A Rapid Introduction to Programming

ENGR 298: Engineering Analysis and Decision Making with Python

A program is a set of instructions for manipulating, moving, and making decisions on data in your computer.

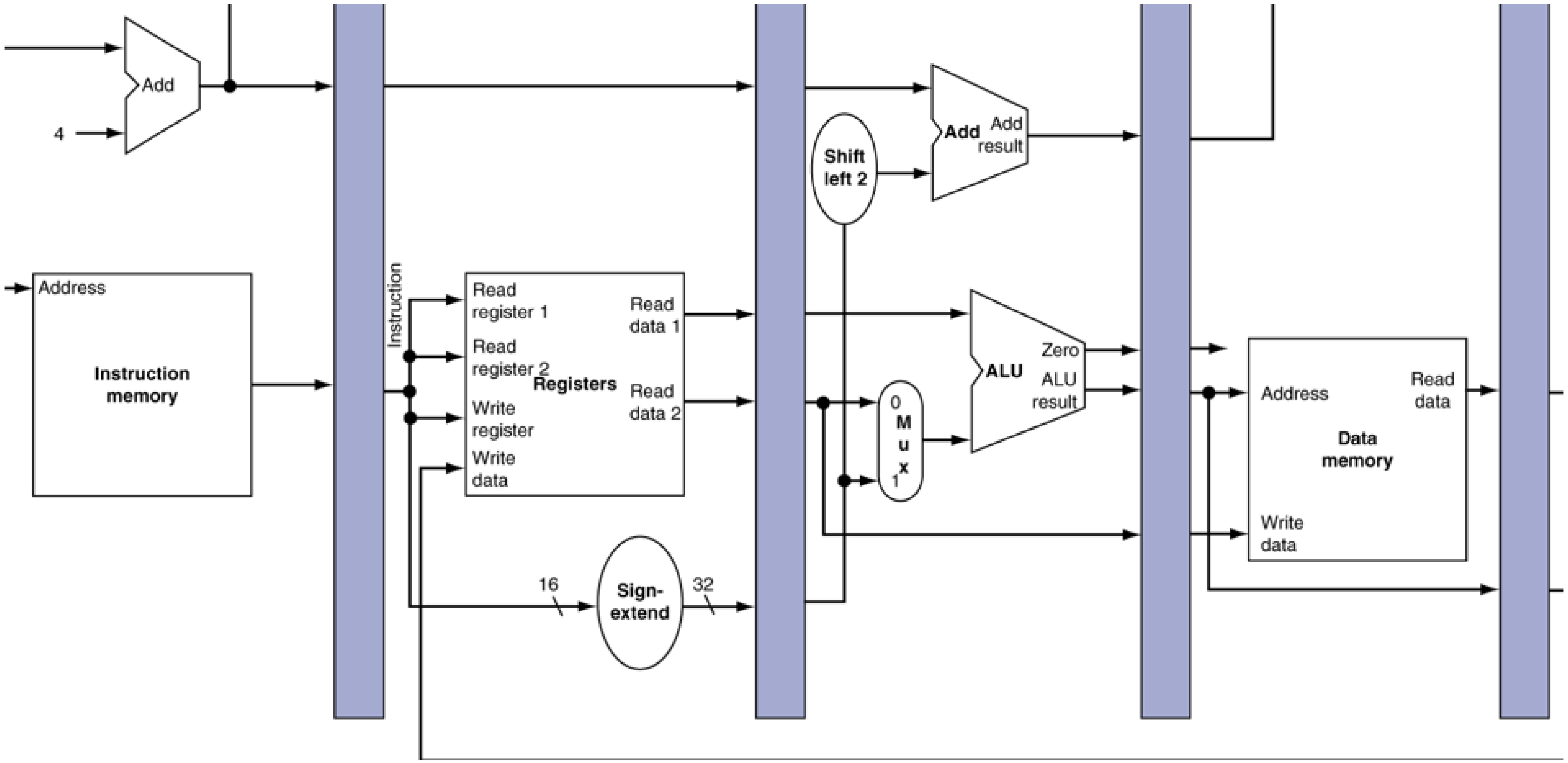
```
swap(int v[], int k)
{int temp;
   temp = v[k];
   v[k] = v[k+1];
   v[k+1] = temp;
}
```

