DeMorgan’s Law, Short circuiting, Global, Tuples

Susan Rodger
February 17, 2022
L is for …

• Loops
  • While, For, Nested – Iteration!

• Library
  • Where we find APIs and Implementations

• Logic
  • Boolean expressions in if statements, loops

• Linux
  • The OS that runs the world?
Keith Kirkland

- BS ME, BFA Accessories Design, MID Industrial and Product Design
- Co-founder of WearWorks
- Wayband – wearable haptic navigation device for blind
- Device guided blind marathon runner in NYC marathon

“We design products that shift people’s lives in a meaningful way”

“We take large challenges and turn them into opportunities that will one day help people and awaken the problems that can be solved. We believe in setting new standards for what is possible.”
Announcements

• APT-3 due tonight
• Assign 3 due Tuesday, March 1
• Lab 6 on Friday, do prelab

• Exam 2 – Tuesday, Feb 22
  • in person during lecture time
• APT Quiz 1 – Feb 24-27
Exam 2 – in person – Tues, Feb 22

- Exam is in class on paper – 10:15am
  - Need pen or pencil
- See study materials under 2/22 date
  - Exam 2 Reference sheet - part of exam
- Covers
  - topics /reading through today
  - APTs through APT3
  - Labs through Lab 5, Lab 6 (Part 1 – list comprehensions)
  - Assignments through Assignment 2
  - Concepts from Assign2, No turtles
Exam 2 – How to Study

• Practice writing code on paper!
• Rewrite an APT
• Try to write code from lecture from scratch
• Try to write code from lab from scratch
• Practice from old exams
• Put up old Sakai quizzes, but better to practice writing code
• Look at Exam 2 reference sheet when writing code!
Exam 2

• Exam 2 is your own work!
• No looking at other people’s exam
• You cannot use any notes, books, computing devices, calculators, or any extra paper
• Bring only a pen or pencil
• The exam has extra white space and has the Exam 2 reference sheet as part of the exam.

• Do not discuss any problems on the exam with others until it is handed back
APT Quiz 1 Feb 24-27

• Opens 2/24 11:30am
• Closes at 11pm 2/27 – must finish all by this time
• There are two parts based on APTs 1-3
  • Each part has two APT problems
  • Each part is 1.5 hours – more if you get accommodations
  • Each part starts in Sakai under tests and quizzes
  • Sakai is a starting point with countdown timer that sends you to a new apt page just for each part
  • Could do each part on different day or same days
• Will put up problems today from an old APT Quiz so you can practice (not for credit) – on APT Page
APT Quiz 1

• Is your own work!
  • No collaboration with others!
  • Use your notes, lecture notes, your code, textbook
  • DO NOT search for answers!
  • Do not talk to others about the quiz until grades are posted

• Post private questions on Ed Discussion
  • We are not on between 10pm and 8am!
  • We are not on all the time
  • Will try to answer questions between 8am – 10pm

• See 101 APT page for tips on debugging APTs
PFTD

- Tuples
- Global
- DeMorgan’s Law
- Short Circuiting
- APT
Tuple: What and Why?

• Similar to a list in indexing starting at 0
  • Can store any type of element
  • Can iterate over
• Immutable - Cannot mutate/change its value(s)
  • Efficient because it can't be altered
• Examples:
  • \( x = (5, 6) \)
  • \( y = ([1, 2], 3.14) \)
Python 3.6
(known limitations)

1  x = (5, 6)
2  print(type(x))
3  y = ([1,2], 5, 3.14)
4  y[0].append(8)
5  y[0][1] = 4
6  y[0] = [7, 9]
Tuple Trace in Python Tutor

Python 3.6 (known limitations)

1  x = (5, 6)
2  print(type(x))
3  y = ([1,2], 5, 3.14)
4  y[0].append(8)
5  y[0][1] = 4
6  y[0] = [7, 9]

Print output (drag lower right corner to resize)

Frames          Objects

Python 3.6 (known limitations)

