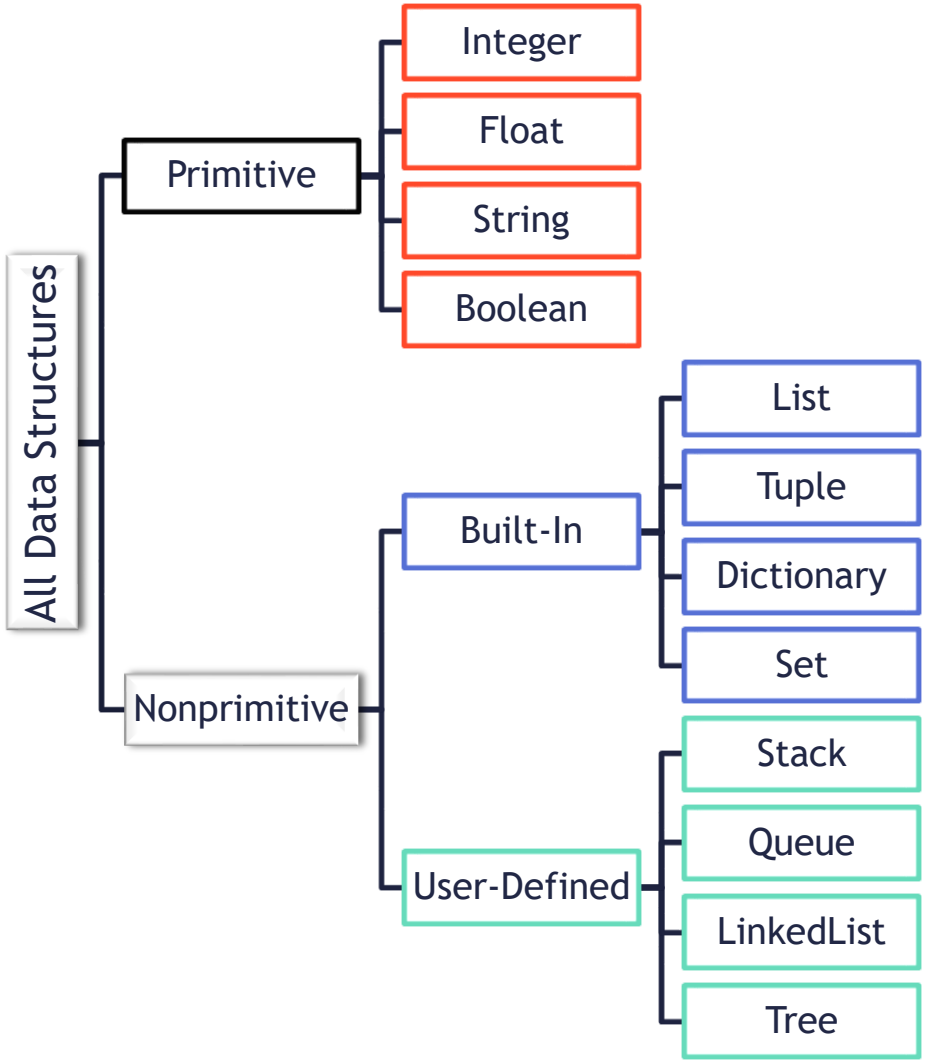
Python Basics – Data Structures

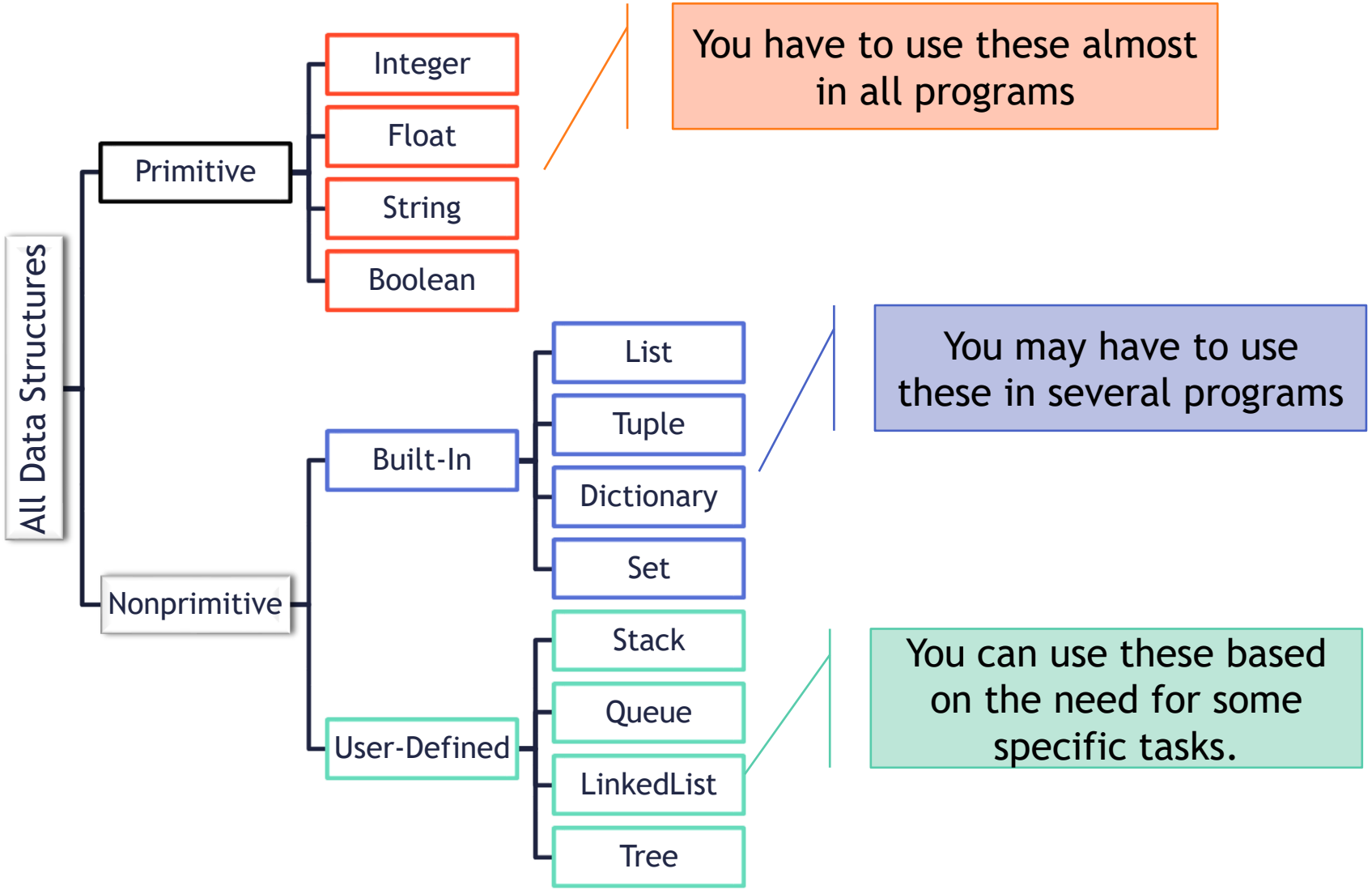
Contents

- Data Structures
- Numbers
- Strings
- Boolean
- Lists
- Tuples
- Dictionaries
- Sets
- Loops and Conditionals
- Functions

Python Data Structures



Python Data Structures



Integers and Float

- Numbers: integers & floats

```
age=30
income=1250.567

print(type(age))
print(type(income))

print("Age - datatype", type(age))
print("Income - datatype", type(income))
```

Strings

- Strings are amongst the most popular types in Python.
- There are a number of methods or built-in string functions

Defining Strings

```
name="Sheldon"
print(name)
```

Accessing strings

```
print(name[0])
print(name[0:3])
print(name[3:6])
print(name[3:4])
```

Strings – Slicing

```
message="Python 5 day course - Statinfer"
print(message)
print(message[0:4])
print(len(message))
```

String Concatenation

```
First_name="Sheldon"
Last_name="Cooper"
Name= First_name + Last_name

Name1= First_name +" "+ Last_name
print(Name1)
print(Name1*10)
```

LAB : Strings

- Create a string “ Hello World ”. Beware of the empty spaces before and after.
- What is the index position of the ‘r’?
- Remove the first and last space from it.
- Extract “ello” from it.
- Access ‘W’ using it’s index location.
- Add “!” at the end.

Boolean

- Used to store and return the values True an False.
- Useful for comparison operations

