John"
```

```
last_name = "Williams"
```

```
if first_name == "John" and last_name  
== "Williams":
```

```
    print("Your music is in many  
movies.")
```

# Control Flow pt 6

How much would you pay for a coffee?  
Anything less than \$1 USD is great!

- Run:

```
price_usd = input("Enter USD Price: ")  
price_usd = float(price_usd)
```

```
if price_usd < 1:  
    print("Great!")
```

Between \$1 and \$3 USD is normal.

- Add this to the above code:

```
if price_usd >= 1 and <= 3:  
    print("That's normal.")
```

**>=** means equal to or greater than.

**<=** means equal to or less than.

More than \$3? Then...

- Add this to the above code:

```
if price_usd > 3:  
    print("This coffee better be good!")
```



# Control Flow pt 7

You can divide by any number, except zero. If you ever make a division-only calculator for some reason, it might look like this:

- Run:

```
print("num1 / num2")
num1 = int(input("Enter num1: "))
num2 = int(input("Enter num2: "))
if num2 != 0:
    print(num1 / num2)
else:
    print("You can't divide by zero!")
```

Remember to **change the strings to ints!**  
You can do this on the same line where you create the new variable.

`==`, `<`, `>`, `!=`, `<=`, and `>=` are called **relational operators**.

# Control Flow pt 8

- Run:

```
height = 89
```

```
if height >= 90 and height < 250 :
```

```
    print("You can ride the ride!")
```

```
if height < 90:
```

```
    print("You're too short to ride the  
ride.")
```

```
if height > 250:
```

```
    print("... you're actually too tall  
for this ride.")
```

**Q:** If height is less than 90, can it also be more than 250 at the same time?

**A:** No way! This means that the last test isn't necessary for every height. Let's make a few small changes to our program so Python doesn't have to do more work than it needs to.

# Control Flow pt 9

- Run:

```
height = 89
```

```
if height >= 90 and height < 250 :
```

```
    print("You can ride the ride!")
```

```
elif height < 90:
```

```
    print("You're too short to ride the  
ride.")
```

```
else:
```

```
    print("... you're actually too tall  
for this ride.")
```

## Q: What changed?

**A:** The second `if` is now `elif`, which means "else if." An `elif` test will only happen if the test before it comes back false.

Also, the last `if` is now `else`. If the first two tests come back false, then `height` has to be 250 or more. No test needed!

# Control Flow pt 10



## Activity:

- Let's make a robot that plays rock, paper, scissors. It will ask the player for a number called `num` from 1 to 10, then ask if the player chooses rock, paper, or scissors.

Based on the value of `num`, the robot will choose rock, paper, or scissors.

Your job is to decide how the robot will use `num` to choose rock, paper, or scissors.

- Challenge your friends to see if they can figure out the pattern and beat the robot every time!

Example Pattern:

If `num`  $\leq 3$ , choose rock.

If not, check to see if `num`  $\leq 6$ . If so, choose paper.

Otherwise just choose scissors.

The pattern for the robot on the next page is:

If `num` is even (a multiple of 2) and greater than 5, choose rock.

If not, choose paper if `num` is odd and greater than 5.

Otherwise just choose scissors.

Save your code, as we'll be using it again!

## Example:

```
num = int(input("Enter a number between 1 and 10: "))
choice = int(input("Enter 1 for Rock, 2 for Paper, 3
for Scissors: "))

if num % 2 == 0 and num > 5:
    print("Robot chooses Rock.")
    if choice == 1:
        print("It's a tie!")
    elif choice == 2:
        print("You win!")
    else:
        print("You lose!")
elif num % 2 != 0 and num > 5:
    print("Robot chooses Paper.")
    if choice == 1:
        print("You lose!")
    elif choice == 2:
        print("It's a tie!")
    else:
        print("You win!")
else:
    print("Robot chooses Scissors.")
    if choice == 1:
        print("You win!")
    elif choice == 2:
        print("You lose!")
    else:
        print("It's a tie.")
```

! Remember that if  $\text{number} \% x = 0$ , that means number is a multiple of  $x$ .