Lecture 16

Topics: *Chapter 8. Loop Structures and Booleans*

review in-class assignment3 from previous class

8.1 *For loops: a quick review*

8.2 *Indefinite loops*

8.3 *Common loop patterns: interactive, sentinel*

8.1 For loops: a quick review

Definite Loops

Let’s have a brief review of definite loops:

A Python for loop has this general form:

```
    for <var> in <sequence>:
        <body>
```

<body> is any sequence of Python statements
<var> is the *loop index* ,
        takes on each successive value in the sequence, and
        the statements in the body are executed once for each value.
sequence portion often consists of a *list* of values.

8.1 For loops: a quick review

Definite Loops

Example 1:

```
y = 1
for counter in [1,2,3,4]:
    y = y + counter
    print(”counter={0}, y={1}”.format(counter,y))
```

8.1 For loops: a quick review

Definite Loops

Example 1:

```
y = 1
for counter in [1,2,3,4]:
    y = y + counter
    print(”counter={0}, y={1}”.format(counter,y))
```

Example 2:

```
for i in range(10):
    x = 3.9 * x * (1-x)
   print(x)
```

begin to typing in `range(` in the interactive window - you'll see:

```
    range([start,] stop[, step]) -> list of integers
```

8.1 For loops: a quick review

Definite Loops

Example 1:

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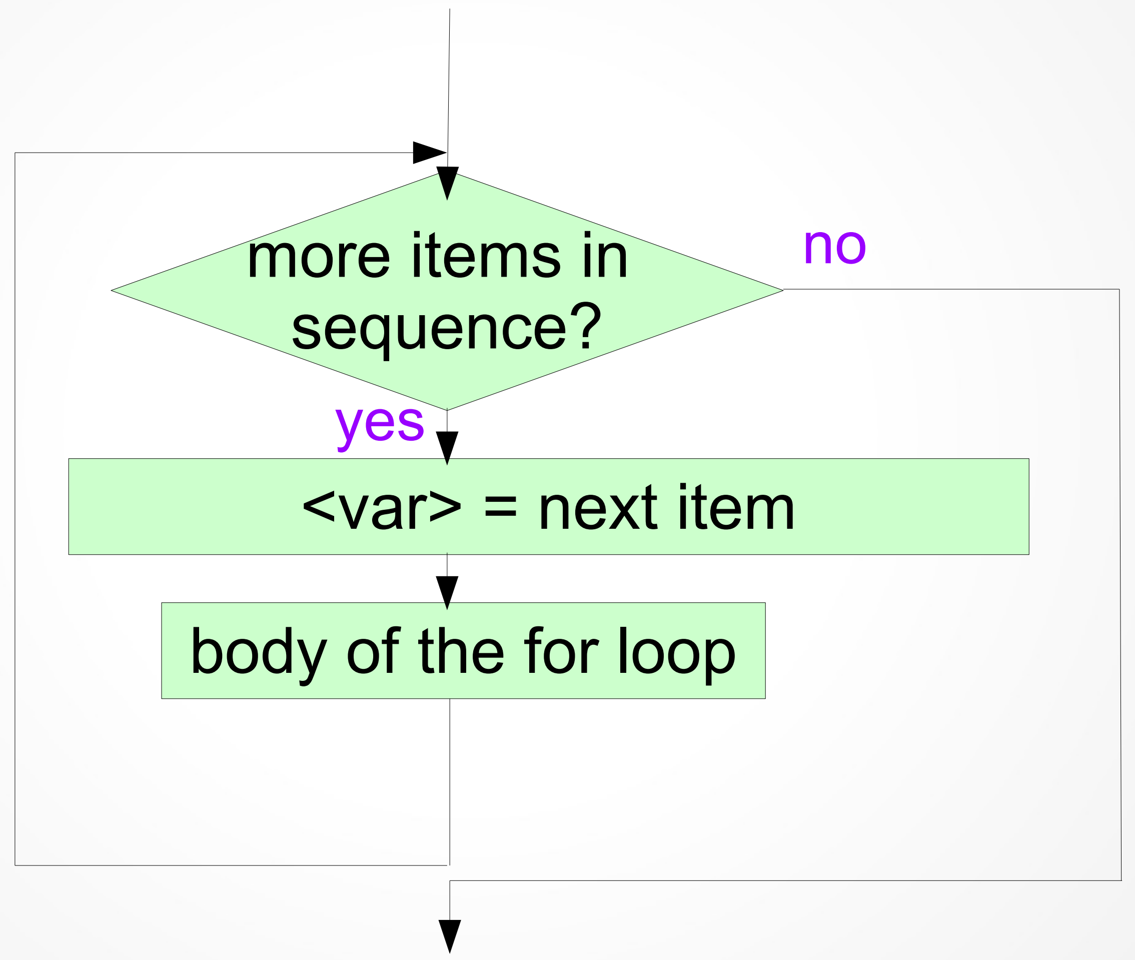
8.1 For loops: a quick review

Definite Loops



8.2 Indefinite loops

Indefinite loops

Assume that we want to write the program that finds the average of inputted numbers. And I don't know in advance how many numbers will be inputted.

Can we use a for loop here?

8.2 Indefinite loops

Indefinite loops

Assume that we want to write the program that finds the average of inputted numbers. And I don't know in advance how many numbers will be inputted.

Can we use a for loop here? **No**

8.2 Indefinite loops

Indefinite loops

Let's take a look at indefinite (conditional) loop:

```
while <condition>:
    <body>
```

`<condition>` is a boolean expression (just like in `if` statements).

The <body> of the loop executes repeatedly as long as the condition remains true.