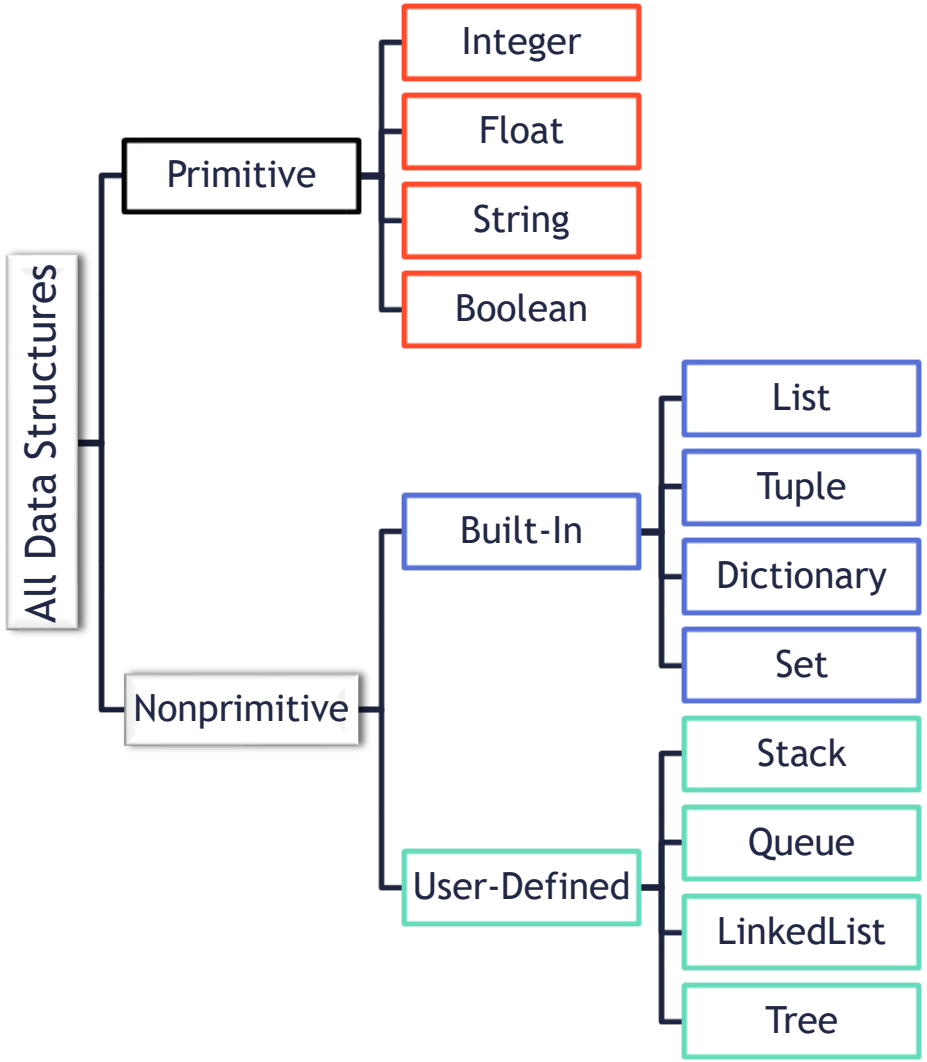
```
a=5>6
print(a)
print(type(a))
```

Boolean

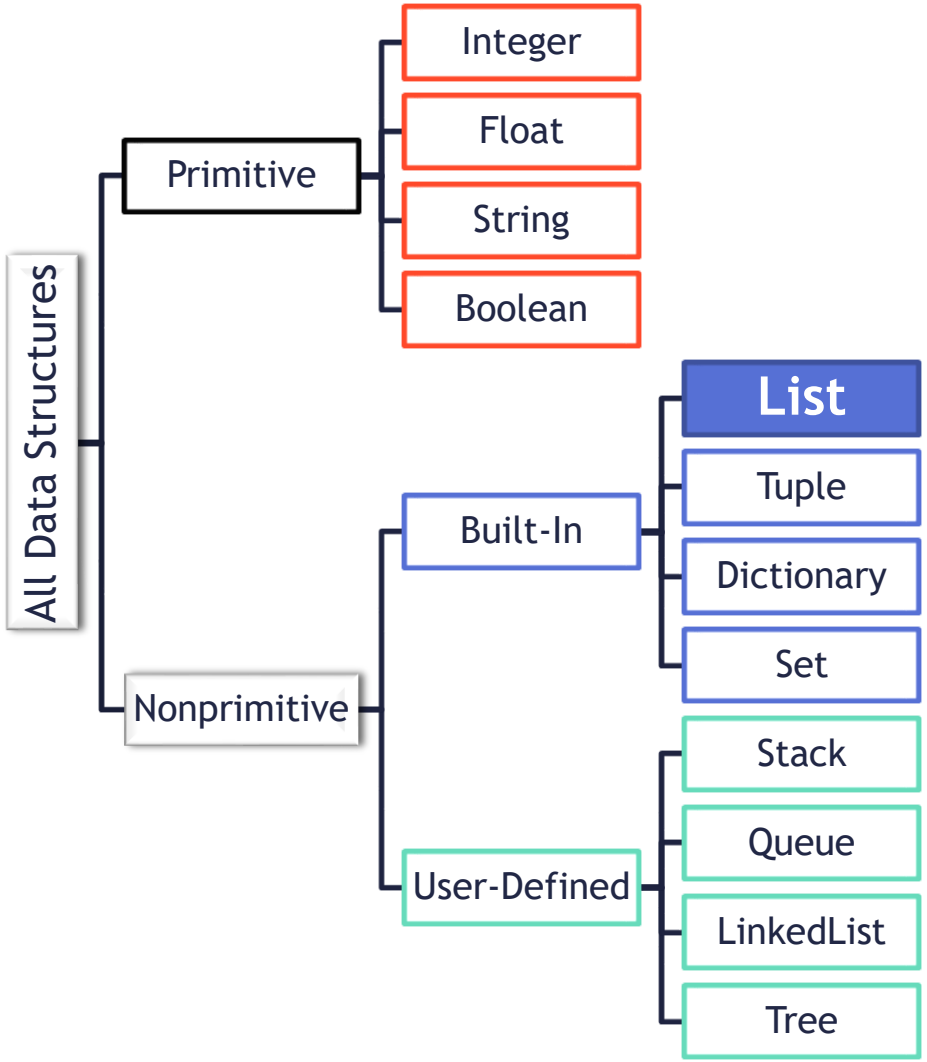
What is the expected output of this code

```
a=5>6
if a:
  print(10)
else:
  print(15)
```

Python Data Structures



Python Data Structures



List

- A sequence or a collection of elements.
- A list looks similar to an array, but not array
- Lists, can contain any number of elements. The elements of a list need not be of the same type

List Creation

Creating a list

```
cust=["Sheldon","leonard", "penny"]
Age=[30, 31, 27]

print(cust)
print(Age)
```

Accessing list elements

```
print(cust[0])
print(Age[1])
```

Combining two lists

```
cust_1=["Amy", "Raj"]
Final_cust=cust + cust_1
print(Final_cust)
print(len(Final_cust))
```

Appending an item to the list

```
Final_cust.append("Howard")
print(Final_cust)
```

Delete – based on value (a.k.a – remove)

- The remove() method removes the first matching element (which is passed as an argument) from the list.

```
Final_cust.remove("penny")
print(Final_cust)
```

- What is the expected result for the below code?

```
Age=[30, 31, 27, 30, 48]
Age.remove(30)
print("After removing 30 ==>", Age)
```

Delete – based on index (a.k.a – pop)

- The pop() method removes the item at the given index from the list and returns the removed item.

```
sales=[300, 350, 200, 250, 300]
sales.pop(0)
print("sales after pop ==>", sales)
```

What is the expected result for the below code?

```
sales.pop(0)
print("sales after second pop ==>", sales)
```

Sort the list items

```
Loans=[3, 0, 2, 6, 20]
Loans.sort()
print(Loans)
```

```
Loans.sort(reverse=True)
print(Loans)
```

Negative Index

List	300	350	200	250	400
Usual Index	0	1	2	3	4
Negative Index	-5	-4	-3	-2	-1

```
sales=[300, 350, 200, 250, 400]
print(sales[-1])

print(sales[-1],sales[-2], sales[-3], sales[-4], sales[-5])
```

