CS 1301 Homework 9

Homework – Functional Programming and Dictionaries!
Due: Friday, April 20th, before 11:55pm (You may turn this homework in anytime before Monday April 23rd at 11:54pm with NO LATE PENALTY! However, it will NOT be accepted after that time.)

THIS IS AN INDIVIDUAL ASSIGNMENT!

You should work individually on this assignment. You may collaborate with other students in this class. Collaboration means talking through problems, assisting with debugging, explaining a concept, etc. Students may only collaborate with fellow students currently taking CS 1301, the TA's and the lecturer. You should not exchange code or write code for others. For individual assignments, each student must turn in a unique program. Your submission must not be substantially similar to another student's submission. Collaboration at a reasonable level will not result in substantially similar code.

Scored out of 100 points
Files to Submit:

hw9.py ***(make sure to complete all 4 parts!)***

If you need help, we have several resources to assist you successfully complete this assignment:
- The TA Helpdesk – Schedule posted on class website.
- Email the TA's
- Jay's office hours

Notes:
• Don’t forget to include the required comments and collaboration statement (as outlined on the course syllabus).
• Do not wait until the last minute to do this assignment in case you run into problems.
• If you find a significant error in the homework assignment, please let a TA know immediately.

Part 1 – Averaging Robot Sensor Values

For the first part of the homework, you will be writing a function to compute an average of the robot obstacle values for a certain period of time. Your function should be named *avgObstacleValues* and should take in an integer parameter, representing the number of seconds that the procedure will run (you will need to use timeRemaining).

For the time specified by the given parameter, you must repeatedly perform the following task

- Get the values of all three obstacle sensors
- Rotate the robot left or right at full speed for a **random** amount of time between 0 and 1 second (inclusive).

While performing this task, you must keep track of each individual obstacle value for the left, center, and right obstacle sensors in a separate list. Once the time for gathering the obstacle values is finished, you must use the **reduce** function to help determine the average value for the left, center, and right light values. Hint: it will be quite helpful to keep count of how many times you gathered the light values.

Your function must return a tuple representing the average light values for the left, center, and right obstacle sensors respectively, as floats, over the period of time specified by the parameter.

You may write any additional helper functions to assist with this part of the homework.

Hint: The Random Module

To generate a random number, take a look at the Random Module.

Sample Input/Output

If, after running your function, the obstacle values were found to be

leftValues = [1300, 1240, 1401]
centerValues = [1470, 1403, 1501]
rightValues = [1200, 1402, 1550]

Then your function would return (1313.6666667, 1458.0, 1384.0)

Note, this is only an example showing the output of your function... in actuality you will probably have much more than three values stored.

Part 2– Calculating Distances

For this part of the homework, you will be reading several points from a file and finding the distance between the points.
Write a function named *findDistances* that takes in two parameter, the input and outupt file names

The input file will always have the following format:

```
15 13 4 2
3 6 9 7
12 2 3 9
3 7 8 6
```

Where each line contains a set of integer values x1 y1 x2 y2 – the x and y coordinates for two points.

Your function should read all the lines of the input file, split each line into a list, and append that list (which results from the split) to a "points list" containing all points. For you to correctly implement the map function, you will probably want your "points list" to look something like this:

[[“15”, “13”, “4”, “2\n”], [“3”, “6”, “9”, “7\n”], … [“3”, “7”, “8”, “6\n”]].

Then, use the **map** function for each item in this list, applying the distance formula:

sqrt((x1-x2)**2 + (y1-y2)**2)

Successfully applying the map function on the list shown above would result in

[15.556349186104045, 6.0827625302982193, … 5.0990195135927845]

Once you have successfully used the map function to calculate the distance between each set of points, you need to write the results to the output file. Be sure to include a newline between each result. The output for this sample is shown below:

```
15.556349186104045
6.0827625302982193
11.401754250991379
5.0990195135927845
```

Part 3 – Finding All Images in a Directory

For this part of the homework, you write a function named *findImages*. This function will take in a single parameter, a string containing the path to a directory on the local machine. Your function must obtain a list of every file in the directory and return a list of all the file names that are of image type. You must use Python's built-in **filter** function in order to receive credit. You may also write any additional helper functions as needed.

You can assume the following image extensions are the only ones we will look for: ".jpg", ".gif", ".bmp", and ".png".