1  x = (5, 6)
2  print(type(x))
3  y = ([1,2], 5, 3.14)
4  y[0].append(8)
5  y[0][1] = 4
6  y[0] = [7, 9]

Print output (drag lower right corner to resize)

Frames          Objects

Global frame

x

tuple

0  5  1  6
Variables and their Scope

- Local variable – variable in function only known in that function
- Parameter – way to pass information to a function
- Global variable - variable known throughout the whole file
When to use Global Variables

• Typically, don’t use global variables
  • Harder to share a function if it refers to a global variable
  • Act differently than other variables

• Sometimes makes sense
  • Global variable is used in most functions
  • Saves passing it to every function

• Best practice = help other humans read the code
  • Global variables define at top of file
  • When global used in function, declared as global at beginning of function
Summary - What is global?

• Accessible everywhere in the file (or “module”)
• Variable is in the global frame
  • First frame in Python Tutor
• If declared global in a function:
  • The variable in the global frame can also be reassigned in that function
  • Despite Python being in a different frame!
• Eliminates the need to pass this value to all the functions that need it
When reading code with globals

• When checking the value of a variable, ask:
  • Is this variable local to the function or in the global frame?

• When in a function and assigning a value to a variable, ask:
  • Has this variable been declared global?
    • If yes, reassign the variable in the global frame
    • If no, create/reassign the variable in the function's local frame
s = 'top'

def func1():
    s = "apple"
    t = "plum"
    print("func1 s:", s, "t:", t)

def func2():
    global s
    s = 'orange'
    t = 'grape'
    print("func2 s:", s, "t:", t)

if __name__ == '__main__':
    print('main1 s:', s)
    s = 'red'
    t = 'blue'
    print('main2 s:', s, "t:", t)
    func1()
    print('main3 s:', s, "t:", t)
    func2()
    print('main4 s:', s, "t:", t)
Global

What will print?

```
1 s = 'top'

def func1():
    s = "apple"
    t = "plum"
    print("func1 s:", s, "t:", t)

def func2():
    global s
    s = 'orange'
    t = 'grape'
    print("func2 s:", s, "t:", t)

if __name__ == '__main__':
    print('main1 s:', s)
    s = 'red'
    t = 'blue'
    print('main2 s:', s, "t:", t)
    func1()
    print('main3 s:', s, "t:", t)
    func2()
    print('main4 s:', s, "t:", t)
```
What will print?

```python
s = 'top'

def func1():
    s = "apple"
    t = "plum"
    print("func1 s:", s, "t:", t)

def func2():
    global s
    s = 'orange'
    t = 'grape'
    print("func2 s:", s, "t:", t)

if __name__ == '__main__':
    print('main1 s:', s)
    s = 'red'
    t = 'blue'
    print('main2 s:', s, "t:", t)
    func1()
    print('main3 s:', s, "t:", t)
    func2()
    print('main4 s:', s, "t:", t)
```

Output:
main1 s: top
Now let’s see the same thing in Python Tutor

• Global variables are in the global frame
```python
s = 'top'

def func1():
    s = "apple"
    t = "plum"
    print("func1 s:", s, "t:", t)

def func2():
    global s
    s = 'orange'
    t = 'grape'
    print("func2 s:", s, "t:", t)

if __name__ == '__main__':
    print('main1 s:', s)
    s = 'red'
    t = 'blue'
    print('main2 s:', s, "t:", t)
    func1()
    print('main3 s:', s, "t:", t)
    func2()
```
## Variables

**What, where, read, write? (in 101)**

<table>
<thead>
<tr>
<th>What is it?</th>
<th>Where first created?</th>
<th>Where accessible? (read)</th>
<th>Where reassign-able? (write)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Regular variable in main</td>
<td>In main</td>
<td>In main only</td>
<td>In main only</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(technically anywhere,</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>but don’t do that)</td>
<td></td>
</tr>
<tr>
<td>Regular local function</td>
<td>In function</td>
<td>In function only</td>
<td>In function only</td>
</tr>
<tr>
<td>function variable</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Global variable</td>
<td>Top of file</td>
<td>If not reassigning the</td>
<td>In main or in any function</td>
</tr>
<tr>
<td></td>
<td></td>
<td>value, in main and all</td>
<td>that first declares it</td>
</tr>
<tr>
<td></td>
<td></td>
<td>functions</td>
<td>global</td>
</tr>
</tbody>
</table>
Assignment 3 Transform

