Discrete Structures: CMPSC 102

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Week 12

Let's Discuss

Key Questions

How do I use the mathematical concepts of **sets** and **Boolean logic** to design Python programs that are easier to implement and understand?

Learning Objectives

To **remember** and **understand** some concepts about the **set**,exploring how its use can simplify the implementation of programs.

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Lists in Python

Lists, similar to arrays, are collections which are ordered and changeable.

Creating lists with append maintains position information

```
myList_list = []
myList_list #or print(myList_list)
   # []
myList_list.append("x")
myList_list.append("x")   # again
myList_list   # ['x', 'x']
```

Creating lists in entirety

```
myList_list = ["a","b","c","d"]
myList_list #or print(myList_list)
   #['a', 'b', 'c', 'd']
type(myList_list)
   #<class 'list'>
```

- With a `list`, position of character is maintained, not so with a `set`.

Lists in Python

Removing an element

```
myList_list = ["a"]
print(myList_list)
   #   ['a']
myList_list.remove("a")
print(myList_list)
   #   []
```

Reverse the entire list, no assignment necessary

```
myList_list = ["a","b","c","d"]
myList_list.reverse()
myList_list  #or print(myList_list)
   # ['d', 'c', 'b', 'a']
```

Lists in Python

Each element has a location

```
myList_list = ["a","b","c","d"]
myList_list[0]  # 'a'
myList_list[3]  # 'd'
myList_list[300] #IndexError
```

Print each element by location

```
for i in range(len(myList_list)):
   print("index = ",i)
   print("   myList_list[i] = ",myList_list[i])
#   index =  0
#   myList_list[i] =  a
#       ...
#   index =  3
#   myList_list[i] =  d
```

Iterating Through Elements in Lists

Iteration

```
l_list = ["a","b","c","d"]
for i in l_list:
  print(i)
```

Iteration

```
l_list = ["a","b","c","d"]
for i in range(len(l_list)):
  print("i = ",i," and l_list[i] = ",l_list[i])
```

Note

- With lists, we know which element will be printed first (the first element, from above).

Lambda Functions

We will use these to create lists ...

Lambda function definition

- The lambda operator or lambda function is a way to create small anonymous functions (i.e. functions without a name), and are *throw-away* functions

General syntax

lambda argument_list: expression

```
g = lambda x: 3*x + 1
g(2) #   7
```

```
sum = lambda x, y : x + y
sum(3,4) #   7
```

List Comprehensions to build lists

List comprehensions definition

- List comprehensions provide a concise way to create lists (or sets)

General syntax

[expression for item in list if conditional]

Make list

```
[i for i in range(10)]
[0, 1, 2, 3, 4, 5, 6, 7, 8, 9]
```

Assign list to variable

```
b_list = [i for i in range(10)]
type(b_list)
<class 'list'>
```

List Comps and Lambda Functions to build lists

Build a list with an anonymous function

```
g_list = lambda x: list(i for i in range(x))
g_list(4)   #   [0, 1, 2, 3]
myList_list = g_list(4)
myList_list #   [0, 1, 2, 3]
# slicing particular elements
myList_list[0:2] #   [0, 1]
```

Tuples

A Tuple is a collection of Python objects separated by commas

An empty tuple

```
empty_tuple = ()
print (empty_tuple)
type(empty_tuple)   # <class 'tuple'>
```

A non-empty tuple

```
nonEmpty_tuple = ("a","b","c","d")
nonEmpty_tuple[0]   #   'a'
nonEmpty_tuple[len(nonEmpty_tuple)-1]   #   'd'
```

Check to see that elements are in a tuple

```
nonEmpty_tuple  #  ('a', 'b', 'c', 'd', 4, 'Hi')
"Hi" in nonEmpty_tuple   #  True
4 in nonEmpty_tuple   # True
3 in nonEmpty_tuple   # False
```

Tuples

Checking for sub-elements of elements at a tuple location

```
nonEmpty_tuple = ("a","b","c","d", 4, "Hi", "My music")
nonEmpty_tuple
   #  ('a', 'b', 'c', 'd', 4, 'Hi', 'My music')
"my" in nonEmpty_tuple   # False
"My" in nonEmpty_tuple   # False

# check to see if detail is in a substring in tuple
"My" in nonEmpty_tuple[6]  # True
```

Adding to Tuples

Convert tuple to list, add element, convert back

```
a_tuple = ('2',) #define Tuple
items = ['a', 'b', 'c', 'd'] # elements to add
l_list = list(a_tuple)# make a list
for x in items:
   l_list.append(x) # add items to list
#output as a tuple
print(tuple(l_list))
```

Iterating Through Elements in Tuples

Iteration

```
nonEmpty_tuple = ("a","b","c","d", 4, "Hi", "My music")
for i in nonEmpty_tuple:
  print(i)
```

Iteration

```
for i in range(len(nonEmpty_tuple)):
  print("i= ",i, "nonEmpty_tuple[i]=",nonEmpty_tuple[i])
```

Note

- With tuples (like lists), we know which element will be printed first (the first element, from above).