Slicing a list

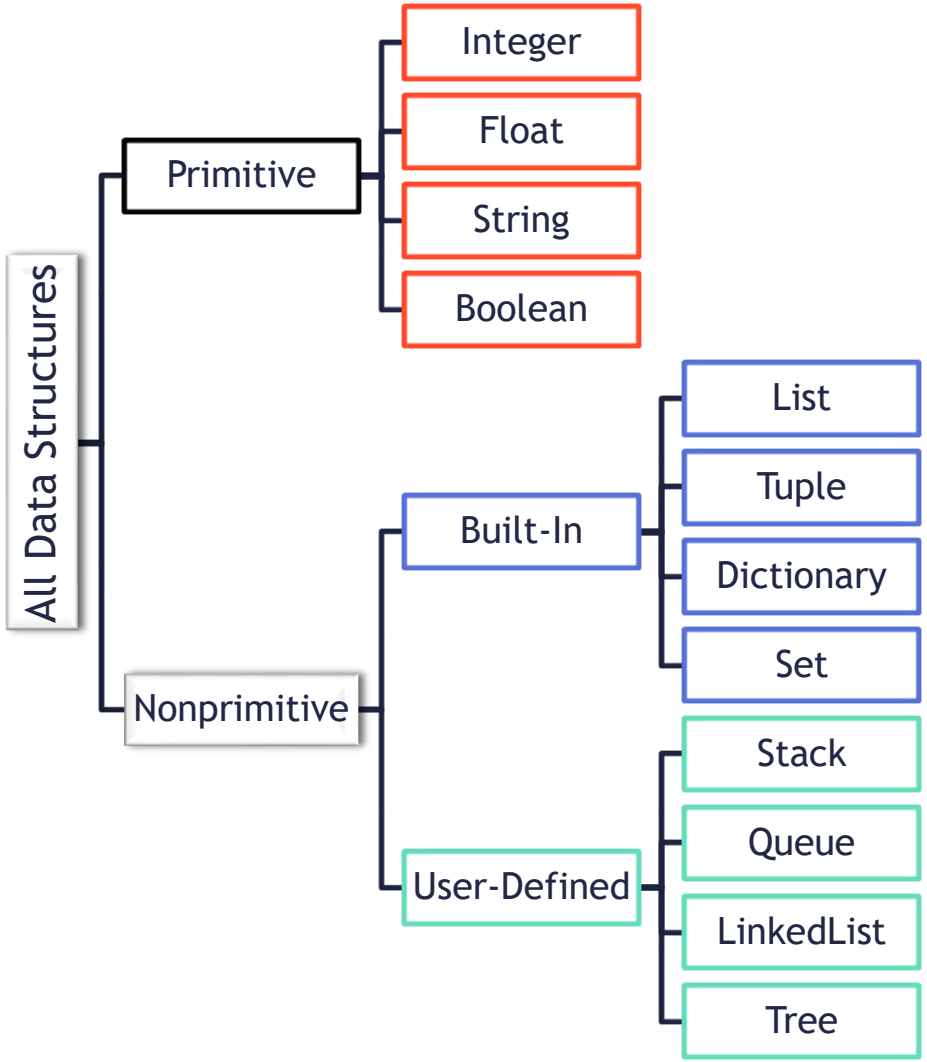
What is the expected result for the below code?

```
Age=[15, 44, 38, 19, 36, 25]
print(Age[2:5])
print(Age[2:10])
print(Age[2:])
print(Age[:4])
print(Age[-4:-2])
print(Age[:-4])
print(Age[-4:])
```

