Welcome to Coding!

Lesson 1: Coding Basics

Brought to you by the University of Maryland Balloon Payload Program

Why Learn to Code?

My story of automating business invoices & emails

- It took 6 hours of work to code my tool
- It saved time and money for a small music business
- ***That means my boss would rather pay me to write code than pay someone to send invoices.***

Endless problems to solve => Coding is Valuable!

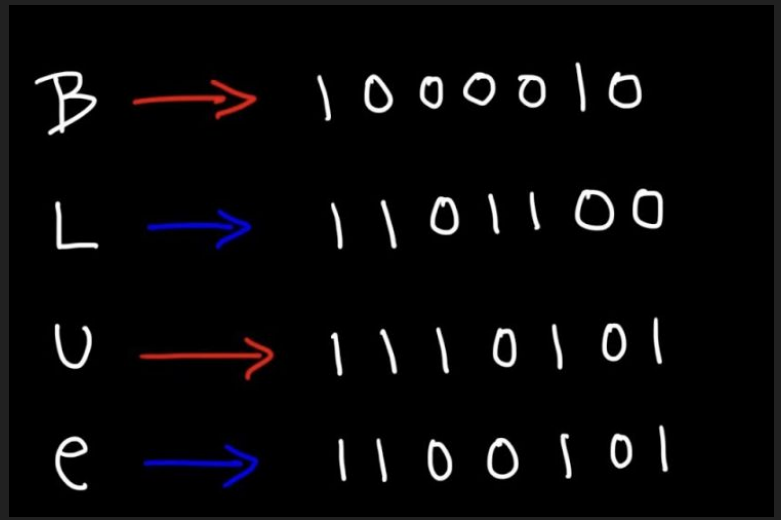
How Do Computers Operate?

Digital means it uses numbers (digits) to make decisions

- On a computer, everything is stored as long lines of 1's and 0's
- Controlling the 1's and 0's means you control the computer
- Instructions, numbers, letters, and even pictures are just 1's and 0's

We call it ***'Binary'***

Binary converter



What Is A Coding Language?

The middle-man between **binary** (1's and 0's) and **human instructions**.

- A language is a list of commands you can give a computer
  - Just like English is a list of words you can give to a person

The computer will follow your commands one at a time, in order, and it will never do anything else.

- Tie your shoe

A website to code on:
pythonsandbox.com
Everything Available Here:
ter.ps/stemworkshop
nearspace@ssl.umd.edu

What is Python?

Finance, Management, Websites, Automation, & NASA

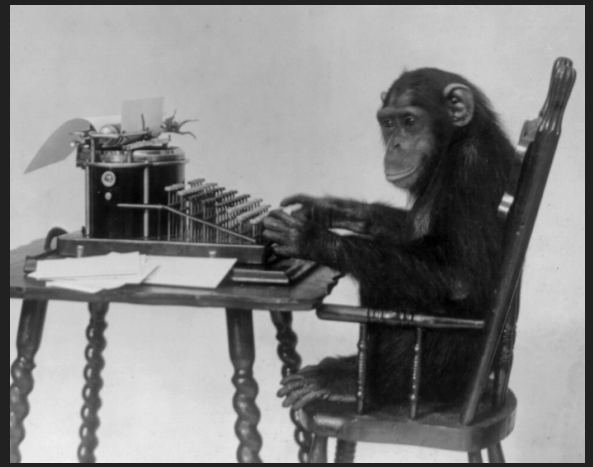
Google → repl.it

Print Statement

Syntax: print(message)

Example (try it): print(“Hello World”)

Or, print numbers: print(10)



The print statement displays messages in the console (area on the right).

If you use quotations, it will output the **String** (Word/phrase) inside!

