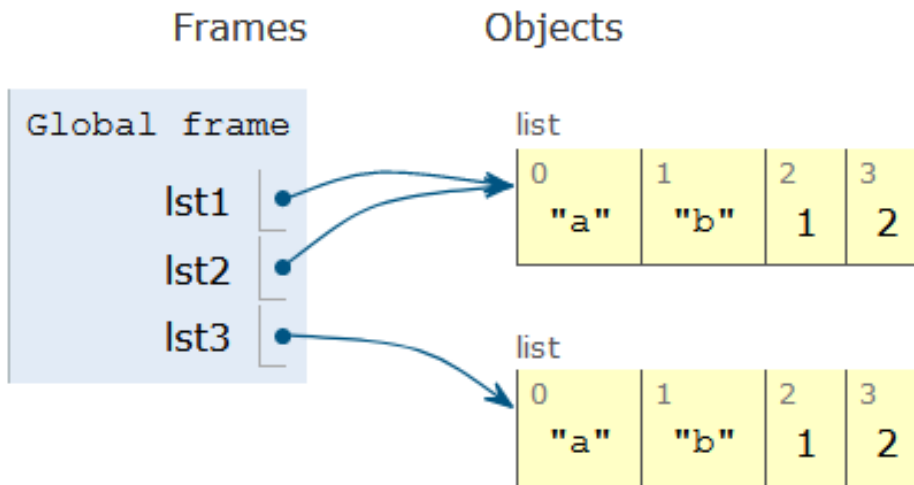


CompSci 101

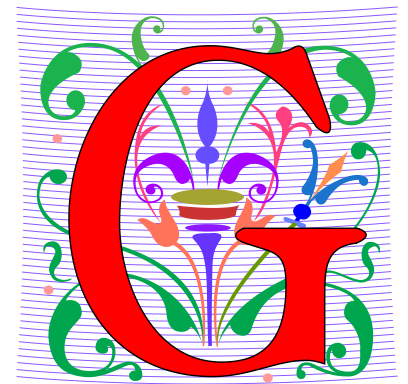
List and String Operations, For loop

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February 2, 2023



G is for ...



- **Google**
 - How to find the answer to everything
- **Global Variable**
 - Accessible everywhere, typically do not do
- **GIGO**
 - Garbage In, Garbage Out
- **Git**
 - Working Together or Solo

Sir Tim Berners-Lee

- Invented World Wide Web
 - Turing award 2016
- HTTP vs. TCP/IP
 - Just protocols?



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“The Web as I envisaged it, we have not seen it yet. The future is still so much bigger than the past.”

“We need diversity of thought in the world to face the new challenges.”

Did you sign up for compsci@duke.edu mailing list?

- **Mailing list to get the CompSci weekly newsletter**
 - Events, research and job opportunities
- **To add yourself:**
 - Go to lists.duke.edu
 - Authenticate and then add compsci@duke.edu

Announcements

- **Assignment 1 Faces**
 - Program due Tonight (has one grace day)
 - Also REFLECT Form due same time
 - Remember, no consulting hours on Friday
- **APT-2 out today, due Feb 9**
 - Some good practice for the exam
- **Lab 3 Friday**
 - Do prelab 3 before attending!
- **Exam 1 on Tuesday, Feb 7**

PFTD

- **Immutable Types**
- **Objects and what that means**
- **Lists continued**
- **String methods and more**
- **For Loops**
- **Exam 1**

Immutable built-in Types

- **In python string, int, float, boolean - Immutable**
 - Once created cannot change
 - These are still objects in Python3!!
- **Assignment makes a copy**
 - `b = a`
 - b gets a copy of a
- **Let's look at an example**
 - Example with integers

```
val = 0  
bee = val  
val = val + 20
```

Immutable built-in Types

- **In python string, int, float, boolean - Immutable**
 - Once created cannot change
 - These are still objects in Python3!!
- **Assignment makes a copy**
 - `b = a`
 - b gets a copy of a
- **Here is another example!**
 - With strings!

```
val = "apple"  
bee = val  
val = val + "sauce"
```


Let's see how the memory works in Python Tutor

Compare assign with integers, strings and lists

Python 3.6
([known limitations](#))

```
→ 1 x = 6
   2 y = x
   3 x = 3
   4 m = "pink"
   5 n = m
   6 m = "red"
   7 a = ["pig", "cow", "dog"]
   8 b = a
   9 a[-1] = "ant"
```

[Edit this code](#)