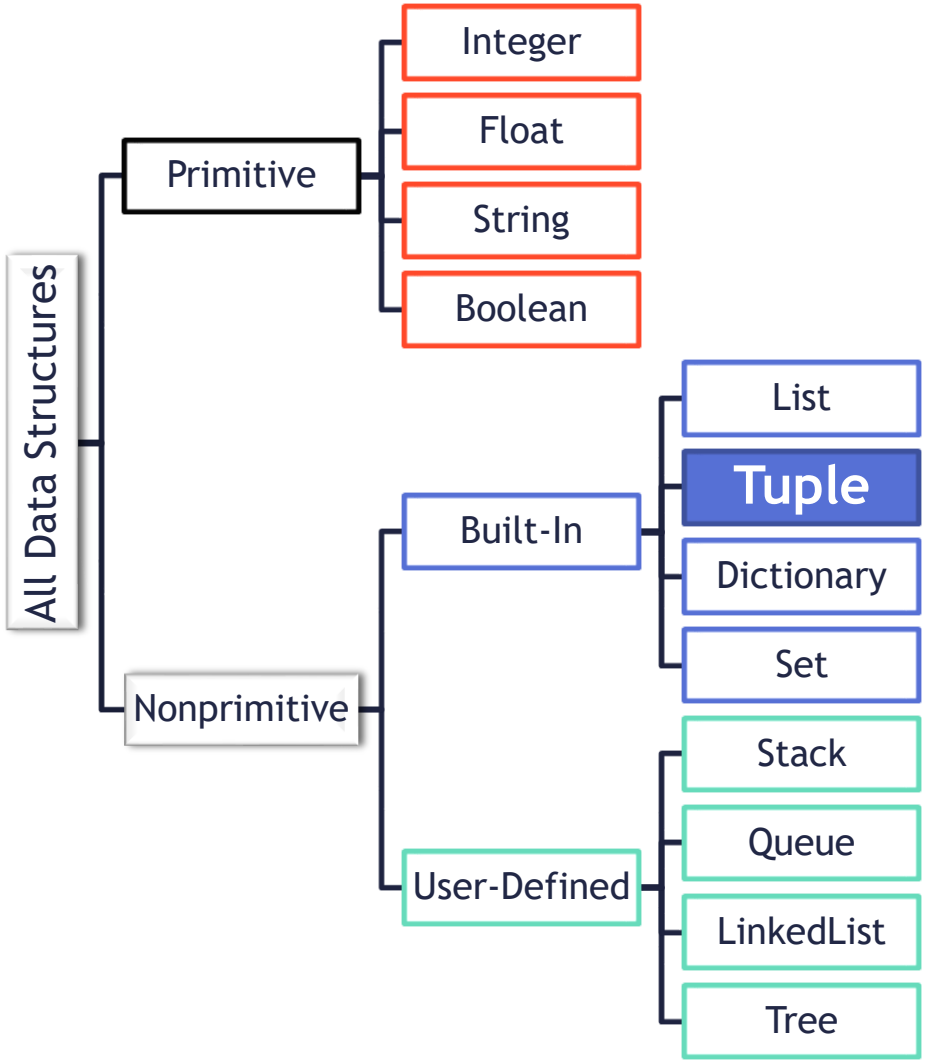
LAB: Lists

- Create a list with these numbers:
  - `names = ['Stan', 'Kyle', 'Cartman', 'Kenny']`
- Change the value of ‘Kenny’ to ‘Butters’.
- Insert ‘Clyde’ at second position, after Stan ? (hint use insert())
- Remove butters but store the list in a variable called **b.**
- Access last 3 element of this list using negative indexing
- Define a list Age=[15, 44, 38, 19, 36, 25]
  - How to reverse the items in a list. (hint use reverse())
  - How to access the minimum and maximum values of a list?
  - How to know the count of all elements inside a list ?
  - How to access the index of a particular value inside a list?

Python Data Structures



Python Data Structures



Tuples

- Tuple is one of 4 built-in data types in Python
- Collection of items stored in a single variable
- Items inside a tuple can be homogeneous or heterogenous.
- Tuples are sequences, just like lists. There are some major differences between tuples and lists.
- Tuples are immutable. We can NOT update or change the values of tuple elements

Tuples – Defining and Accessing

```
custd_id=("c00194", "c00195", "c00198")
type(custd_id)

rank=(1, 46, "NA", 5, 8)
type(rank[1])
print(type(rank[1]),type(rank[2]))
```

Tuple packing

```
region= "E", "W", "N", "S"
type(region)
```

- The above operation is called tuple packing. "E", "W", "N", "S" are packed together.
- The reverse is also possible.

```
r1, r2, r3, r4= region
