UMBC
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CMSC 201 Fall 2015
Lab 12 – Tuples and Dictionaries

Assignment: Lab 12 – Tuples and Dictionaries
Due Date: During discussion, November 30th through December 3rd
Value: 1% of final grade

Part 1: Data Types

So far this semester, we have been learning about the different data types that we can use. We have discussed numbers (both integers and floats), Booleans, strings, and lists. Interestingly, strings and lists share a lot of characteristics and functionalities, such as indexing and slicing operations. We have a name for these types of structures: they are called sequence types. In this lab we are going to practicing using two more data types that are also sequence structures: tuples and dictionaries.

Part 2: Tuple Creation

Tuples look a lot like lists. They contain information in a "list" form and they act pretty similarly. The two main differences between tuples and lists are:

1. The tuples cannot be changed (they are immutable), unlike lists
2. Tuples use parentheses, whereas lists use square brackets

So when should you use a tuple and when should you use a list? Generally, we use a tuple when the number of items in the structure is known in advance, and wont' ever need to be changed. Tuples are faster than lists, so if we won't be changing the values in the structure, we should use a tuple.

Creating a tuple is as simple as assigning comma-separated values to a variable between parentheses. Technically, the parentheses are optional – however, for clarity, we will always include them.

Here are some examples of tuple creation:

```
tup1 = ('physics', 'chemistry', 1997, 2000)
tup2 = (1, 2, 3, 4, 5 )
tup3 = ("a", "b", "c", "d")
```

Part 3: Updating and Deleting Tuples

As we have discussed, tuples are immutable, which means they cannot be changed (*i.e.*, updated in place). For this reason, we cannot directly add or remove individual items of a tuple after it has been created. However, we can use pieces of existing tuples to create new ones. For example:

```
tup1 = ("CMSC", "201")
tup2 = ("Rules", "Hooray")

tup3 = tup1 + tup2
```

The **tup3** variable now contains the following information:

```
('CMSC', '201', 'Rules', 'Hooray')
```

Although we cannot change a tuple, it is possible to completely delete one. To do this, we use the function **del**, which is just short for "delete." To remove the variable **tup3**, we would use the following command:

```
del(tup3)
```

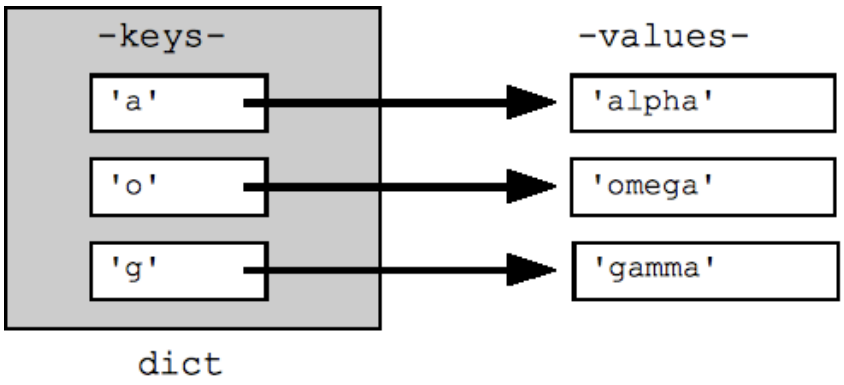
After using the **del** function, the variable is completely gone! If we try to reference it, Python will tell us that there is a "NameError" and that the variable named "**tup3**" is not defined.

As tuples are similar to strings, almost all the functions we use on strings are usable on tuples including:

- **len()** length
- **+** concatenation
- ***** repetition
- **3 in (1, 2, 3)** membership
- **for x in tupleName** iteration

Part 4: Dictionaries

Another useful data type built into Python is the ***dictionary***. Dictionaries are sometimes found in other languages as "associative memories" or "associative arrays." Dictionaries basically map a key to a value. So, in the example below, we have a dictionary that maps the key '**a**' to the value '**alpha**'; the key '**o**' to the value '**omega**'; and the key '**g**' to the value '**gamma**'.



We can create this dictionary with this line of code:

```
greek = {'a': 'alpha', 'o': 'omega', 'g': 'gamma'}
```

Dictionaries may look a lot like lists, but there are a few key differences:

1. A dictionary uses curly braces instead of square brackets
2. A dictionary is made up of (key, value) pairs
3. The key and value are separated by a colon (`:`)
4. The (key, value) pairs are separated by a comma (`,`)
5. The keys must be unique (just like the indexes of a list are unique)

Lists are indexed by ***order***, which we see as a range of numbers. Dictionaries are indexed by ***association***, or their key values. Keys can be any immutable type, and every key in a dictionary must be unique. Strings, floats, and integers are common choices for a key; tuples can also be used as a key.

Part 5: Dictionary Functions

We can start by looking at how we could create a simple dictionary. Let's create a new dictionary called **example**.

```
example = {'fname' : 'Santa', 'lname' : 'Claus',
'occupation' : 'Salesman'}
```

In this dictionary, we have mapped **fname** to **Santa**, **lname** to **Claus**, and **occupation** to **Salesman**. Using this dictionary, we can perform a number of operations.