→ line that just executed

→ next line to execute

Frames

Objects

List Cloning (or copying)

```
lst1 = ['a', 'b', 1, 2]
```

```
lst2 = lst1
```

```
lst3 = lst1[:]
```

WOTO-1 Cloning

<http://bit.ly/101s23-0202-1>

List Concatenation Steps

1. Calculate the length of the new list
2. Create list of that length
3. Copy values from first list
4. Copy values from second list
5. Assign the variable to the new list



Brand
new list!

```
1 lst0 = [1, 2]
2 lst1 = [3, 4, 5]
3 lst2 = lst0 + lst1
```

Concatenation:

length, create, copy, copy, assign

```
1 lst0 = [1,2]
2 lst1 = [3, 4, 5]
3 lst2 = lst0 + lst1
```

Concatenation: Makes new List

```
1 lst0 = [1,2]
2 tmp = lst0
3 lst0 = lst0 + [4]
```

Concatenation:

length, create, copy, copy, assign

- **How is the inner list copied?**

```
1 lst0 = [1, ['b', 3.0]]
2 lst1 = [4]
3 lst2 = lst0 + lst1
```

What will Python Tutor Display? How many copies of ['b', 3.0] will be present?

List Mutation: `.append(...)`

- `.append()` – list function that adds element to end of list
 - Mutates list to left of “.”
 - “.” – call function to the right of the dot on the thing to the left of the dot (LEFT.RIGHT)

```
x = [6, 2, 4]
```

```
x.append(3)
```

```
x.append( [5,2] )
```

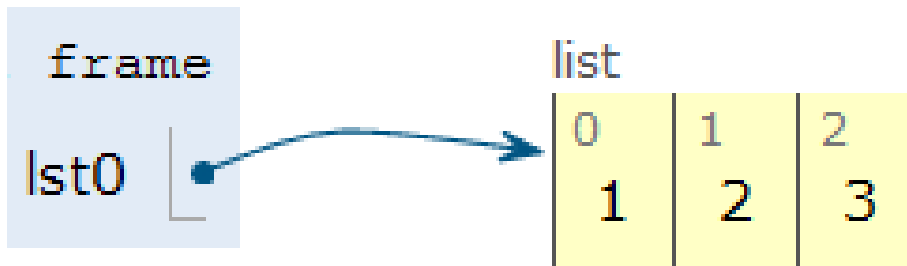
List Mutation: `.append(...)`

```
1 lst0 = [1, 2, 3]
2 tmp = lst0
3 lst0.append(4)
```

What will Python
Tutor Display? One or
two lists?

List Mutation: .append(...)

```
→ 1 lst0 = [1, 2, 3]
   2 tmp = lst0
   3 lst0.append(4)
```



