Compsci 101
List and String Operations, For loop

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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?

“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.”

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• 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**

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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

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PFTD

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

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Mutable 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 = "apple"
    - bee = val
    - val = val + "sauce"
Let's see how the memory works in Python Tutor

List Cloning (or copying)

```python
lst1 = ['a', 'b', 1, 2]
lst2 = lst1
lst3 = lst1[:]  
```

WOTO-1 Cloning
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

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

Brand new list!

Concatenation: Makes new List

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

Concatenation: length, create, copy, copy, assign

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

- How is the inner list copied?

```
lst0 = [1, [‘b’, 3.0]]
lst1 = [4]
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)

```python
x = [6, 2, 4]
x.append(3)
x.append([5, 2])
```

What will Python Tutor Display? One or two lists? 

WOTO-2 – Mutable and Append

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?

Example for loop with a list

• What does this for loop do?

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

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

Example for loop with a string

```python
animal = 'cat'
word = animal
for ch in animal:
    word = word + ch
print(word)
```

- What does this for loop do?
- What is first value of `ch`?
- What is final value of `ch`?
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

<table>
<thead>
<tr>
<th>String</th>
<th>List</th>
</tr>
</thead>
<tbody>
<tr>
<td>.find(s)</td>
<td>sum(lst)</td>
</tr>
<tr>
<td>.rfind(s)</td>
<td>max(lst)</td>
</tr>
<tr>
<td>.upper()</td>
<td>min(lst)</td>
</tr>
<tr>
<td>.lower()</td>
<td>.append(elm)</td>
</tr>
<tr>
<td>.strip()</td>
<td>Mutates the list by adding elm to the end of the list</td>
</tr>
<tr>
<td>.count(s)</td>
<td>.count(elm)</td>
</tr>
<tr>
<td>.startswith(s)</td>
<td>Number of times see elm in the list</td>
</tr>
<tr>
<td>.endswith(s)</td>
<td></td>
</tr>
</tbody>
</table>

WOTO-3 – Split and Join  
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

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)