print(r1, r4)
print(type(r1))
```

Tuples vs. Lists – Difference

- Tuples are immutable. Seal the data in the tuple, totally prevent it from being modified at any stage of the development.
- Tuples are faster and use less memory than lists.

```
custd_id_t=("c00194", "c00195", "c00198")
custd_id_l=["c00194", "c00195", "c00198"]
custd_id_l[1]="c00176"
custd_id_t[1]="c00176"
```

Tuples utilize less memory

- A list is mutable. Python needs to allocate more memory than needed to the list. This is called over-allocating.
- Meanwhile, a tuple is immutable. When the system knows that there will be no modifications, memory allocations will be very efficient.

```
from sys import getsizeof

custd_id_t=("c00194", "c00195", "c00198")
custd_id_l=["c00194", "c00195", "c00198"]

print("tupple size ", getsizeof(custd_id_t))
print("list size ", getsizeof(custd_id_l))
```

Working with a tuple is faster

- Time that needs to copy a list and a tuple 1 billion times

```
from timeit import timeit
timeit("list(['c00194', 'c00195', 'c00198'])", number=10000000)
```

```
2.224825669999973
```

```
timeit("tuple(('c00194', 'c00195', 'c00198'))", number=10000000)
```

```
0.9755565370001023
```

Tuple vs List – Which one to use?

- We have to use both.
- Sometimes we need mutability and modifications to the variables, in some other cases, we need speed and utilize less memory.

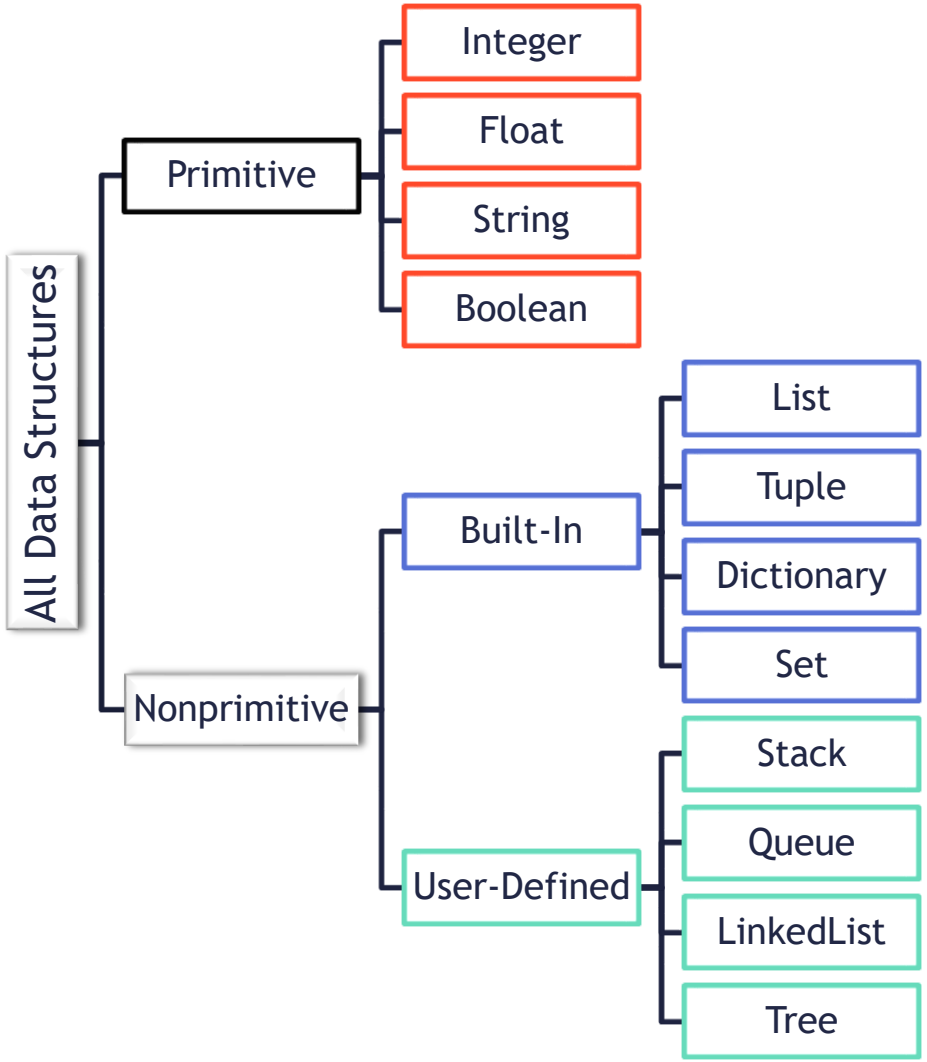
Tuple vs List – Which one to use?