- Uses several global variables.
- Only use global variables when we specify in an assignment.
List .index vs String .find

str = "computer"  
Values:
pos = str.find("m")
pos = str.find("b")

lst = ["a", "b", "c", "a"]
indx = lst.index("b")
indx = lst.index("B")
Let’s Write list Index function

• Call in findIndex(lst, item)
• Write it so it works like the string find function
  • lst is a list
  • elm is an element
  • Return the position of elm in lst
  • Return -1 if elm not in lst
  • Use while loop to implement
• What is the while loop’s Boolean condition?
  index = 0
  while BOOL_CONDITION:
    index += 1
While Boolean condition

```python
index = 0
while BOOL_CONDITION:
    index += 1
```

- What is the while loop’s Boolean condition?
DeMorgan's Law

• While loop stopping conditions, stop with either:
  • \( \text{lst}[\text{index}] == \text{elm} \)
  • \( \text{index} >= \text{len(lst)} \)

• While loop needs negation: DeMorgan's Laws
  \( \neg (A \land B) \) equivalent to \( (\neg A) \lor (\neg B) \)
  \( \neg (A \lor B) \) equivalent to \( (\neg A) \land (\neg B) \)
### Think: DeMorgan’s Law

#### Fill in the blanks

<table>
<thead>
<tr>
<th>A</th>
<th>B</th>
<th>not (A and B)</th>
<th>(not A) or (not B)</th>
</tr>
</thead>
<tbody>
<tr>
<td>True</td>
<td>True</td>
<td></td>
<td>False</td>
</tr>
<tr>
<td>True</td>
<td>False</td>
<td></td>
<td>True</td>
</tr>
<tr>
<td>False</td>
<td>True</td>
<td></td>
<td>True</td>
</tr>
<tr>
<td>False</td>
<td>False</td>
<td></td>
<td>True</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>A</th>
<th>B</th>
<th>not (A or B)</th>
<th>(not A) and (not B)</th>
</tr>
</thead>
<tbody>
<tr>
<td>True</td>
<td>True</td>
<td>False</td>
<td></td>
</tr>
<tr>
<td>True</td>
<td>False</td>
<td>False</td>
<td>False</td>
</tr>
<tr>
<td>False</td>
<td>True</td>
<td>False</td>
<td></td>
</tr>
<tr>
<td>False</td>
<td>False</td>
<td>False</td>
<td>True</td>
</tr>
</tbody>
</table>
WOTO-2: Will this work?
Next look at future APT

- Understanding this APT will help you understand Assignment 3 Transform
Problem Statement

Strange abbreviations are often used to write text messages on uncomfortable mobile devices. One particular strategy for encoding texts composed of alphabetic characters and spaces is the following:

- Spaces are maintained, and each word is encoded individually. A word is a consecutive string of alphabetic characters.

- If the word is composed only of vowels, it is written exactly as in the original message.

- If the word has at least one consonant, write only the consonants that do not have another consonant immediately before them. Do not write any vowels.

- The letters considered vowels in these rules are 'a', 'e', 'i', 'o' and 'u'. All other letters are considered consonants.

For instance, "ps i love u" would be abbreviated as "p i lv u" while "please please me" would be abbreviated as "ps ps m". You will be given the original message in the string parameter original. Return a string with the message abbreviated using the described strategy.

Specification

```python
filename: TxMsg.py
def getMessage(original):
    ""
    return String that is 'textized' version of String parameter original
    ""
    # you write code here
```
Examples

1. "text message"
   Returns "tx msg"

5. "aeiou bcdfghijklmnpqrstuvwxyz"
   Returns: "aeiou b"
WOTO-3 – TxMsg
Write helper function *transform*

- How?
- Use seven steps
- Work an example by hand