Programming in Python

BBM103 Introduction to Programming Lab 1
Week 7

Fall 2017
Collections

• A Collection Groups Similar Things
  
  **List**: ordered
  
  **Set**: unordered, no duplicates
  
  **Tuple**: unmodifiable list
  
  **Dictionary**: maps from keys to values
Lists

The list is a most versatile datatype available in Python which can be written as a list of comma-separated values (items) between square brackets. Important thing about a list is that items in a list need not be of the same type.

Creating a list:

```python
my_list = [1, 2, 3, 4, 5]
```

Splitting a string to create a list:

```python
s = 'spam-spam-spam'
delimiter = '-'
s.split(delimiter)
```

Output: `['spam', 'spam', 'spam']`
Lists

Making a list of chars in a string:

```python
ts = 'spam'
t = list(s)
print(t)
```

Output:
```
['s', 'p', 'a', 'm']
```

Joining elements of a list into a string:

```python
t = ['programming', 'is', 'fun']
delimiter = ' '  # Join delimiter
join(t)
```

Output: 'programming is fun'
Accessing Values in Lists by Index:

```python
list1 = [1, 2, 3, 4, 5]
print("list1[0]: ", list1[0])
print("list1[1:5]: ", list1[1:5])
```

Output:
list1[0]: 1
list1[1:5]: [2, 3, 4, 5]
Updating Lists:

```python
list = [1, 2, 3, 4, 5]
print("Value available at index 2: ", list[2])
list[2] = 6
print("New value available at index 2: ", list[2])
```

Output:
Value available at index 2:  3
New value available at index 2:  6
Deleting List Elements

```python
list = [1, 2, 3, 4, 5]
print(list)
del list[2]
print("After deleting value at index 2: ", list)
```

Output:

```plaintext
[1, 2, 3, 4, 5]
After deleting value at index 2:  [1, 2, 4, 5]
```
## Basic List Operations

<table>
<thead>
<tr>
<th>Python Expression</th>
<th>Results</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><code>len([1, 2, 3])</code></td>
<td>3</td>
<td>Length</td>
</tr>
<tr>
<td><code>[1, 2, 3] + [4, 5, 6]</code></td>
<td><code>[1, 2, 3, 4, 5, 6]</code></td>
<td>Concatenation</td>
</tr>
<tr>
<td><code>['Hi!'] * 4</code></td>
<td><code>['Hi!', 'Hi!', 'Hi!', 'Hi!']</code></td>
<td>Repetition</td>
</tr>
<tr>
<td><code>3 in [1, 2, 3]</code></td>
<td>True</td>
<td>Membership</td>
</tr>
<tr>
<td><code>for x in [1, 2, 3]: print x,</code></td>
<td>1 2 3</td>
<td>Iteration</td>
</tr>
</tbody>
</table>
**List Functions & Methods:**

**len (list)**: Gives the total length of the list.

Example:

```python
list = [1, 2, 3, 4, 5]
print ('length of the list is', len(list))
```

Output:

length of the list is 5
max(list): Returns the item from the list with the maximum value.

Example:

```python
list=[456, 700, 200]
print("Max value element:", max(list))
```

Output:
Max value element: 700
min(list): Returns the item from the list with the minimum value.

Example:

```python
list=[456, 700, 200]
print ("Min value element:", min(list))
```

Output:
Min value element: 200
list.append(obj): Appends object obj to list

Example:

```python
list = [123, 'xyz', 'zara', 'abc']
list.append(2009)
print("Updated List: ", list)
```

Output:
Updated List:  [123, 'xyz', 'zara', 'abc', 2009]
list.count(obj): Returns the count of how many times obj occurs in a list

Example:

```python
aList = [123, 'xyz', 'zara', 'abc', 123]
print("Count for 123: ", aList.count(123))
print("Count for zara: ", aList.count('zara'))
```

Output:
Count for 123:  2
Count for zara:  1
list.extend(seq) : Appends the contents of seq to list

Example:

```python
aList = [123, 'xyz', 'zara']
bList = [2009, 'manni']
aList.extend(bList)
print("Extended List: ", aList)
```

Output:
Extended List:  [123, 'xyz', 'zara', 2009, 'manni']
list.index(obj): Returns the lowest index of obj in the list

Example:

```python
list=[456, 700, 200]
print ("Index of 700: ", list.index(700) )
```

Output:

Index of 700:  1
list.insert(index, obj): Inserts object obj into the list at offset index

