Lect: B. Najafi

- An Introduction to Scientific computing using Python
 - > Python Fundamentals

Ref: MITx: 6.00.1x Introduction to Computer Science and Programming Using Python

• A program:

a sequence of definitions and commands.

♣ Data Objects:

Each data object has a type that defines the kind of things the programmes can do to it.

- Objects:
 - > Scalar: cannot be subdivided.
 - Non-Scalar: can be subdivided
- **♣** Scalar objects:
 - ✓ Int: represent integers
 - ✓ float: represent real numbers
 - ✓ bool: represent boolean values
- Using Shell
- ✓ You can type: 5, 5.0 or True
- **↓** type command
- Simple calculations with ints and floats
- > 5+8, 5.0+4, 5*4
- > 5/4, 5.0/4
- > (5+4)*2
- > 2+3*4
 - ✓ Precedence: In the absence of parentheses, execution is made from left to right first using ** then * and/ and then + and -
- Comparing ints and floats:
 - ✓ i>j, i<j,i>=j, i<=j, i==j, i!=j
 - **✓** 3>5, 3<5, 3>3, 3>=3, 4==4, 5!=5
- Operations on bools
 - ✓ a and b
 - ✓ a or b
 - ✓ not a or not b
 - v

- ♣ Type Casting (Type Conversion)
- ✓ float(3), int(4.9)
- Variables: simple means of abstraction
- ✓ Variable Assignment: "="
 - > L=0.3
 - > A=15
 - ➤ k=0.9
 - > R=L/(k*A)

what if:

- > k=10
- > R=?
- ♣ Non-Scalar Objects:
- Strings (str): sequence of charcters
- either a single (' ')or double quotes(" ")
 - > name1="abc"
 - > type(name1)
 - > type("123")
 - >
- String Operations:
 - > 3*"a"
 - > 3*"ab"
 - > ab+str(12)
 - len("name")
- Extracting parts of strings
- indexing
- > "res"[1]: Starts from 0
- > "res"[3]:?
- ✓ Going backwards:
- > "res"[-1]
- ✓ Slicing
- res"[a:b] ----> starts at a and stops just before b
- > "resistance"[1:3]

- Using IDLE Shell is not desirable
 - ✓ we need to save our code in a separate script
 - ✓ Print Command
 - print("Resistance")
 - print(3*"R")
 - print(R)
 - print("The resistance is determined to be " +str(R)+ "degC/W")
 - ✓ raw input Command
 - > input k=raw input("Please Enter the layer's conductivity")
 - print(input k)
 - > print("You just told me that the conductivity is "+k+ " W/(m.degC)")
 - k=float(input k)
 - > print("The resistance is determined to be "+str(R)+ "degC/W")
- ♣ A simple script:
- L=raw input("Please Enter the length of the layer (in m): ")
- > A=raw input("Please Enter the area of the wall (in m2): ")
- \triangleright k=raw input("Please Enter the condictivty of the layer (in W/(m*K)): ")
- print("\n you just said "+ "L= " + L+ " m "+ "A= " + A+ " m2 "+ "k= "+ k +" W/(m*K) \n")
- ightharpoonup R=float(L)/(float(k)*float(A))
- print("Well the Thermal Resistnace is "+ str(R)+ " degC/W")
- **Comments:**
 - ✓ starting with #
- > Till now we just executed commands line by line!
- Branching programs:
- Conditioning
 - ✓ evaluating a boolean :
 - ✓ a script executing if the boolean is True
 - ✓ (optional) a script executing if the boolean is False

```
❖ A not so intelligent way of extracting material properties!:
L=raw input("Please Enter the length of the layer (in m): ")
A=raw input("Please Enter the area of the wall (in m2): ")
   material=raw input("Please Enter the material of the layer: ")
  if material=="glass":
       k="1.145" \#W/(mK)
   else:
       print("I do not have the properties of this material")
       k=(raw input("Please Enter the conductivity off the layer(in W/(m K): "))
   print("\n you just said "+ "L= " + L+ " m "+ "A= " + A+ " m2 "+ "k= "+ k +" W/(m*K) \n")
   R = float(L)/(float(k) * float(A))
   print("Well the Thermal Resistnace is "+ str(R)+ " degC/W")
Nested if
L=raw input("Please Enter the length of the layer (in m): ")
A=raw input("Please Enter the area of the wall (in m2): ")
  material=raw input("Please Enter the material of the layer: ")
   if material=="glass":
       type glas=raw input("which type of glass do you mean:window=1, wool
                                                                                       insulation=2
       if int(type glas)==1:
               k=str(0.96) #W/mK
       else:
       k = str(0.04) \#W/mK
   elif material=="brick":
       k=str(0.8) \#W/mK
   else:
       print("I do not have the properties of this material")
       k=(raw input("Please Enter the conductivity off the layer(in W/(m K): "))
   print("\n you just said "+ "L= " + L+ " m "+ "A= " + A+ " m2 "+ "k= "+ k +" W/(m*K) \n")
   R = float(L)/(float(k)*float(A))
   print("Well the Thermal Resistnace is "+ str(R)+ " degC/W")
```

♣ Still Each statement gets executed just once!

4 Loops and iterations

```
> x=4
> itersLeft=x
> Sum=0
> while(itersLeft!=0):
> Sum=Sum+x
> itersLeft=itersLeft-1
> print(Sum)
> print(itersLeft)
> print(str(x)+"**"+" 2 = "+str(Sum))
```