- Example-1
  - You are writing a function. You need to take the input parameters from the user and perform the calculations inside the function to return some result.
  - How would you like to store the input parameters ? Inside a tuple? Or inside a list?
- Example-2
  - Store all the columns inside a variable and return the first two columns. Later, rename the first column and pass it on to the next step.
  - How would you like to store the column names? Inside a tuple? Or inside a list?

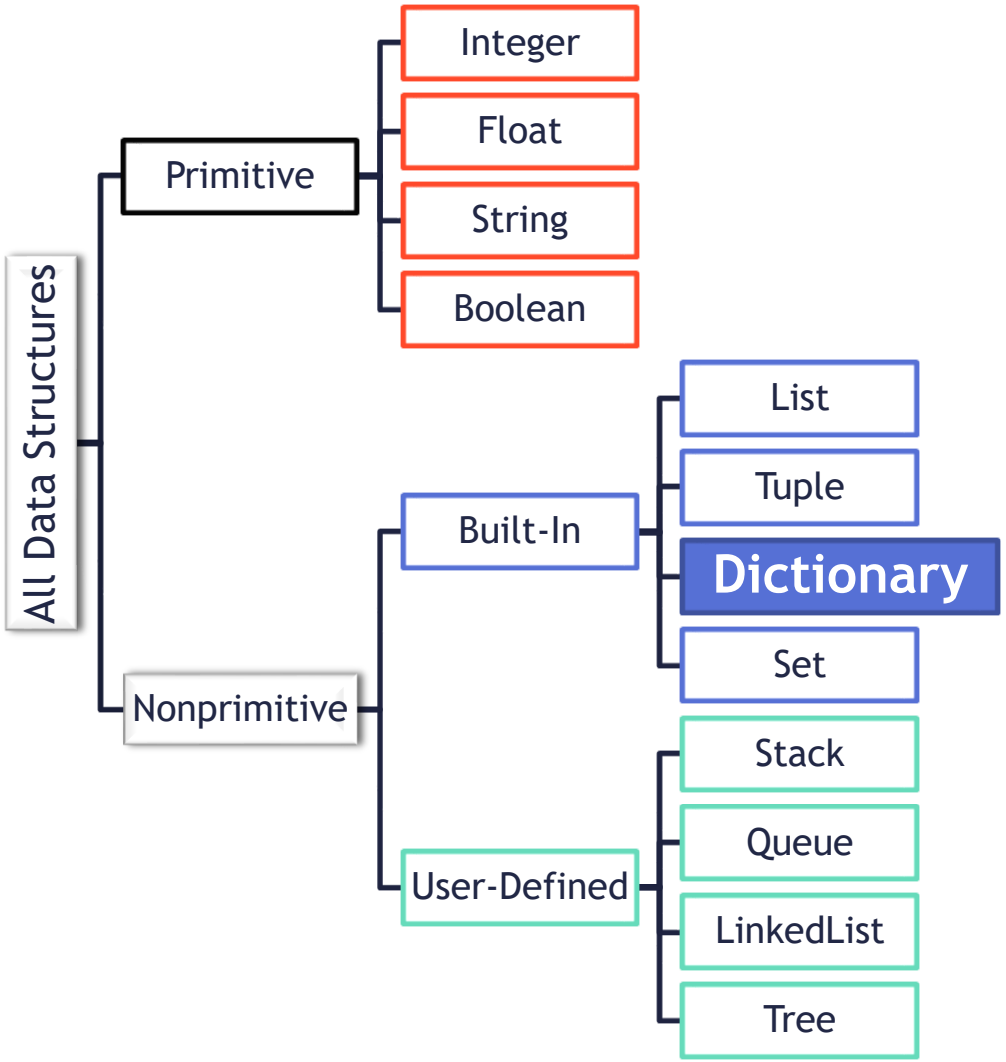
LAB: Tuple

- Create a tuple:
  - (28, ‘Sophia’, True, names) | beware the names is a list containing 4 names
- Access first element of the names from this tuple.
- Re-assign a new value for the last element of the list names via this tuple.
- Print the list names and see if it has changed.

Python Data Structures



Python Data Structures



Dictionaries

- Dictionaries have two major element types key and Value.
- Dictionaries are collection of key value pairs
- Each key is separated from its value by a colon (:), the items are separated by commas, and the whole thing is enclosed in curly braces.
- Keys are unique within a dictionary

```
city={0:"L.A", 9:"P.A", 7:"FL"}
type(city)

print(city)
print(city[1])
print(city[0])
```

Dictionaries

- In dictionary, keys are similar to indexes. We define our own preferred indexes in dictionaries

```
cust_profile={"C001":"David", "C002":"Bill", "C003":"Jim"}
print(cust_profile[0])
print(cust_profile[C001])
print(cust_profile["C001"])

#Updating values
cust_profile["C002"]="Tom"
print(cust_profile)
```

Dictionaries

Updating keys in dictionary

Delete the key and value element first and then add new element

```
#Updating Keys
#C001 ---> C009

#Delete + Add

del(cust_profile["C001"])
print(cust_profile)

cust_profile["C009"]="David"
print(cust_profile)
```

Dictionaries

- Fetch all keys and all values separately

```
city.keys()
city.values()
```

Iterating in a Dictionary

```
Employee = {"Name": "Tom", "Emp_id": 198876, "Age": 29, "salary":25000
,"Company":"FB"}
```