Example:
```
aList = [123, 'xyz', 'zara', 'abc']
aList.insert(3, 2009)
print("Final List: ", aList)
```

Output:
```
Final List: [123, 'xyz', 'zara', 2009, 'abc']
```
Example:

```python
aList = [123, 'xyz', 'zara', 'abc']
print ("A List: ", aList.pop())
print ("B List: ", aList.pop(2))
```

Output:

A List:  abc
B List:  zara
list.remove(obj): Removes object obj from list

Example:

```python
aList = [123, 'xyz', 'zara', 'abc', 'xyz']
aList.remove('xyz')
print ("List: ", aList)
aList.remove('abc');
print ("List: ", aList)
```

Output:
List:  [123, 'zara', 'abc', 'xyz']
List:  [123, 'zara', 'xyz']
list.reverse(): Reverses the objects of a list

Example:

```python
aList = [123, 'xyz', 'zara', 'abc', 'xyz']
aList.reverse()
print ("List: ", aList)
```

Output:

```
List:   ['xyz', 'abc', 'zara', 'xyz', 123]
```
list.sort([func]): Sorts objects of list, uses compare func if given

Example:

```python
aList = ['xyz', 'zara', 'abc', 'xyz']
aList.sort()
print("List: ", aList)
```

Output:

List:  ['abc', 'xyz', 'xyz', 'zara']
List Comprehensions

```python
liste = [i for i in range(1000)]
```

**Method 1:**
```python
liste = [i for i in range(1000) if i % 2 == 0]
```

**Method 2:**
```python
liste = []
for i in range(1000):
    if i % 2 == 0:
        liste += [i]
```
Sets are lists with no duplicate entries.

<table>
<thead>
<tr>
<th>Operation</th>
<th>Equivalent</th>
<th>Result</th>
</tr>
</thead>
<tbody>
<tr>
<td>s.update(t)</td>
<td>s</td>
<td>= t</td>
</tr>
<tr>
<td>s.intersection_update(t)</td>
<td>s &amp;= t</td>
<td>return set s keeping only elements also found in t</td>
</tr>
<tr>
<td>s.difference_update(t)</td>
<td>s -= t</td>
<td>return set s after removing elements found in t</td>
</tr>
<tr>
<td>s.symmetric_difference_update(t)</td>
<td>s ^= t</td>
<td>return set s with elements from s or t but not both</td>
</tr>
<tr>
<td>s.add(x)</td>
<td></td>
<td>add element x to set s</td>
</tr>
<tr>
<td>s.remove(x)</td>
<td></td>
<td>remove x from set s; raises <strong>KeyError</strong> if not present</td>
</tr>
<tr>
<td>s.discard(x)</td>
<td></td>
<td>removes x from set s if present</td>
</tr>
<tr>
<td>s.pop()</td>
<td></td>
<td>remove and return an arbitrary element from s; raises <strong>KeyError</strong> if empty</td>
</tr>
<tr>
<td>s.clear()</td>
<td></td>
<td>remove all elements from set s</td>
</tr>
</tbody>
</table>
Example:

```python
list = ['elma', 'armut', 'elma', 'kebap', 'şeker',
       'armut', 'çilek', 'ağaç', 'şeker', 'kebap', 'şeker']
for i in set(list):
    print(i)
```

Output:

```
çilek
elma
kebap
şeker
```

Example:

```python
list = ['elma', 'armut', 'elma', 'kiraz',
       'çilek', 'kiraz', 'elma', 'kebap']
for i in set(list):
    print(f'{{i}} count:  {{list.count(i)}}')
```

Output:

```
armut count:  1
çilek count:  1
ehma count:  3
kiraz count:  2
```
**Tuples**

- A tuple is a sequence of **immutable** Python objects. Tuples are sequences, just like lists.
- What are the differences between tuples and lists?
Tuples

• A tuple is a sequence of immutable Python objects. Tuples are sequences, just like lists.

• The differences between tuples and lists are,
  • the tuples cannot be changed unlike lists,
  • tuples use parentheses, whereas lists use square brackets.