Compiler

```
swap:
      muli $2, $5,4
      add  $2, $4,$2
      lw   $15, 0($2)
      lw   $16, 4($2)
      sw   $16, 0($2)
      sw   $15, 4($2)
      jr   $31
```

Assembler

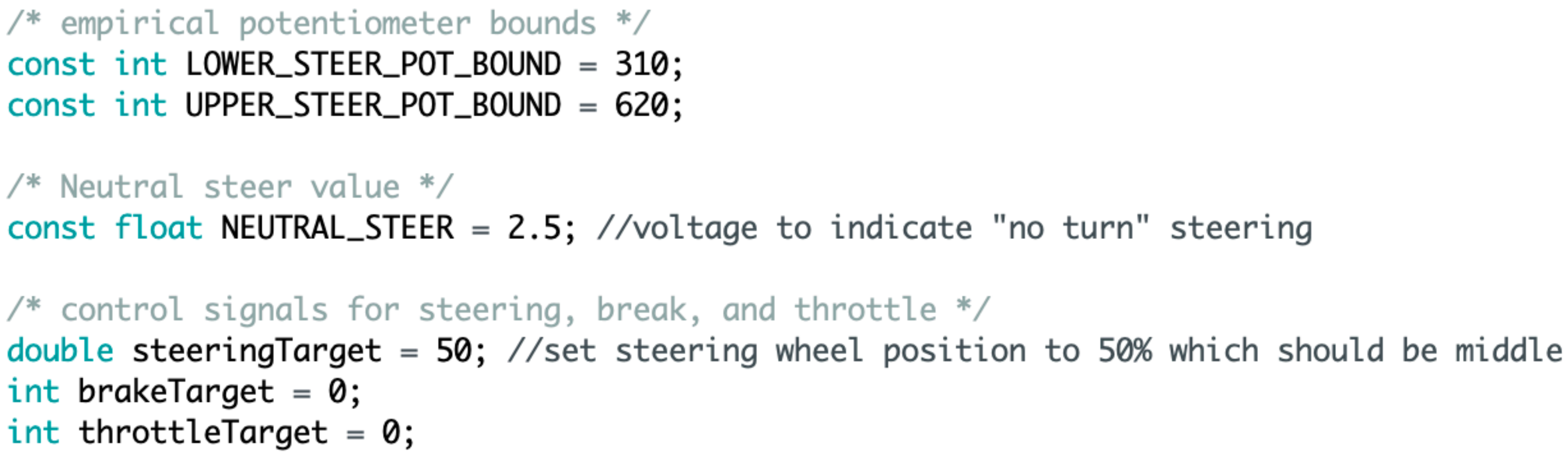
```
00000000101000010000000000011000
00000000000110000001100000100001
10001100011000100000000000000000
10001100111100100000000000000100
10101100111100100000000000000000
10101100011000100000000000000100
00000011111000000000000000001000
```



data

- Can be any information in your computer. Numbers, strings, images, databases… Each data piece has a ’type’ that represents its underlying information content.

- Within a program each piece of data is named by a **variable**.



```
/* empirical potentiometer bounds */
const int LOWER_STEER_POT_BOUND = 310;
const int UPPER_STEER_POT_BOUND = 620;

/* Neutral steer value */
const float NEUTRAL_STEER = 2.5; //voltage to indicate "no turn" steering

/* control signals for steering, break, and throttle */
double steeringTarget = 50; //set steering wheel position to 50% which should be middle
int brakeTarget = 0;
int throttleTarget = 0;
```

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Variables in Python are **dynamically** assigned Data Type when the program runs based upon what occurs.

