# For loops in Python

September 26, 2022

# Administrative Notes

Homework #3 is out; due next Monday night, October 3

HW 2 is due tonight if you haven’t submitted it yet

# Program control - a review

Sequential - execute a statement, then execute the next statement,then…

Conditional - if statements: if, if-else; if-elif-else

- Execute a statement or set of statements only if some condition is True

Iterative - execute a statement or set of statements multiple times

# Python Loops

Today's lecture covers "for each" and "for i" loops; "while" loops are on Wednesday

Python provides a number of ways to implement iterative program control flow

- "while" loops -
  - The most general solution - the most power, if you will
  - The most dangerous - with great power, comes great responsibility
    - It's very easy to tromp all over your code with a while loop if you're not careful
- "for i" loops
  - Moderately general - will work in most cases
  - Allows direct modification to program data structures, so some care must be exercised
- "for each" loops
  - Simple to understand; simple to use
  - Works if you want to do "something" to each member of your data structure (list) one time and one time only

# “For” loops

Allow us to do some things with some or all the elements of a list

Two cases to consider:

- You want to do something with each element in the list, exactly once
  - Called a “for each” loop
- You want to do something with some of the elements in the list, but not necessarily all
  - Called a “for i” loop

# For each loops - doing the same thing with each element in a list

Start with a list:

grocery_list = [“Milk”, “Eggs”, “Cereal”, “Coffee”, “Apples”, “Strawberries”, “Broccoli”, “Cucumber”, “Tomatoes”, “Green Onions”]

We want to print the list, one item on a line, so that we can send someone else to the store.

Use a “for each” loop.

Remember that reserved word “in”? We’ll use it here.

# Example

```
for item in grocery_list:

    print(item)
```

"item in grocery_list" is a boolean conditional. The colon ends the conditional. This continues to execute as long as there are more items.

Indent!!! Just like with if-else. White space is important in Python

What this means:

- "Item" is a new variable; not used in the program
- Python automatically creates this to be the same type as the elements of the list
  - What if not all elements are the same type? We'll get to that in a minute
- "Item" is given the value of each element in the list, one at a time, and the code is executed for each value of "item"

# “for i” loops

Used when you may not want to iterate over every item in the object

Syntax:

```
for iterator in range(a, b, c): # see the next slide
    #do something
```

“Iterator” is just a variable that tracks where you are in the list or other object.  It is most often an integer, although it doesn’t absolutely have to be. “I” is often used.

The value of “iterator” does NOT have to be pre-set.

# Lists with different element types

```
mixed_list = [“eggs”, 12, “milk”, 128.0]
for item in mixed_list:
        print(item)


#here’s a test

for item in mixed_list:
        if item == str(item):
                print(item)
```

- Python automatically changes the type of item to match the value of each element

- This test decides if a value of item is a string, or another type. The == will only be true if “item”  is already a string.

# “for i” loops

- Called this because “i” is often used as the index variable. But you don’t have to use “i”
- Used to loop through an object - e.g., a list - and optionally skip some elements

# range()

range() is a function that takes 3 parameters:

1. A starting integer
2. An ending integer
3. A hop size

Range will give you back all the integers from (1) to (2) hopping by (3) each time. Also, we have to wrap range in list() to see all the numbers at once.

Let’s try it!

Note: doesn’t have to be an integer, but it’s really confusing if it’s not.

# Not all the arguments are needed

If you give one argument it’s the end of the range.

- What are the assumed start and hop size?

If you give two it’s the start and end of the range.

- What is the assumed hop size?

# For loops

Here's how a "for i" loop iterates through the items of a list

```
lizards = [“gecko”, “iguana”, “komodo dragon”, “chameleon”]
for i in range(len(lizards)):
    print(lizards[i])
```

# Modifying your list

You can modify the contents of a list you're iterating through, while you're iterating through it.

An example:

```
grade_list = [98, 92.5, 123, 199.8]
for i in range(len(grade_list)):
        grade_list[i] *= grade_list[i]
print(grade_list)
```

# Sample problem

Let's try to take a list of integers and increase each integer by one.

First we'll try it with a "for each" loop.  What happens?

Next we'll try it with a "for i" loop.  Any better?

# Some questions:

1. How can we print the even numbers between two integers x and y with a for loop?
2. How can we use range to go backwards through a list?
3. Print all the elements of a list with their index!

range(len(integer_list)-1,0, -1)

# “for” loops and strings

A string is zero or more characters treated as a single entity

Sounds kind of like a list, where each element of the list is one character long.

- You can treat it that way

```
word = “supercalifragilisticexpialidocious”:
for i in word:
    print(i)
```

Or:

```
word = “supercalifragilisticexpialidocious”:
for i in range(len(word)):
    print(word[i])
```

# Some Examples

## The “states” list from last week:

```
states = ["Alabama","Alaska","Arizona","Arkansas","California","Colorado",
"Connecticut","Delaware","Florida","Georgia","Hawaii","Idaho","Illinois",
  "Indiana","Iowa","Kansas","Kentucky","Louisiana","Maine","Maryland",
  "Massachusetts","Michigan","Minnesota","Mississippi","Missouri","Montana",
  "Nebraska","Nevada","New Hampshire","New Jersey","New Mexico","New York",
  "North Carolina","North Dakota","Ohio","Oklahoma","Oregon","Pennsylvania",
  "Rhode Island","South Carolina","South Dakota","Tennessee","Texas","Utah",
  "Vermont","Virginia","Washington","West Virginia","Wisconsin","Wyoming"]
```

- Write a “for” loop that prints out each state that ends in “a”
- Write a “for” loop that prints out each state that ends in a vowel. The hard way; the medium way; and the easy way

# If there’s time

Input validation - verify that a user has actually entered an integer before trying to convert the input into an int

```
digits = ['0','1','2','3','4','5','6','7','8','9']

score = input("Please enter your test score")
is_digits = True
for j in score:
   if not j in digits:
       is_digits = False

if is_digits == True:
   print ("hooray, you entered a digit")
   score = int(score)
else:
   print ("I'm sorry, that's not a valid test score")
```

- Harder problem: do the same with a float