Creating a tuple: \[ \texttt{tup} = (1, 2, 3, 4, 5) \]
Accessing Values in Tuples:

tup1 = ('physics', 'chemistry', 1997, 2000)
tup2 = (1, 2, 3, 4, 5, 6, 7)
print ("tup1[0]: ", tup1[0])
print ("tup2[1:5]: ", tup2[1:5])

Output:
tup1[0]: physics
tup2[1:5]: (2, 3, 4, 5)
Updating Tuples

tup1 = (12, 34.56)
tup2 = ('abc', 'xyz')
tup3 = tup1 + tup2
print (tup3)

Output:
(12, 34.56, 'abc', 'xyz')
Dictionaries

• Dictionary as an unordered set of *key: value* pairs, with the requirement that the keys are **unique** (within one dictionary).

• Unlike sequences, which are indexed by a range of numbers, dictionaries are indexed by *keys*, which can be any immutable type.

Creating a dictionary:

```
dict = {'Name':'Zara','Age':7,'Class':'First'}
```
Accessing Values in a Dictionary:

dict = {'Name': 'Zara', 'Age': 7, 'Class': 'First'}
print ("dict['Name']": ", dict['Name']")
print ("dict['Age']": ", dict['Age'])

Output:
dict['Name']': Zara
dict['Age']: 7
Updating a Dictionary

dict ={'Name':'Zara','Age':7,'Class':'First'}
dict['Age']=8
dict['School']="DPS School"
print ('dict['Age']': ',dict['Age'])
print ('dict['School']': ',dict['School'])

Output:
dict['Age'] : 8
dict['School' ] : DPS School
<table>
<thead>
<tr>
<th>SN</th>
<th>Method with Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td><code>dict.clear()</code> : Removes all elements of dictionary <code>dict</code></td>
</tr>
<tr>
<td>2</td>
<td><code>dict.copy()</code> : Returns a shallow copy of dictionary <code>dict</code></td>
</tr>
<tr>
<td>3</td>
<td><code>dict.fromkeys()</code> : Create a new dictionary with keys from <code>seq</code> and values set to <code>value</code></td>
</tr>
<tr>
<td>4</td>
<td><code>dict.get(key, default=None)</code> : For key <code>key</code>, returns <code>value</code> or <code>default</code> if <code>key</code> not in dictionary</td>
</tr>
<tr>
<td>5</td>
<td><code>dict.has_key(key)</code> : Returns true if key in dictionary <code>dict</code>, false otherwise</td>
</tr>
<tr>
<td>6</td>
<td><code>dict.items()</code> : Returns a list of <code>dict</code>'s (key, value) tuple pairs</td>
</tr>
<tr>
<td>7</td>
<td><code>dict.keys()</code> : Returns list of dictionary <code>dict</code>'s keys</td>
</tr>
<tr>
<td>8</td>
<td><code>dict.setdefault(key, default=None)</code> : Similar to <code>get()</code>, but will set <code>dict[key]=default</code> if key is not already in <code>dict</code></td>
</tr>
<tr>
<td>9</td>
<td><code>dict.update(dict2)</code> : Adds dictionary <code>dict2</code>'s key-values pairs to <code>dict</code></td>
</tr>
<tr>
<td>10</td>
<td><code>dict.values()</code> : Returns list of dictionary <code>dict</code>'s values</td>
</tr>
</tbody>
</table>
Example:

```python
phone_book = {
    "ahmet öz": "0532 532 32 32",
    "mehmet su": "0543 543 42 42",
    "seda naz": "0533 533 33 33",
    "eda ala": "0212 212 12 12"
}

person = input("Please enter a name of a person: ")

if person in phone_book:
    answer = "{} adlı kişinin telefon numarası: {}"
    print(answer.format(person, phone_book[person]))
else:
    print("This name is not in this telephone book!")
```
Example:

names = ["ahmet", "mehmet", "firat", "zeynep", "selma", "abdullah", "cem"]
dict = {i: len(i) for i in names}
The `open` Function:

Example:

```python
# Open a file
fo = open("foo.txt", "wb")
print ("Name of the file: ", fo.name)
print ("Closed or not : ", fo.closed)
print ("Opening mode : ", fo.mode)
```

Output:
Name of the file:  foo.txt
Closed or not :  False
Opening mode :  wb
Opening files to read:

```python
my_file = open("grades.txt", "r")
first_line = my_file.readline()
grades = first_line.split(' - ')
print ("Grades from the first line: ", grades)
my_file.close()
```

Output:
Grades from the first line: ['98', '86', '100', '54', '63\n']
## File I/O