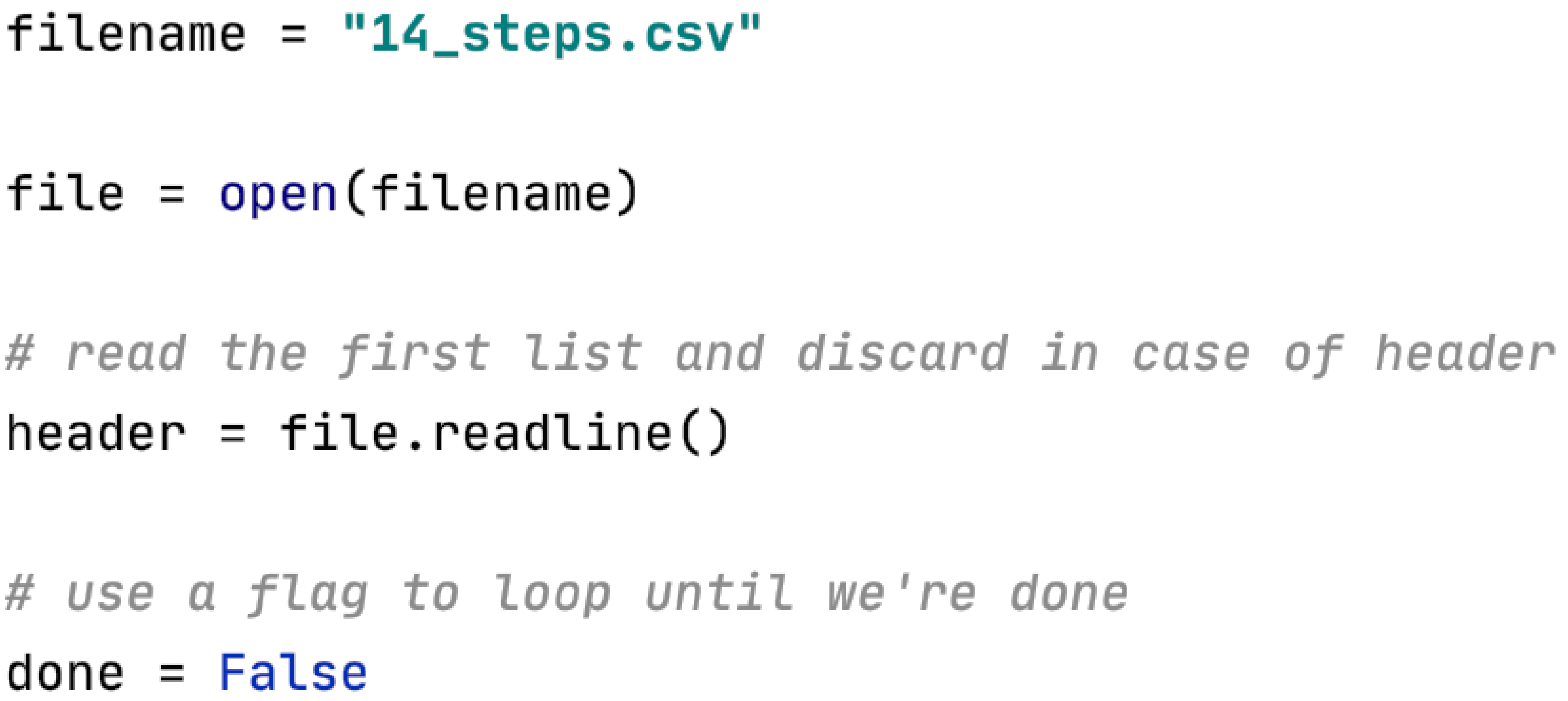
People often think “Python doesn’t have types”. This is a lie. The type is assigned “behind the scenes”.