Dictionaries

An array of a key and a value that is connected for quick searching

- A dictionary maps a set of objects (keys) to another set of objects (values).
- A Python dictionary is a mapping of unique keys to values.
- Dictionaries are mutable, which means they can be changed.
- The values that the keys point to can be any Python value

An empty dictionary

```
myDictionary_dict = {}
print (myDictionary_dict)
type(myDictionary_dict)   # <class 'dict'>
```

Dictionaries

Adding to a dictionary

```
myDictionary_dict = {}
myDictionary_dict[0] = "zero"
myDictionary_dict[0] # gives 'zero'

myDictionary_dict[1] = "one"
print (myDictionary_dict)  #{1: 'one', 0: 'zero'}
```

Removing elements from a dictionary

```
myDictionary_dict = {}
myDictionary_dict[3] = "three"

del myDictionary_dict[3]
print (myDictionary_dict)  #{} (is empty)
```

Randomly Choosing Elements

Choosing Elements from a List

```
import random
abc_list = ['a','b','c','d','e']
random.choice(abc_list)    # 'c'
random.choice(abc_list)    # 'd'
```

Choosing Elements from a List

```
import random
abc_set = set(['a','b','c','d','e'])
  # convert to list
abc2_list = list(abc_set)
random.choice(abc2_list)   # 'd'
```

Randomly Choosing Elements

Choosing Elements from a Dictionary

```
import random
abc_dict = {1:"one",2:"two",3:"Three"} # {vals : keys}
num_list = list(abc_dict) # convert dict to list
n = random.choice(num_list) # pick a number in list
abc_dict[n]  # sub in n to get key value
  #  'two'
```

How to use lists

```
import random
aliceVocab_list = ["I like cats", "I like dogs",
"I like rabbits", "I gave carrots to horses",
"I live on a farm"]

# choose random element
aliceSays_str = random.choice(aliceVocab_list)
print("  This is Alice. I say to Bob :", aliceSays_str)

bobVocab_list = ["I have two cats", "I have three dogs",
"I know several rabbits","I love carrots",
"I love horses","I also live on a farm"]

bobSays_str = random.choice(bobVocab_list)
print("  This is Bob. I reply to Alice :",bobSays_str)
```

Removing Stop-Words

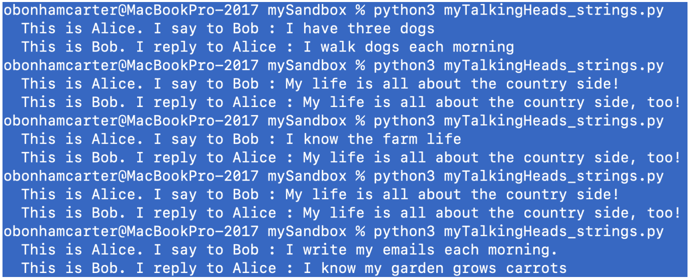
Remove Words from Strings Using Lists

```
stopWords_list =["I", "have","know",
"like", "love", " to ", " a "]

  # we remove stop words
  # as they do not add specificity to the strings

def removeStopWords(in_str): # string input
  for s in stopWords_list:
    in_str = in_str.replace(s,"") #word with empty space
  return in_str.strip()  # remove spaces, return.
  #end of removeStopWords()
```

- Remove stop-words and compare the lists for common words.
- When you find the common words between two lists, you have found a contextual link between them.

Talking Heads Demo

File: sandbox/myTalkingHeads_strings.py



```
obonhamcarter@MacBookPro-2017 mySandbox % python3 myTalkingHeads_strings.py
  This is Alice. I say to Bob : I have three dogs
  This is Bob. I reply to Alice : I walk dogs each morning
obonhamcarter@MacBookPro-2017 mySandbox % python3 myTalkingHeads_strings.py
  This is Alice. I say to Bob : My life is all about the country side!
  This is Bob. I reply to Alice : My life is all about the country side, too!
obonhamcarter@MacBookPro-2017 mySandbox % python3 myTalkingHeads_strings.py
  This is Alice. I say to Bob : I know the farm life
  This is Bob. I reply to Alice : My life is all about the country side, too!
obonhamcarter@MacBookPro-2017 mySandbox % python3 myTalkingHeads_strings.py
  This is Alice. I say to Bob : My life is all about the country side!
  This is Bob. I reply to Alice : My life is all about the country side, too!
obonhamcarter@MacBookPro-2017 mySandbox % python3 myTalkingHeads_strings.py
  This is Alice. I say to Bob : I write my emails each morning.
  This is Bob. I reply to Alice : I know my garden grows carrots
```

- Two lists that interact with each other
- Parsing: Searching for words