- What is the expected output?

```
for x in Employee:
    print(x)
```

- What is the expected output?

```
for x in Employee.values():
    print(x)
```

Iterating in a Dictionary

- What is the expected output?

```
for x in Employee.keys():
    print(x,Employee[x])
```

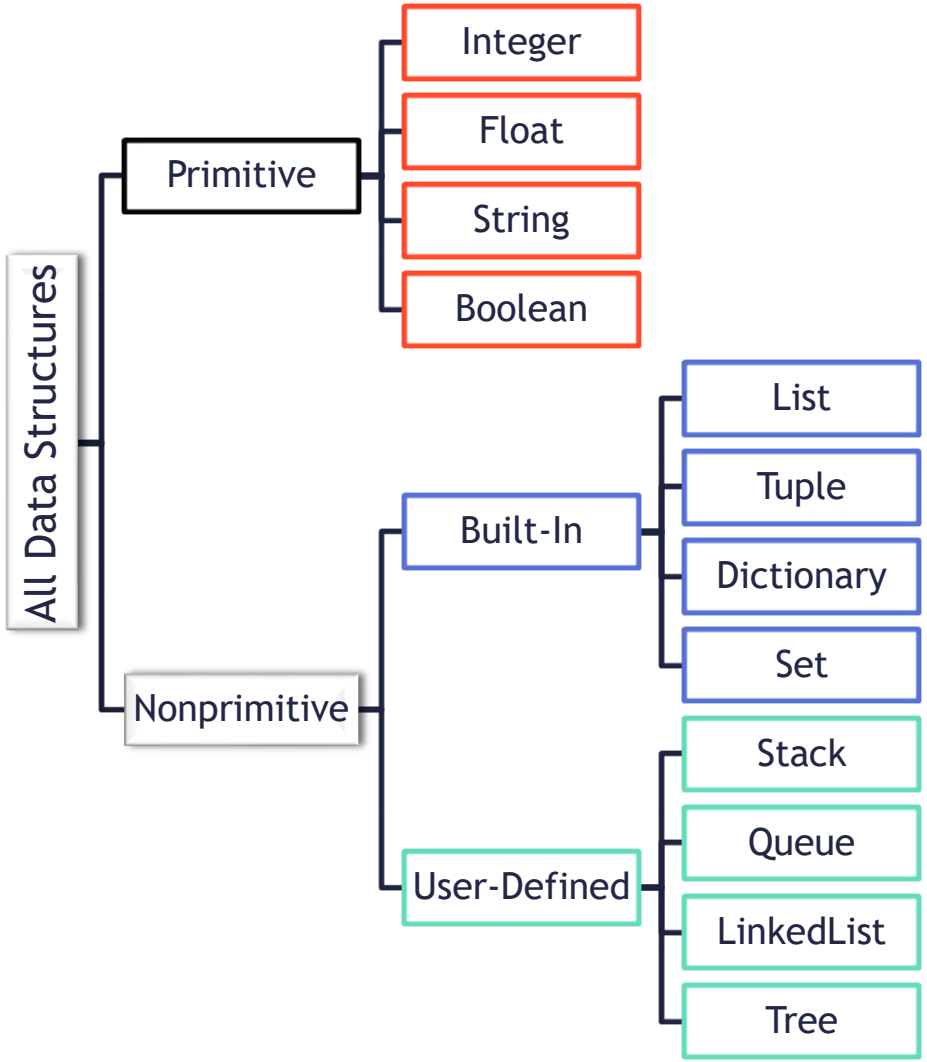
- You can also use items.

```
for x in Employee.items():
    print(x)
```