Filename

File object

First line of file

True/False flag

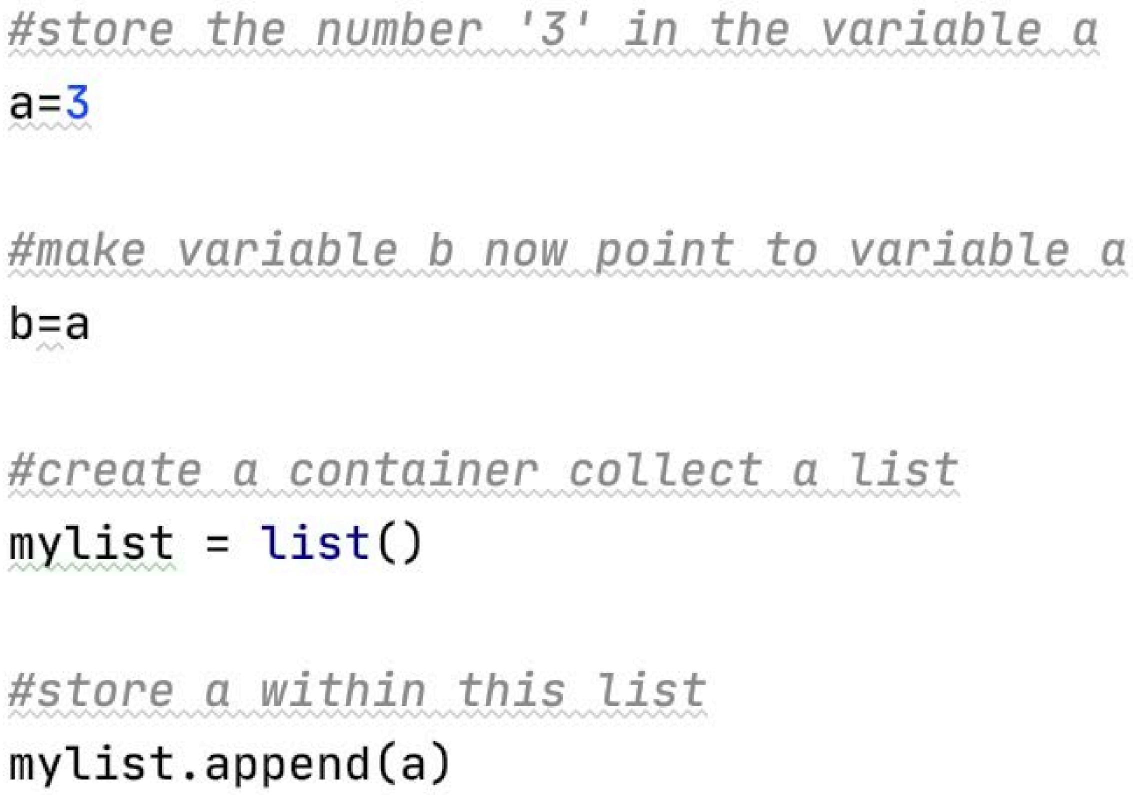


```
filename = "14_steps.csv"

file = open(filename)

# read the first list and discard in case of header
header = file.readline()

# use a flag to loop until we're done
done = False
```

moving

- Data for the program must be generated or pulled in from somewhere. Furthermore, it must be saved (temporally) or stored (permanently).

- Data can be stored in a single variable or in an organized **collection**



```
#store the number '3' in the variable a
a=3

#make variable b now point to variable a
b=a

#create a container collect a list
mylist = list()

#store a within this list
mylist.append(a)
```

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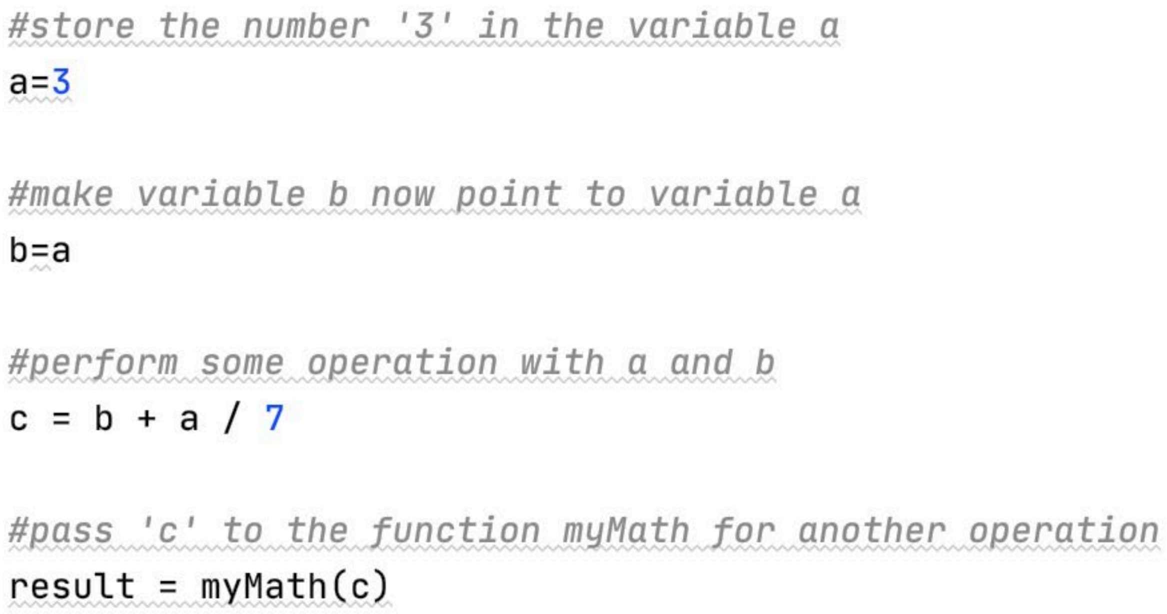
manipulating