Let’s Talk About Data

In a coding language, you need to work with data - but data comes in different types:

- Integer: 1, 2, 3, 4, 5, …
- Float: 1.5, 20.2, 100.12354, 3.1415, …
- Character: ‘a’, ‘b’, ‘c’, …
- String: ‘Hello World’, ‘abcdefg’, …
- Boolean: True, False

The computer has trouble doing some things with certain data types. We will see that:

5 + 5 is obvious

‘a’ + ‘b’ is less obvious

True + False makes no sense

Practice

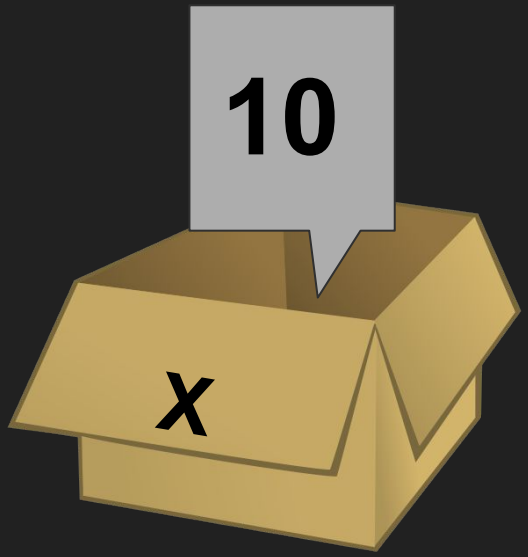
What is each data type?

7.4	Float
1.2	Float
1000000000	Integer
-12	Integer
False	Boolean
“False”	String
“4.5”	String
[1,2,3]	List
(1,2,3)	Tuple

What is a Variable?

A variable can take any data, and have any name

It's like a labeled box that holds whatever you put into it.



X = 10 Variable called "X", with **integer** value 10

word = "Hello" Variable called "Word", with **String** value "Hello"

OR:

X = "Hello" Variable called "X", with **string** value "Hello"

word = 10 Variable called "word", with **integer** value 10

The variable name should help you

Variable ‘Initialization’ = Creating Variables

When you create a variable, Python will assign it a type. In other programming languages, you have to specify the type yourself.

Examples:

Int: x = 20

Float: x = 20.5

String: x = “Hello World” **OR** x = ‘Hello World’

List: x = ["apple", "banana", "cherry"]

Boolean: x = True

Data Types	Operators
- **Numeric types:** int, float, complex	→ +/- , range(int:int), abs(), *, /
- **Text types:** str	→ len(), upper(), lower()
- **Boolean types**: bool	→ ==
- **Sequence types:** tuple, range, list	→ + , len()

Variable Example

Try typing in this code:

```
word = “Hello everyone”

print(word)
```

```
word = 5280

print(word)
```

User Input

Syntax: input(message)

Example (try it): input(“Input your name:”)

The user input statement is similar to the **print** statement, while also asking for the user to put in an answer.

The next thing typed in will be the input.

User Input Example

Try typing in this code:

```
word = input(“Input your name:”)

print(word)
```

After running the code, input your name!

What prints out?

Another User Input Example

```
x = input(“Enter a Number:”)

print(x + 7)
```

What do you expect to see?

What happened?

Type Casting: Changing Data Types

How can we switch between data types?

Example: Integer to String

```
A = 5

B = str(A)

print(B + B)  % output is “55”
```

Example: Integer to Double

```
A = “5”

B = int(A)

print(B + B)    % output is 10
```

Libraries

Pre-written code we can import and use without needing to write ourselves

Almost all work in coding uses libraries - they are very useful!

Common libraries and uses:

- Numpy: additional tools for lists, tables, etc.
- Matplotlib: plotting and creating graphs
- Pandas: data analysis
- PyTorch: machine learning and AI

We will be using the Random library…

Random Numbers

Syntax: random.randint(starting number, ending number)

General form: library.operator(components)