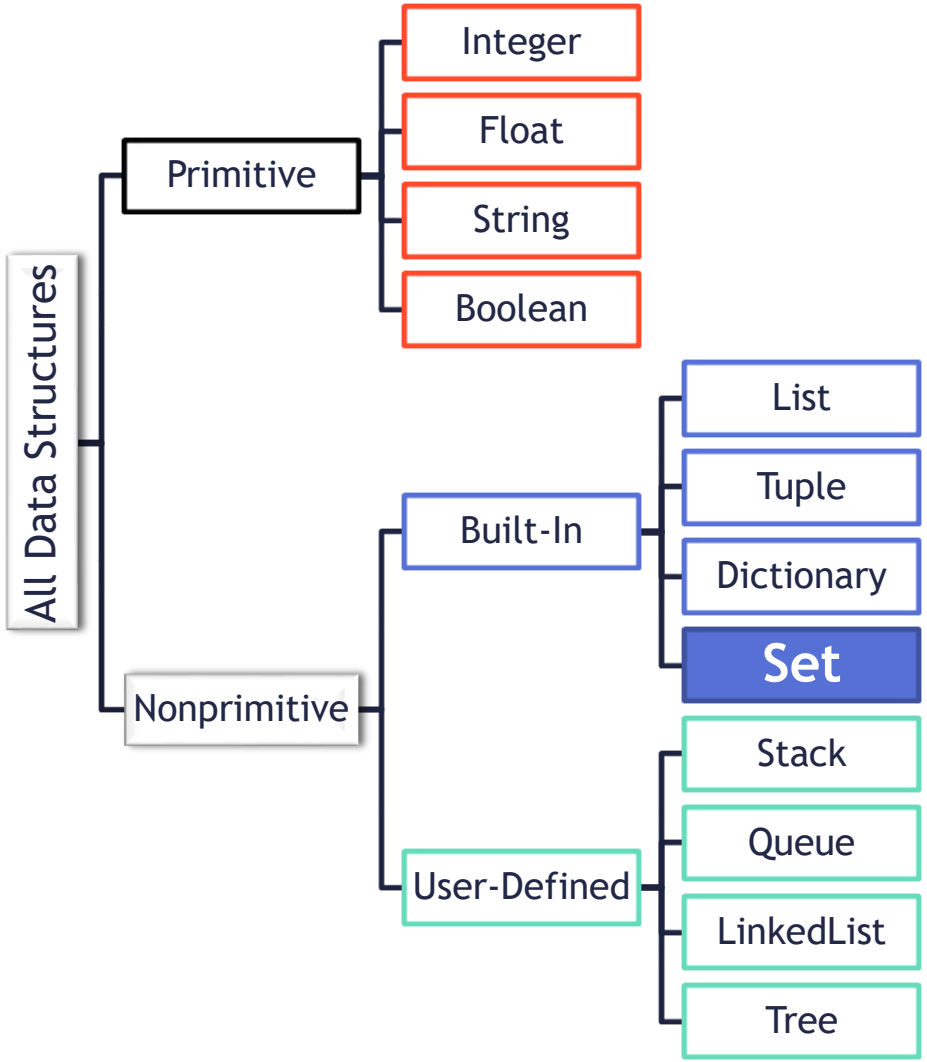
LAB: Dictionary

- Create a the below dictionary with 3 names as keys and their age as values.
  - `name_age = {'Stan':8, 'Kyle':8, 'Cartman':10}`
- Access the age of 3rd key.
- Append dictionary with single key and value pair. Kenny - 9
- Update the dictionary with a two values `{'Cartman':11, 'Token':10}`

Python Data Structures



Python Data Structures



Sets

- Sets are an **unordered** collection of unique elements.
- Sets are mutable but can hold **only unique** values in the dataset.
- Set operations are similar to the ones used in arithmetic.
- There is **no index** attached to the elements of the set
- We cannot directly access any element of the set by the index.

Operations on Sets

- Either use {} or set() function for sets certation

```
products = {"Phone", "T.V", "Tablet", "Laptop", "Fridge", "Camera"}
type(products)

products1 = set(["Phone", "T.V", "Tablet", "Laptop", "Fridge"])
type(products)
```

- Careful with empty set created using {}

```
products2={}
type(products2)
```

Operations on Sets

- Set values are always unique

```
orders = set(["Phone", "Phone", "toys", "toys", "Camera", "Camera"])
print(orders)
```

Operations on Sets

- Sets Union

```
union_set=products|orders
print(union_set)
```

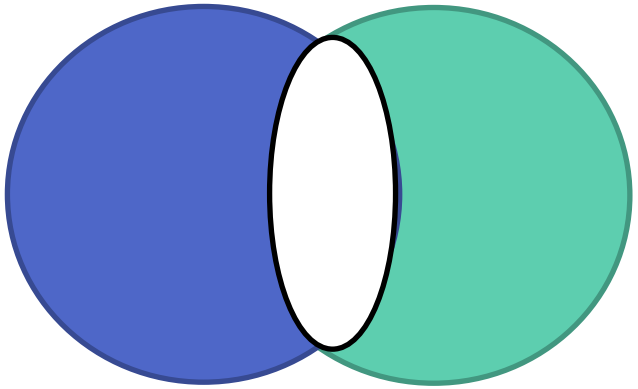
- Sets Intersection

```
intersection_set=products & orders
print(intersection_set)
```

- Symmetric difference

```
Symmetric_diff=products ^ orders
print(Symmetric_diff)
```

Symmetric difference



LAB: Sets

- Create a list : [20,5,41,5,35,5,23,15,2] – Let this be list1
- Convert this list to a new list with unique values using set. – Let this be list2
- Find intersection between list-2 and list3= [1,5,3,2,4,6,7]

If-Then-Else statement

If Condition

```
age=60
if age<50:
  print("Group1")
print("Done with if")
```

```
age=40
if age<50:
  print("Group1")
print("Done with if")
```

If-else statement

```
age=60
if age<50:
  print("Group1")
  print("Done with if")
```

If-else statement

```
age=60

if age<50:
  print("Group1")
else:
  print("Group2")

print("Done with if")
```

Multiple else conditions in if

If condition for checking whether a candidate secured First class/ second class or failed in an exam.

```
marks=86

if(marks<30):
  print("fail")
elif(marks<60):
  print("Second Class")
elif(marks<80):
  print("First Class")
elif(marks<100):
  print("Distinction")
else:
  print("Error in marks")
```

For loop

For loop

Print first 20 values

```
#Example-1

for i in range(1,20):
  print("Number is", i)
```

LAB : For loop

Print first 20 values cumulative running sum

```
sumx=0

for i in range(1,10):
  sumx=sumx+i
  print("Cumulative sum is", sumx)
```

Break Statement in for loop

- To stop execution of a loop
- Stopping the loop in midway using a condition

- Print cumulative sum and stop when sum reaches 100

```
sumx=0
for i in range(1,200):
  sumx=sumx+i
  if(sumx>100):
    break
  print("Cumulative sum is", sumx)
```

LAB: for-loop

- Create a list: [1,2,5,4,6,3,4,8]
- Use for loop and if statement to print out all even values

List Comprehension

```
#for i in range(1,20):
#  print("Number is", i)

[i for i in range(1,20)]


result=[i for i in range(1,20)]
print(result)
```

List Comprehension

```
result=[i for i in range(1,20) if i<15]
print(result)

result=[i for i in range(1,20) if i<15 if i%2 == 1 ]
print(result)
```

Writing Function

```
def my_function_name(param1, param2, param3):
    code lines
    code lines
    code lines
    return;
```

Distance Calculation function

- Distance Calculation function

```
def mydistance(x1,y1,x2,y2):
    import math
    dist=math.sqrt(pow((x1-x2),2)+pow((y1-y2),2))
    return(dist)

mydistance(0,0,2,2)
mydistance(4,6,1,2)
```

Lab: User Defined Functions

- Create a function that calculates the Absolute percentage difference between two input values. Take second value as reference
  - Test it with (30,80)

Thank you