- Data stored in variable can be modified through simple operations (+ - / *) or passed to *functions* for more complex operations. A function is a series of instructions that be repeated multiple times on various data.



```
#store the number '3' in the variable a
a=3

#make variable b now point to variable a
b=a

#perform some operation with a and b
c = b + a / 7

#pass 'c' to the function myMath for another operation
result = myMath(c)
```

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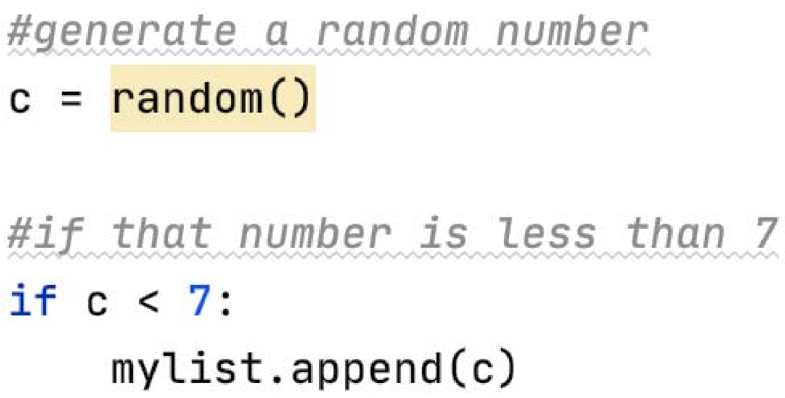
making decisions

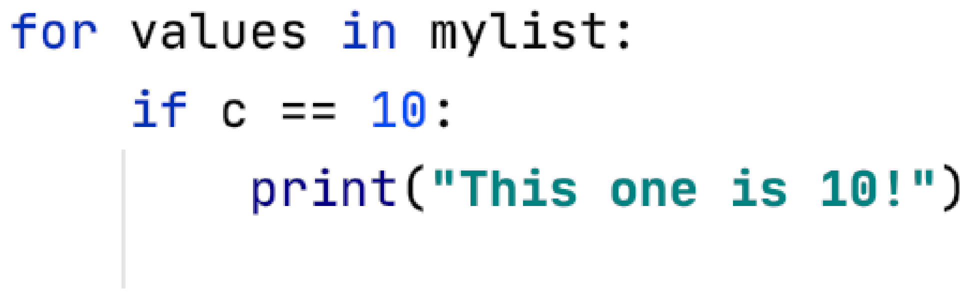
- Rarely can information be directly processed (add 3 to all elements) and frequently some decision or comparison must be made to determine which manipulation or movements must be performed.