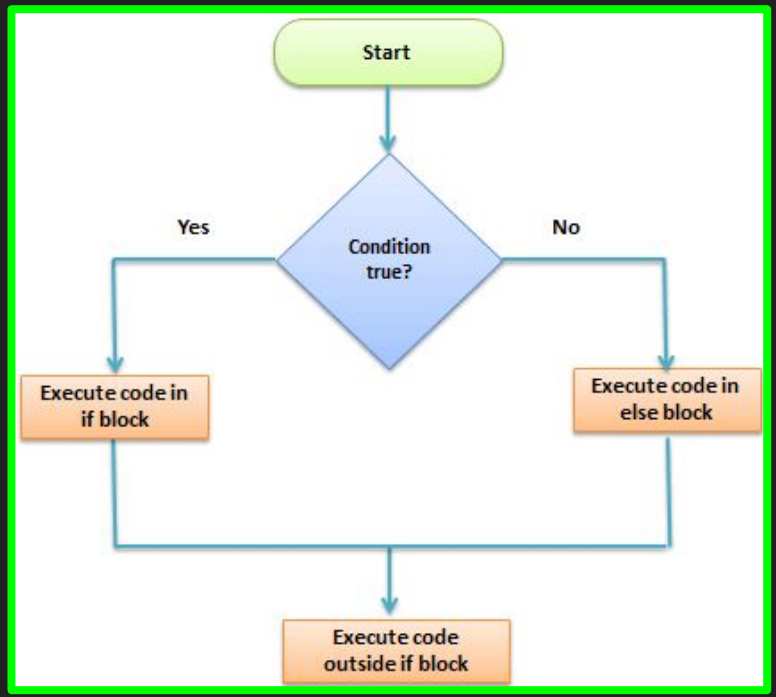
Chooses a random number from the starting number to the ending number.

So: random.randint(1, 3) will give us either 1, 2, or 3.

‘Conditional Statements’: Computer making choices

- Conditional statements: carry out a certain task based on *if something else happens*
  - e.g. if statements, if-else statements

- Indentations: used to define blocks of code (in conditional statements)
  - You can create an indentation by using the “Tab” key

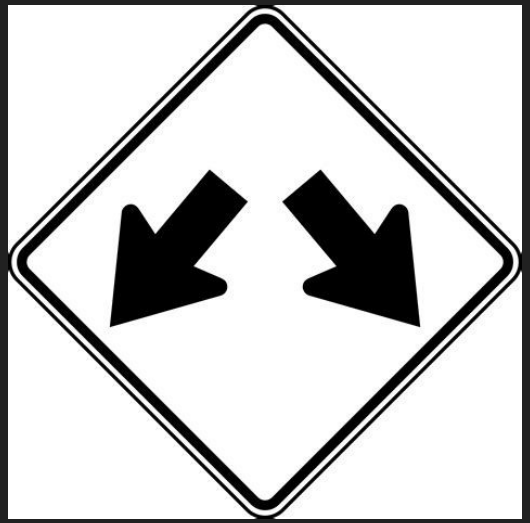


“If” Statement

This is an incredibly important logic statement. If the condition is true, it will perform the statement inside:

```
if (condition):
    Statement
```

(note the indentation)



“If” examples

```
num1 = 5

if (num1 == 6):

    print(“Hello Friend”)
```

```
num1 = 6

if (num1 == 6):

    print(“Hello Friend”)
```

Note: “=” means “make this equal this”, and “==” means “is this equal to this?”

“Else if” Statement

This is the next step after the “if” statement. The computer will first check the “if”, then check each “else if” so you can check multiple conditions at once!

```
if(condition):
    Action
elif(another condition):
    Another action
```