### Opening modes

<table>
<thead>
<tr>
<th>Sr.No.</th>
<th>Modes &amp; Description</th>
<th>Modes &amp; Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td><code>r</code></td>
<td>Opens a file for reading only. The file pointer is placed at the beginning of the file. This is the default mode.</td>
</tr>
<tr>
<td>2</td>
<td><code>rb</code></td>
<td>Opens a file for reading only in binary format. The file pointer is placed at the beginning of the file. This is the default mode.</td>
</tr>
<tr>
<td>3</td>
<td><code>r+</code></td>
<td>Opens a file for both reading and writing. The file pointer placed at the beginning of the file.</td>
</tr>
<tr>
<td>4</td>
<td><code>rb+</code></td>
<td>Opens a file for both reading and writing in binary format. The file pointer placed at the beginning of the file.</td>
</tr>
<tr>
<td>5</td>
<td><code>w</code></td>
<td>Opens a file for writing only. Overwrites the file if the file exists. If the file does not exist, creates a new file for writing.</td>
</tr>
<tr>
<td>6</td>
<td><code>wb</code></td>
<td>Opens a file for writing only in binary format. Overwrites the file if the file exists. If the file does not exist, creates a new file for writing.</td>
</tr>
<tr>
<td>7</td>
<td><code>w+</code></td>
<td>Opens a file for both writing and reading. Overwrites the existing file if the file exists. If the file does not exist, creates a new file for reading and writing.</td>
</tr>
<tr>
<td>8</td>
<td><code>wb+</code></td>
<td>Opens a file for both writing and reading in binary format. Overwrites the existing file if the file exists. If the file does not exist, creates a new file for reading and writing.</td>
</tr>
<tr>
<td>9</td>
<td><code>a</code></td>
<td>Opens a file for appending. The file pointer is at the end of the file if the file exists. That is, the file is in the append mode. If the file does not exist, it creates a new file for writing.</td>
</tr>
<tr>
<td>10</td>
<td><code>ab</code></td>
<td>Opens a file for appending in binary format. The file pointer is at the end of the file if the file exists. That is, the file is in the append mode. If the file does not exist, it creates a new file for writing.</td>
</tr>
<tr>
<td>11</td>
<td><code>a+</code></td>
<td>Opens a file for both appending and reading. The file pointer is at the end of the file if the file exists. The file opens in the append mode. If the file does not exist, it creates a new file for reading and writing.</td>
</tr>
<tr>
<td>12</td>
<td><code>ab+</code></td>
<td>Opens a file for both appending and reading in binary format. The file pointer is at the end of the file if the file exists. The file opens in the append mode. If the file does not exist, it creates a new file for reading and writing.</td>
</tr>
</tbody>
</table>
Opening files and reading all lines:

```python
my_file = open("expenses.txt", "r")
total_expense = 0
for line in my_file.readlines():
    expenses_list = line.split('-')
    for expense in expenses_list:
        total_expense += int(expense)
print("Total expense was:", total_expense)
my_file.close()
```

Output:
Total expense was: 751
Example:

```python
file = open("input.txt","r")
for aline in file.readlines():
    list = aline.split(':')
    print("name: ",list[0]," phone number: ",list[1])
file.close()
```

output.txt
Ahmet Özbudak : 0533 123 23 34
Mehmet Sülün : 0532 212 22 22
Sami Sam : 0542 333 34 34

Output:
name: Ahmet Özbudak  phone number:  0533 123 23 34
name: Mehmet Sülün  phone number:  0532 212 22 22
name: Sami Sam  phone number:  0542 333 34 34
Opening files to write (print output):

my_file = open("output.txt", "w")
my_file.write("I am writing this output to a file")
my_file.close()

Output: The sentence “I am writing this output to a file” will be written into a file named output.txt

New function: `f.write(string)` writes the contents of `string` to the file, returning the number of characters written.
Opening files to write (print output) cont.:

```python
my_file = open("myage.txt", "w")
my_age = 20
my_file.write("I am " + str(my_age) + " years old.")
my_file.close()
```

**Output:** The sentence “I am 20 years old.” will be written into a file named `myage.txt`

`file.write(string)` takes only one argument, so you need to change any other types into strings and concatenate (+) all parts before passing them as an argument.
Exercise

• Write a program that reads an input file grades.txt which stores student names and their grades separated by a colon (:), prints out the name of the student with the highest grade, the name of the student with the lowest grade, and the average grade for this class. Your program should also write the same output to an output file named class_stats.txt

• Note: use a dictionary to store the information from grades.txt