- Decisions in are often formed as “conditionals” or “loops”.



```
#generate a random number
c = random()

#if that number is less than 7
if c < 7:
    mylist.append(c)
```



```
for values in mylist:
    if c == 10:
        print("This one is 10!")
```

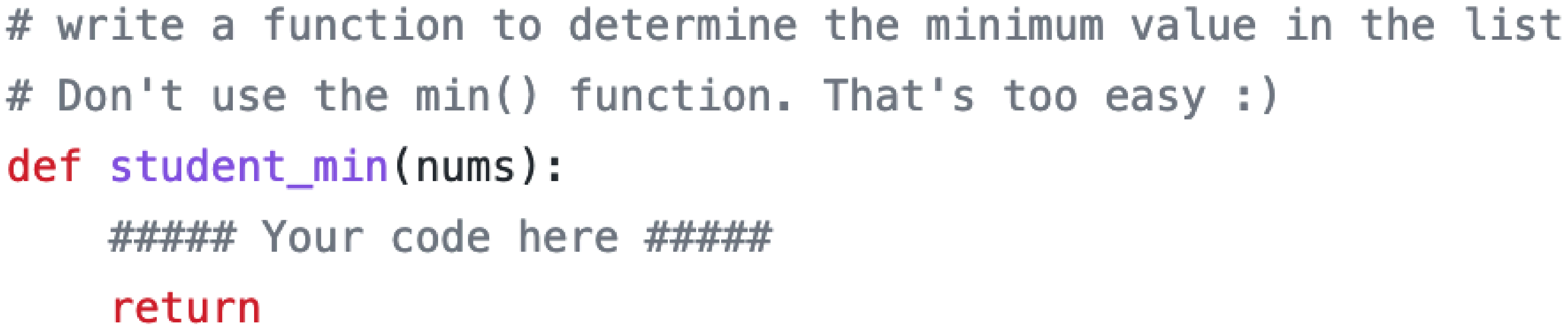
When thinking about writing programs

- First, consider how you (as a human) would approach the problem.

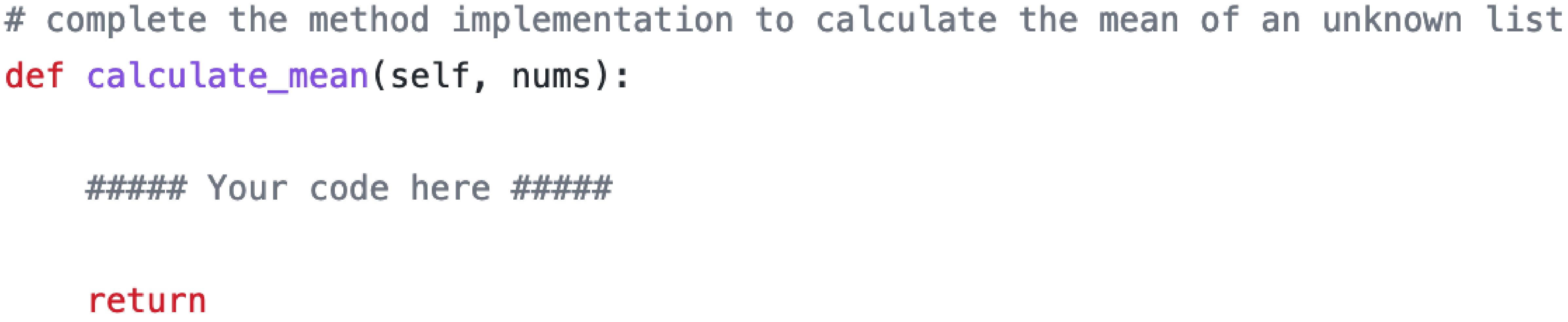
- What information would you need to acquire? What information would you need to store?

- Should information be placed (or removed) from some container? Should some data be keeping a tally of a result?

- When examining a piece of data, what comparisons and examinations are needed? Do you need to search through some container to find a particular object?



```python
# write a function to determine the minimum value in the list
# Don't use the min() function. That's too easy :)
def student_min(nums):
    ##### Your code here #####
    return
```



```python
# complete the method implementation to calculate the mean of an unknown list
def calculate_mean(self, nums):

    ##### Your code here #####

    return
```

Summary

- All programing languages have similar objectives, but with varying syntax. Information is moved into the computer, modified, saved, and eventually exported.

- In constructing a program, consider what high-level operations a person may do, and then sketch them out in the appropriate language.

- Overtime, patterns and common approaches will emerge.