“Else if” Example

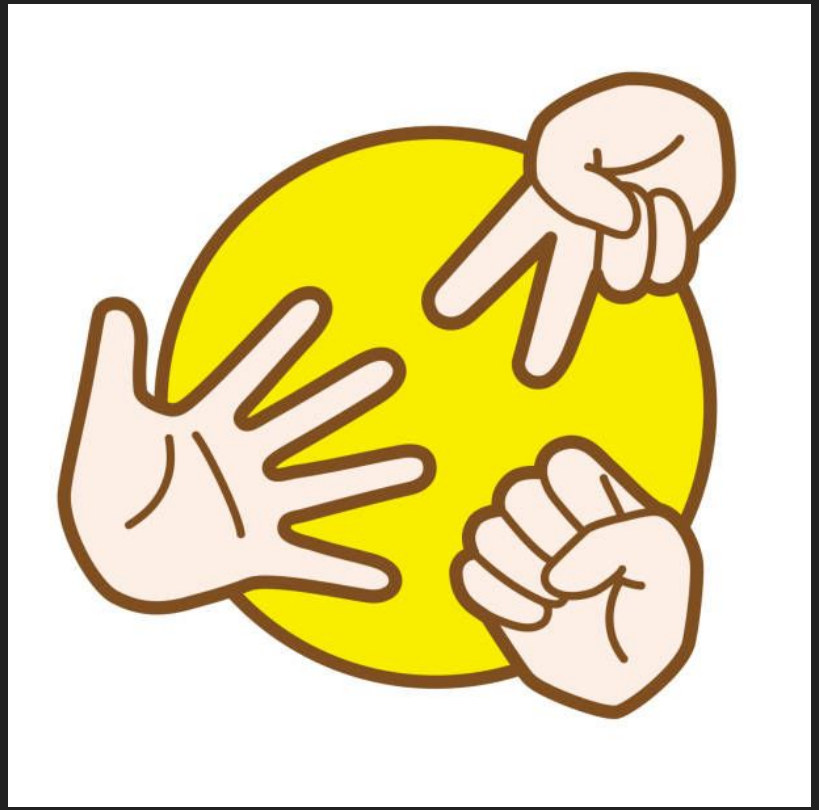
```
num1 = 5

if(num1 == 4):
    print(“Howdy partner”)
elif(num1 == 5):
    print(“Hello, friend”)
```

```
num1 = 4

if(num1 == 4):
    print(“Howdy partner”)
elif(num1 == 5):
    print(“Hello, friend”)
```

Now let’s make a simple application!

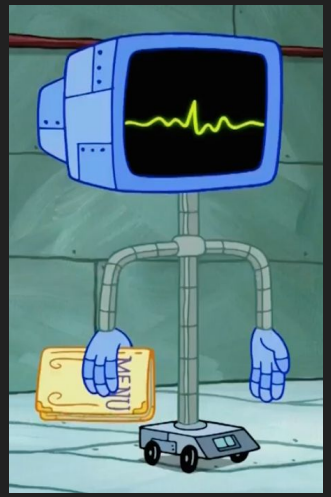


We will code a rock, paper, scissors game.

This is very good practice for making all sorts of tools.

Access the code and follow along!