WOTO-2 – Mutable and Append

<http://bit.ly/101s23-0202-2>

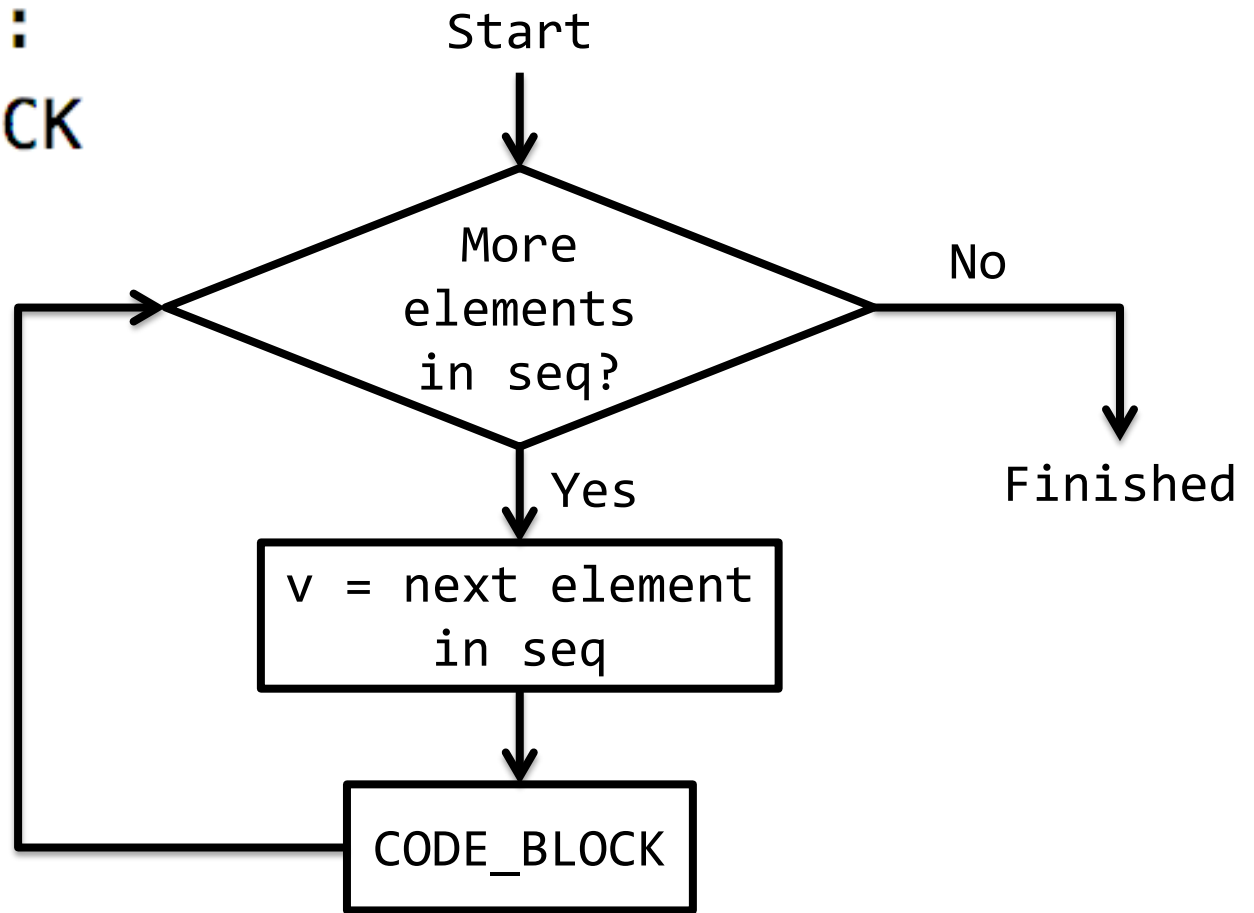
Anatomy of a for loop

```
for VARIABLE in SEQUENCE:  
    CODE_BLOCK
```

- **Think of as:**
 - “For each element in the SEQUENCE put it in the VARIABLE and execute the CODE_BLOCK.”
 - Also called: *Iterate* over the sequence
- **What type(s) are sequences?**
 - Strings, Lists
- **Will VARIABLE likely be in CODE_BLOCK?**

Anatomy of a for loop

```
for v in seq:  
    CODE_BLOCK
```




Example for loop with a list

- What does this for loop do?

```
1 lst = [5, 3, 2]
2 sum = 0
3 for num in lst:
4     sum = sum + num
5 print(sum)
```

- What is first value of **num**?
- What is final value of **num**?

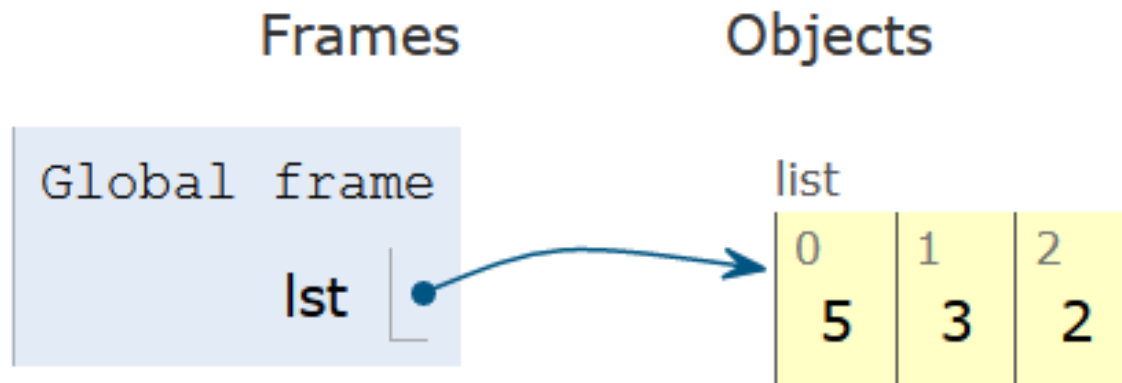
Trace through for loop



```
1 lst = [5, 3, 2]
2 sum = 0
3 for num in lst:
4     sum = sum + num
5 print(sum)
```


Trace through for loop

```
1 lst = [5, 3, 2]
2 sum = 0
3 for num in lst:
4     sum = sum + num
5 print(sum)
```




Example for loop with a string

- What does this for loop do?

```
1 animal = 'cat'  
2 word = animal  
3 for ch in animal:  
4     word = word + ch  
5 print(word)
```


- What is first value of **ch**?
- What is final value of **ch**?