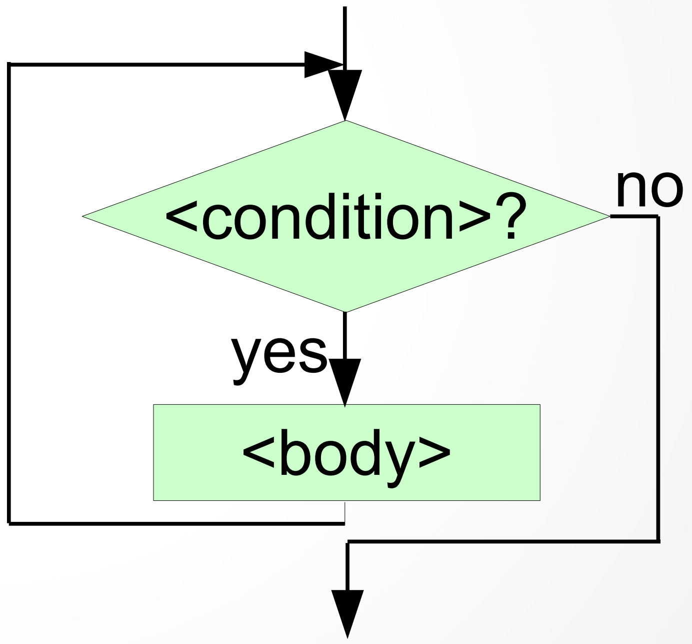
8.2 Indefinite loops

Indefinite loops

Let's take a look at indefinite (conditional) loop:

```
while <condition>:
    <body>
```

Flowchart of the while loop



8.2 Indefinite loops

Indefinite loops

example: a program that counts from 0 to 9

```
i=0
while i<=9:
    print(i)
    i=i+1
```

the for *loop* would look:

```
for i in range(10):
    print(i)
```

8.2 Indefinite loops

Indefinite loops

example: a program that counts from 0 to 9

```
i=0
while i<=9:
    print(i)
    i=i+1
```

the for *loop* would look:

```
for i in range(10):
    print(i)
```

Now, if we slightly change our original program:

```
i=0
while i<=9:
    print i
```

- we get an infinite loop

Infinite loops are a bad thing.

8.2 Indefinite loops

Indefinite loops

Example: a program that takes numbers until the user enters a negative number, and then finds their average.

This example is not do easy to do with a for loop

8.2 Indefinite loops

Indefinite loops

Example: a program that takes numbers until the user enters a negative number, and then finds their average.

```
x, s, counter = 0, 0, 0
while x >= 0:
   x = float(input("Enter a value:"))
   s += x
   counter += 1
print("You entered {0} non-negative values, their
average is {1}.".format(counter,s/counter))
```

see program example1.py with more details

8.3 Common loop patterns: interactive, sentinel

Indefinite loops

Two good uses of indefinite loops:

- Interactive loops: at each iteration ask the user if he/she wants to input more data values or it is enough.

- Sentinel loop: loop continues to process data until it reaches a special value that signals the end (that value is called ”sentinel”).

8.3 Common loop patterns: interactive, sentinel

Let's take a look at two algorithms that employ those uses:

```
sum = 0
counter = 0
answer = 'yes'

while answer is 'yes':
     get the next_value
     counter = counter + 1
     sum = sum+next_value
     ask user if he/she
            wants to continue

average=sum/counter
```

interactive

```
sum = 0
counter = 0
next_value = 0

while next_value is not
-1000

     counter = counter + 1
     sum=sum+next_value
     get the next_value

average=sum/(counter-1)
```

sentinel

8.3 Common loop patterns: interactive, sentinel

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```
sum = 0
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    get the next_value
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interactive

```
sum = 0
counter = 0
next_value = 0

while next_value is not
-1000

    counter = counter + 1
    sum=sum+next_value
    get the next_value

average=sum/(counter-1)
```

sentinel

see average_i.py

see average_s.py, average_s_mod.py

8.3 Common loop patterns: interactive, sentinel

Indefinite loops

In both approaches it is necessary to pay attention to the following details:

- *Make sure that the loop runs exactly as many times as it is correct* (not more and not less)
- *Check what happens if there are 0 loop iterations*
- *Check what happens if there are 1 loop iterations*
- *Check what happens if there are the maximum possible number of loop iterations for the problem you are solving.*
- *Make sure that the loop terminates*
    - *Test on different inputs*

8.3 Common loop patterns: interactive, sentinel

Indefinite loops

See the previous example implemented with exceptions:

average_i_mod_exceptions.py

and

average_s_mod_exceptions.py

8.3 Common loop patterns: interactive, sentinel

Work with files

Let's write a program that finds the average of all numbers in a file. We assume that the numbers are typed into a file one per line.

Here is an example of the content of the file input.txt

```
1
5
4
9
2
12
39
0
```

8.3 Common loop patterns: interactive, sentinel

Work with files

Let's write a program that finds the average of all numbers in a file. We assume that the numbers are typed into a file one per line.

Algorithm / design:

```
print an explanatory notice
take a file name from the user
open file
counter = 0
for loop over lines in the file
    covert the line into a float/integer
    add to the sum
    increment the counter
find the average
display the average
```

see program in average_file.py

8.3 Common loop patterns: interactive, sentinel

Work with files

Let's write a program that finds the average of all numbers in a file. We assume that the numbers are typed into a file one per line.

Modification:

If a file contains characters other than numbers, then they will be ignored.

see average_file_mod.py

8.3 Common loop patterns: interactive, sentinel

Work with files

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Modification:

If a file contains characters other than numbers, then they will be ignored.

Can we use while loop?

8.3 Common loop patterns: interactive, sentinel

Work with files

Let's write a program that finds the average of all numbers in a file. We assume that the numbers are typed into a file one per line.

Modification:

If a file contains characters other than numbers, then they will be ignored.

Can we use while loop? Yes

see average_file_mod_while.py