https://replit.com/@umdworkshop/RockPaperScissors

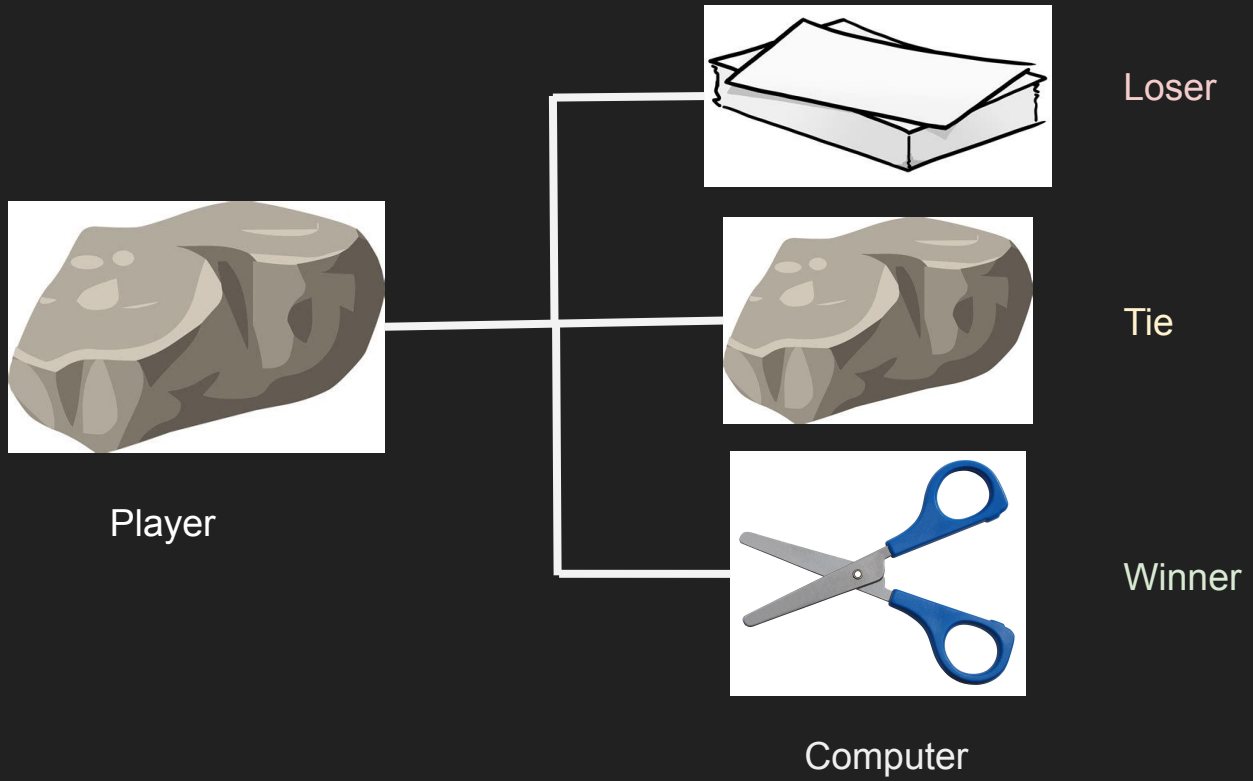


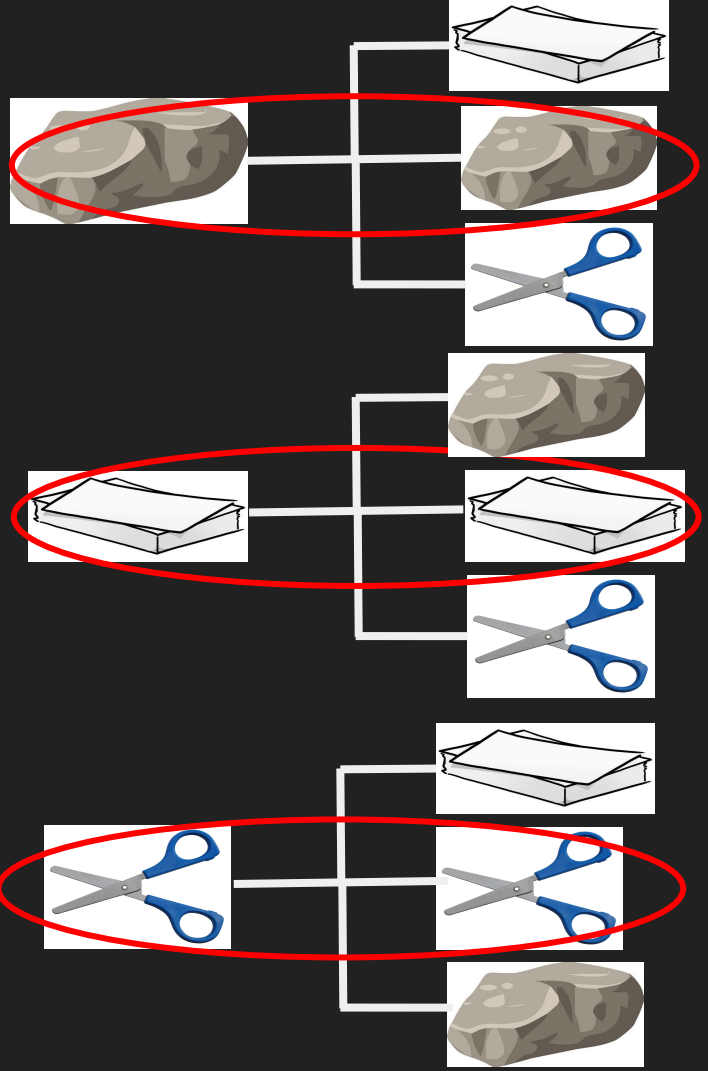
Rock Paper Scissors

Simple rules we can teach to the computer:

1. Each player randomly chooses: Rock, Paper, or Scissors
2. Rock beats Scissors beats Paper beats Rock
3. If both players select the same thing, it's a Tie

The Possibilities

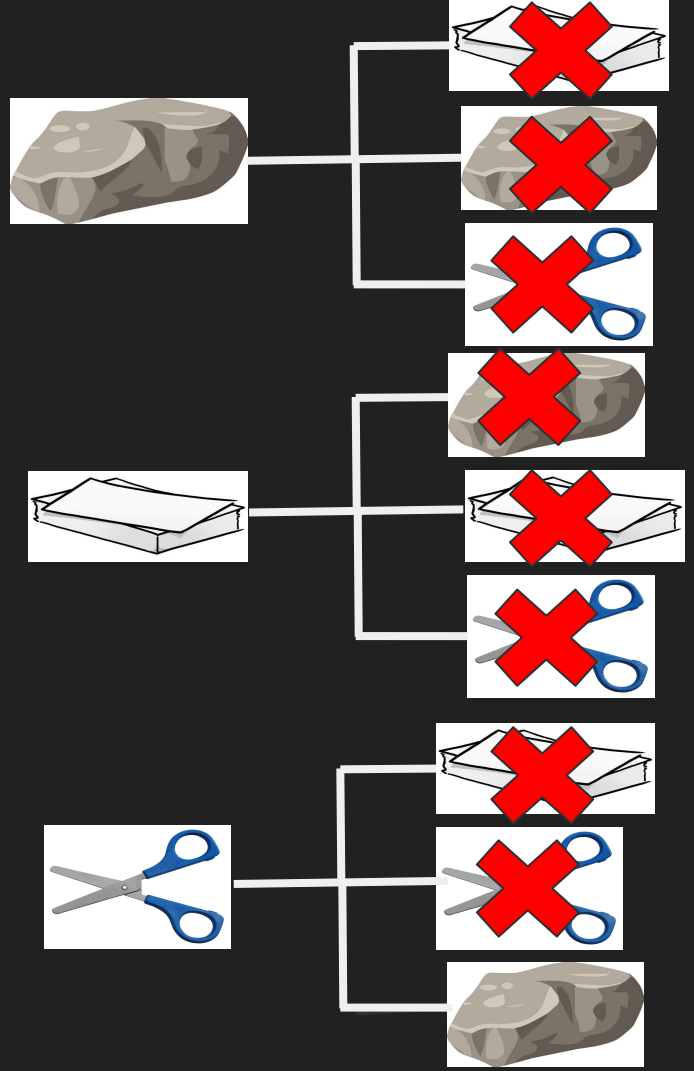




3. If both players select the same thing, it's a Tie

```
# both player and computer choose the same option
if (player == comp):
    winner = "tie"
```

1 line of code, 3 combinations!



6 options left!

```
21  # Player chooses Rock, computer chooses paper
22  elif (player == 1) and (comp == 2):
23    winner = "computer wins"
24
25  # Player chooses Rock, computer chooses scissors
26  elif (player == 1) and (comp == 3):
27    winner = "user wins"
28
29  # Player chooses Paper, computer chooses rock
30  elif (player == 2) and (comp == 1):
31    winner = "user wins"
32
33  # Player chooses Paper, computer chooses scissors
34  elif (player == 2) and (comp == 3):
35    winner = "computer wins"
36
37  # Player chooses Scissors, computer chooses rock
38  elif (player == 3) and (comp == 1):
39    winner = "computer wins"
40
41  # Player chooses Scissors, computer chooses paper
42  elif (player == 3) and (comp == 2):
43    winner = "user wins"
```

Selection: Explanation

```
45  # Print the final winner
46  print(winner)
47
48  # Print the choices
49  print("Computer chose: " + comp)
50  print("User chose: " + player)
```

THANKS!

Access this lesson and extra materials online!

Visit our Wiki Page:

https://ter.ps/STEMworkshop