Trace through for loop



```
1 animal = 'cat'
2 word = animal
3 for ch in animal:
4     word = word + ch
5 print(word)
```

Trace through for loop



```
1 animal = 'cat'  
2 word = animal  
3 for ch in animal:  
4     word = word + ch  
5 print(word)
```

Global frame

animal "cat"

String's split(...)

- **Strings have functions too!**
- **TYPE_STRING.FUNCTION(PARAMETERS)**
 - **“.”** means apply function to what is on the left
- **'one fish two fish'.split()** returns a list
- What did it divide the string by?
 - When no parameter, default whitespace
- **'one fish, two fish'.split(',')**

String's join(...)

- **TYPE_STRING.join(SEQ_OF_STRINGS)**
 - Opposite of .split()
 - Creates string from sequence's items separated by the string to the left of join
- ' '.join(['one', 'fish', 'two', 'fish'])
- '+'.join(['one', 'fish', 'two', 'fish'])
- 'ish'.join(['f', 'w', 'd', 'end'])

More Methods

String

<code>.find(s)</code>	index of first occurrence of s
<code>.rfind(s)</code>	index of last occurrence of s (from Right)
<code>.upper()/ .lower()</code>	uppercase/lowercase version of string
<code>.strip()</code>	remove leading/trailing whitespace
<code>.count(s)</code>	number of times see s in string
<code>.startswith(s)</code>	bool of whether the string begins with s
<code>.endswith(s)</code>	bool of whether the string ends with s

List

<code>sum(lst)</code>	sum of the elements in lst
<code>max(lst)</code>	maximum value of lst
<code>min(lst)</code>	minimum value of lst
<code>.append(elm)</code>	Mutates the list by adding elm to the end of the list
<code>.count(elm)</code>	Number of times see elm in the list

WOTO-3 – Split and Join

<http://bit.ly/101s23-0202-3>

APT2 out today – Due Feb 9

Do early - practice for exam

- **5 problems**
 - Write code on paper first - good practice!
 - Then type in and debug

- ReadQuizScore
- RemoveMiddle
- PortManteau
- TotalWeight
- SentenceLength

One of
these uses a
loop

Exam 1 – Feb 7, 2023

- **All lecture/reading topics through today**
 - Topics today at simpler level
 - Loop over list, loop over characters in a string
- **Understand/Study**
 - Reading, lectures
 - Assignment 1, APT-1, (APT-2 helpful, not required)
 - Labs 0-3
 - Very Important! Practice writing code on paper
- **Logistics:**
 - Exam in person, in lecture



Simple
for
loop

Exam 1 – Feb 7, 2023 (cont)

- **What you should be able to do**
 - Read/trace code
 - Determine output of code segment
 - Write small code segments/function
- **Look at old test questions**
 - We will look at some in Lab 3
- **Exam 1 is your own work!**
 - Only bring a pen or a pencil!
 - Do not consult with anyone else.
 - Closed book, no notes, no paper, no calculators
 - See Exam 1 Reference sheet (will be on exam)

Python Reference Sheet, is attached to your exam (see link on calendar page, under 2/7)

Python Reference Sheet for CompSci 101, Exam 1, Spring 2023

On this page we'll keep track of the Python types, functions, and operators that we've covered in class. You can also review the online [Python References](#) for more complete coverage, BUT NOTE there is way more python in the there then we will cover! The reference page below is all you should need to complete the exam.

Mathematical Operators		
Symbol	Meaning	Example
+	addition	4 + 5 = 9
-	subtraction	9 - 5 = 4
*	multiplication	3*5 = 15
/ and //	division	6/3 = 2.0 6/4 = 1.5 6//4 = 1
%	mod/remainder	5 % 3 = 2
**	exponentiation	3**2 = 9, 2**3 = 8
String Operators		
+	concatenation	"ab"+"cd"="abcd"
*	repeat	"xo"*3 = "xoxoxo"
Comparison Operators		
==	is equal to	3 == 3 is True
!=	is not equal to	3 != 3 is False
>=	is greater than or equal to	4 >= 3 is True
<=	is less than or equal to	4 <= 3 is False
>	is strictly greater than	4 > 3 is True
<	is strictly less than	3 < 3 is False
Boolean Operators		
x=5		
not	flips/negates the value of a bool	(not x == 5) is False