A. **Returning** something from the dictionary:

```
print(example['fname'], example['lname'])
```

B. **Adding** something to the dictionary:

```
example['salary'] = 1250595
```

C. **Updating** something in the dictionary:

```
example['occupation'] = 'Pilot'
```

D. **Deleting** something from the dictionary:

We can remove a single entry by referencing the key itself:

```
del example['occupation']
```

We can remove all entries in the dictionary by using **clear**

```
example.clear()
```

We can delete the entire dictionary by using **del**

```
del example
```

E. **Checking if a key is present** in the dictionary:

```
'occupation' in example
```

(This will return a Boolean (True or False) that indicates whether the key is in the dictionary.)

F. Dictionaries also have methods that enable some additional functionality. In addition to the commands and examples above, here are some of the more helpful methods we can use:
   a. **dict.items()**
      i. Returns a list of **`dict`**'s (key, value) tuple pairs
   b. **dict.values()**
      i. Returns a list of dictionary **`dict`**'s values
   c. **dict.keys()**
      i. Returns a list of dictionary **`dict`**'s keys

Part 6: English to Spanish Translator

After logging into GL, navigate to the **Labs** folder inside your **201** folder. Create a folder there called **lab12**, and go inside the newly created **lab12** directory.

```
linux2[1]% cd 201
linux2[2]% cd Labs
linux2[3]% pwd
/afs/umbc.edu/users/k/k/k38/home/201/Labs
linux2[4]% mkdir lab12
linux2[5]% cd lab12
linux2[6]% pwd
/afs/umbc.edu/users/k/k/k38/home/201/Labs/lab12
linux2[7]%
```

To open the file for editing, type

emacs translate.py &

and hit enter. (The ampersand at the end of the line is important – without it, your terminal will "freeze" until you close the emacs window. **Do not include the ampersand if you are not on a lab computer.**)

The first thing you should do in your new file is create and fill out the comment header block at the top of your file. Here is a template:

```
# File:          translate.py
# Author:        YOUR NAME
# Date:          TODAY'S DATE
# Section:       YOUR SECTION NUMBER
# E-mail:        USERNAME@umbc.edu
# Description:   YOUR DESCRIPTION GOES HERE AND HERE
#                YOUR DESCRIPTION CONTINUED SOME MORE
```

For Lab 12, you will be implementing a very simple English to Spanish translator program. First things first, download the file containing the English and Spanish word pairs by running this command inside your lab12 folder:

```
cp /afs/umbc.edu/users/k/k/k38/pub/cs201/eng2sp.txt .
```

The file contains the Spanish translation for the following English words:

after, always, bad, bathroom, before, big, boy, eight, five, four, friend, girl, good, goodbye, happy, hello, less, man, more, never, nine, no, one, over, sad, seven, six, small, ten, thanks, thing, three, two, under, woman, yes, zero

In order to complete your lab, you will need to implement a program that does the following tasks:

1. Read in the **`eng2sp.txt`** file (you can hardcode the filename). *(HINT: You will need to take a look at how the file is formatted to be able to extract the parts you need!)*
2. Write a function to store the data from the file in a dictionary, where the English words are the key, and the Spanish translation is the value. *(HINT: Your function should return the dictionary. The* **`split()`** *function should prove useful in getting the data out of the file.)*

3. Ask the user to input a word – check if the word appears in the dictionary's keys. *(HINT: Use the* **`in`** *keyword discussed earlier.)*
    a. If the word doesn't appear in the dictionary, tell the user that.
    b. If the word does appear in the dictionary, return the translation.
4. Allow the user to keep looking up words as long as they like; if they type "**`EXIT`**" in all caps, the program should finish.

You can find a sample run of the program on the next page.

Here is a sample run of the program, with the user input in blue:

```
linux2[6]% /usr/bin/scl enable python33 bash
bash-4.1$ python translate.py

Please enter the English word you would like to translate.
(Enter the word 'EXIT' to quit the program): hello

        In Spanish, the word "hello" is "hola"

Please enter the English word you would like to translate.
(Enter the word 'EXIT' to quit the program): eight

        In Spanish, the word "eight" is "ocho"

Please enter the English word you would like to translate.
(Enter the word 'EXIT' to quit the program): uno

        Sorry, I do not know the word "uno"

Please enter the English word you would like to translate.
(Enter the word 'EXIT' to quit the program): computer

        Sorry, I do not know the word "computer"

Please enter the English word you would like to translate.
(Enter the word 'EXIT' to quit the program): EXIT

Thank you for using the English -> Spanish translator!
```

Part 7: Completing Your Lab

To test your program, first enable Python 3, then run **`translator.py`**. Try asking it to translate different words than the one shown in the sample run shown above.

Since this is an in-person lab, you do not need to use the **`submit`** command to complete your lab. Instead, raise your hand to let your TA know that you are finished.

They will come over and check your work – they may ask you to run your program for them, and they may also want to see your code. Once they've checked your work, they'll give you a score for the lab, and you are free to leave.

IMPORTANT: If you leave the lab without the TA checking your work, you will receive a **zero** for this week's lab. Make sure you have been given a grade before you leave!

References:

Python Software Foundation. (2015). "Dictionaries". Retrieved from https://docs.python.org/2/tutorial/datastructures.html

Tutorials Point (2015). "Python Dictionary". Retrieved from http://www.tutorialspoint.com/python/python_dictionary.htm

Tutorials Point (2015). "Python Tuples". Retrieved from http://www.tutorialspoint.com/python/python_tuples.htm