Hint: The OS Module

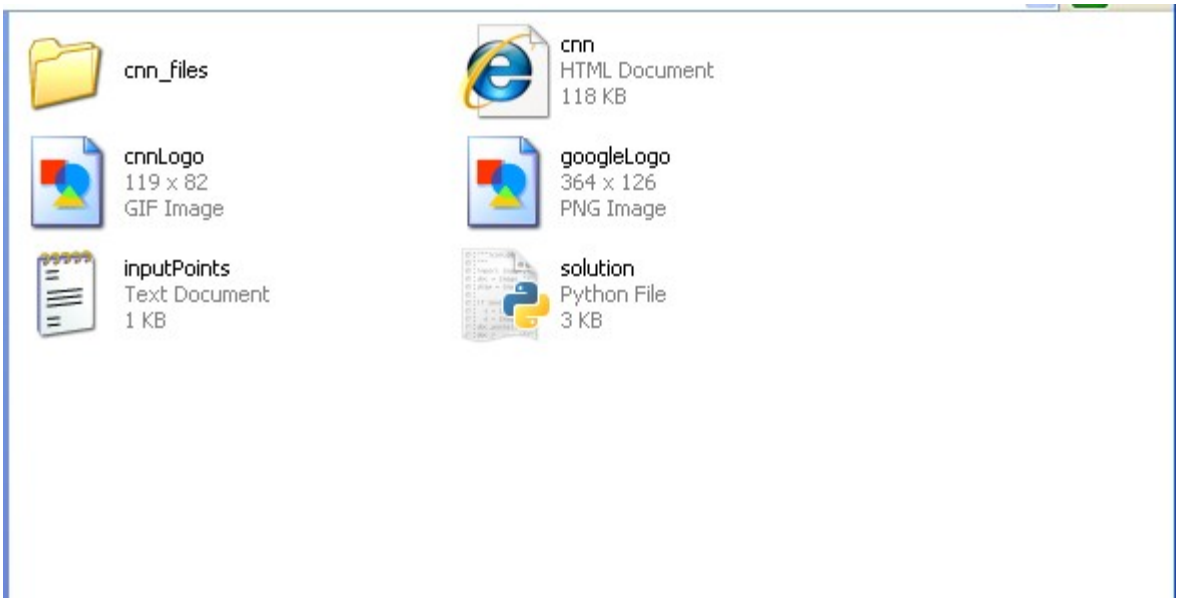
To help with this function, take a look at the OS Module. This module will provide interfaces to operating system features such as files, a clock, and other useful things.

- Entire OS Module Documentation
- Specific OS Module Documentation (which includes the function needed for this part of the assignment).

Sample Input/Output

Assume the following folder exists with the file path

"C:\Documents and Settings\sasghari3\Deskop\myFolder"



Running *findImages* on the specified folder path yields the following result.

```
>>> findImages("C:\Documents and Settings\sasghari3\Desktop\myFolder")
['cnnLogo.gif', 'googleLogo.png']
>>>
```

Part 4 – Generating File System Dictionary

For this part of the homework, you will be writing a function that takes in a string as a parameter. The parameter should represent a path to a directory on your local machine. Your function will return a dictionary where the keys are the sub-directories inside of the directory represented by the parameter and the associated value for each key is a list of the names of all files and sub-directories inside of the the sub-directory. You should also have the directory that is passed in as a parameter be a key in your dictionary. Name your function *generateFileSystemDictionary*.

Sample Input/Output

As an example, imagine the following directory structure (where "/folderX" is a directory and everything else is a file):

/folder1

img1.jpg

img2.jpg

img3.gif

/folder2

solution.py

notAnImage.doc

/folder3

img4.png

Passing "/folder1" as the parameter, you should return:

{"/folder1" : ["img1.jpg", "img2.jpg", "img3.gif", “folder2”], “/folder1/folder2”: [“solution.py”, “notAnImage.doc”, “folder3”], "/folder1/folder2/folder3" : ["img4.png"]}

Hints

Once again, look at the OS module. You will find the *listdir*, *path.isdir*, and other functions quite helpful. You may also want to implement a recursive solution to handle sub-directories.

Grading Rubric:

Averaging Robot Obstacle Values (25pts)

- robot rotates using a random time (random module) 5pts
- successfully applies reduce function on the right type of data 10pts
- returns a tuple containing the correct average of the values 5pts
- properly iterates for the right amount of time and successfully grabs obstacle values 5pts

Calculating Distance (25pts)

- successfully opens/closes, and reads/writes the correct information from the input and output files 10pts
- successfully applies the map function to calculate the distance for each line in the input file. 15pts

Finding All Images (20pts)

- function works for specified image types (.jpg, .png, .bmp, .gif) 5pts
- function correctly uses filter function to find correct file names 10pts
- function returns a list containing only the names with the specified image extensions 5pts

Generate File System Dictionary (30pts)

- function returns dictionary with correct output, following key-value scheme of {"path": [“filename”]} 10pts
- function finds all sub-directories inside the given path 10pts
- function works for all file types 5pts
- function uses the os module 5pts