

# Essential Concepts of CompSci101

## Variables

Variables assign a name to a value, which in python is any type of data, from a string, to an integer, to a dictionary. Variables can be created and assigned a new value with an assignment statement. Creating variables is a great way to easily access data. Make sure your variable name does not start with a capital letter or a number!

## Operators

You can manipulate your data through operators. Operators are symbols that represent computations. Certain operators can only apply to certain data types.

Addition is +, multiplication is \*, division is /, exponentiation is \*\*, integer division is //, and modulus operator is %. The order of operations follows PEMDAS.

## Recursion

Recursion is when a function calls itself to simplify a problem into smaller pieces to calculate. A recursive function has a base case, which is a condition that prevents the recursive call from being called, a change of state, which modifies data to grow closer to the base case, and a call to itself called a recursive call.

## Functions

Functions organize code into chunks of statements that belong together so that calling the function results in a step towards the end goal. A function is passed an argument, or certain initial values, that are used as parameters. It then returns a new value, assuming the function is fruitful and manipulates the data in some way.

## Turtle Graphics

A turtle is a type of data object that can be given directions through code to draw a picture. A turtle has attributes like color and width that can be changed, and has methods that are instructions it can take to draw a picture. For example, a turtle named turt moves forward with `turt.forward(100)` and turns left with `turt.left(60)`.

## Logic Operators

if BOOLEAN\_CONDITION1:  
    CODE\_BLOCK\_A  
elif BOOLEAN\_CONDITION2:  
    CODE\_BLOCK\_B  
else:  
    CODE\_BLOCK\_C

If the boolean condition 1 is true, then code block A is performed. If boolean condition 1 is false and boolean condition 2 is true, then code block B is performed. Elif statements are a way to stack if statements. If neither boolean condition 1 or 2 is true, then the else statement is performed. If there are multiple if statements, then all if statements are checked and performed if true, whereas if an if statement is true, and else or elif statement is not checked.

## Types of data

Strings: made up from characters and are immutable  
ex) "string"

Lists: made up from multiple objects of any type and are mutable  
ex) ["L", "I", "S", "T"]

Tuples: made up of ordered objects and are immutable

Tuples can be used to assign variables.  
ex) (a,b) = (1,2)

Dictionaries: maps keys, which are any immutable object type, to a value, which can be any object type  
ex) {"a" : 1, "b" : 2, "c" : 3}

Sets: made up of unordered and unique objects

Sets have their own operations, like set union, set intersection, and set difference, and symmetric difference

ex) set(["a", "a", "b", "b"]) = {"a", "b"}

## Loops

A loop iterates through items in a data set. Definite iteration is when the value for how many times the loop is repeated is known. For loops are examples of definite iteration. Indefinite iteration is when the number of times the loop is repeated is unknown, and instead relates to the data itself. While loops are an example of indefinite iteration.

A for loop iterates through every item in a data set and performs a given statement on every item. For loops are often used in lists, and are helpful when iterating through lines in a file.

A while loop iterates through items in a data set while a boolean condition is still true. The boolean condition should be opposite of the desired ending condition. An infinite loop (where the code in the loop does not break) will occur if the condition remains true. This can be avoided by updating the condition with every loop so that it approaches a value that will break the condition and return false.