Koç University
COMP 125: Programming with Python
Homework #3

Deadline: May 2, Sunday at 23:59pm
Submission through: Blackboard
Make sure you read and understand every part of this document

This homework assignment contains 3 programming questions.

Download Hw3.zip from Blackboard and unzip the contents to a convenient location on your computer. Each file in Hw3.zip contains the starter code for one programming question.

Solve each question in its own file. **DO NOT CHANGE THE NAMES OF THE FILES. DO NOT CHANGE THE HEADERS OF THE GIVEN FUNCTIONS (FUNCTION NAMES, FUNCTION PARAMETERS). DO NOT USE TURKISH CHARACTERS.** If you want, you can add helper functions.

When you are finished, compress your Hw3 folder containing all of your answers. The result should be a SINGLE compressed file (file extension must be .zip, or .rar). Upload this compressed file to Blackboard.

Q1: Daily Temperatures - 45 pts

You are given two data files: ISTANBUL.txt and ANKARA.txt, which contain daily temperature readings from these two cities. The data contains 4 columns: first column is month, second column is day, third column is year, fourth column is average daily temperature (in Fahrenheit). Note that there are some entries with value "-99" in the temperature column; this is because the temperature reading for that day is missing.

```
1	1	1995	46.2
1	2	1995	50.9
1	3	1995	46.7
1	4	1995	41.6
1	5	1995	41.8
1	6	1995	36.9
1	7	1995	35.6
1	8	1995	34.7
1	9	1995	32.4
1	10	1995	33.4
```

Open DailyTemperatures.py and solve the following parts. **While opening the files, please do not use any path specific to your computer. When you have the .txt and .py files in the same folder, you don't need to specify the path, you can directly open the file you want using its name.**

Part A: (15 pts)

Write a function called read_temperatures(filename) to read the data from the given text file into a matrix (stored as a list of lists).

- filename is the name of the file that should be read, e.g., "ANKARA.txt"
- The return value should be a matrix in list of lists representation such that:
  - Each row in the matrix is one row of the data file
  - First column is month, second column is day, third column is year, fourth column is average daily temperature (same column order as the file)
- Convert day, month, year to int. Convert temperature to float.

Partial output for ANKARA.txt when the matrix is printed to console (full matrix is quite large):

```
[[1, 1, 1995, 46.2], [1, 2, 1995, 50.9], [1, 3, 1995, 46.7], [1, 4,
1995, 41.6], [1, 5, 1995, 41.8], [1, 6, 1995, 36.9], [1, 7, 1995,
35.6], [1, 8, 1995, 34.7], [1, 9, 1995, 32.4], [1, 10, 1995, 33.4],
[1, 11, 1995, 37.2], [1, 12, 1995, 37.0], [1, 13, 1995, 42.0], [1,
14, 1995, 41.2], [1, 15, 1995, 37.2], [1, 16, 1995, 32.1], [1, 17,
1995, 26.6], [1, 18, 1995, 24.2], [1, 19, 1995, 24.3], [1, 20,
1995, 24.4], [1, 21, 1995, 23.5], [1, 22, 1995, 20.6], [1, 23,
1995, 25.9], [1, 24, 1995, 32.3], [1, 25, 1995, 36.5], [1, 26,
```

HINT: *In addition to trailing whitespace characters, pay attention to leading whitespace characters as well.*

Part B: (15 pts)

Write a function called delete_year(data, year) to remove data from a given year.

- data is the matrix from Part A
- The return value should contain all rows from data minus those rows that have year equal to the given year

For example, if year = 2020, then the return value (list of lists) of delete_year contains all rows other than those rows with year equal to 2020.

Part C: (15 pts)

Write a function called monthly_averages(data, year) to calculate month-by-month average temperatures for the given year.

- data is the matrix from Part A
- year is an integer, e.g.: year = 2004 or year = 2019
- The return value should be a list of length 12:

[avg_of_January, avg_of_February, avg_of_March, …, avg_of_December]

- When calculating the monthly averages, only calculate the monthly averages for the given year. Do not calculate a multi-year average.
- Make sure that you account for missing data ("-99"). For example, if 2 days out of 30 are missing for a certain month, then you need to calculate the average across the remaining 28 days. In other words, do not take "-99"s into consideration.

Sample output for ANKARA data and 2017 when the return value is printed to console:

```
[25.22258064516129, 33.49285714285714, 43.719354838709684,
48.89999999999999, 57.222580645161294, 65.33, 74.31935483870967,
73.63548387096773, 69.21, 51.164516129032265, 41.01666666666665,
36.98064516129033]
```

Q2: Iris Dataset - 30 pts

Iris flower dataset is a multivariate dataset which includes sepal and petal characteristics of three different iris flower species (Iris Setosa, Iris Virginica and Iris Versicolor). It was first introduced by Ronald Fisher in 1936 and since then has been widely used in many statistical classification projects as a test dataset to validate the proposed algorithms. (If you are curious about the dataset, you can read the following paper: *The Use of Multiple Measurements in Taxonomic Problems.*)

Here are the images for these three flower species *(images were taken from Wikipedia)*

Iris Setosa

Iris Virginica

Iris Versicolor

Assume that you are working at a research lab and you need to perform some analyses on the Iris dataset. You are given a csv file: iris_data.csv and a starter code AnalyzeIris.py

You can check the contents of iris_data.csv either using Excel (if your settings are correct) or using another program (such as TextEdit or NotePad++)

	A	B	C	D	E
1	sepal_length	sepal_width	petal_length	petal_width	variety
2	5.1	3.5	1.4	0.2	Setosa
3	4.9	3	1.4	0.2	Setosa
4	4.7	3.2	1.3	0.2	Setosa
5	4.6	3.1	1.5	0.2	Setosa
6	5	3.6	1.4	0.2	Setosa
7	5.4	3.9	1.7	0.4	Setosa
8	4.6	3.4	1.4	0.3	Setosa
9	5	3.4	1.5	0.2	Setosa
10	4.4	2.9	1.4	0.2	Setosa
11	4.9	3.1	1.5	0.1	Setosa

iris_data.csv

```
sepal_length,sepal_width,petal_length,petal_width,variety
5.1,3.5,1.4,0.2,Setosa
4.9,3,1.4,0.2,Setosa
4.7,3.2,1.3,0.2,Setosa
4.6,3.1,1.5,0.2,Setosa
5,3.6,1.4,0.2,Setosa
5.4,3.9,1.7,0.4,Setosa
4.6,3.4,1.4,0.3,Setosa
5,3.4,1.5,0.2,Setosa
4.4,2.9,1.4,0.2,Setosa
4.9,3.1,1.5,0.1,Setosa
5.4,3.7,1.5,0.2,Setosa
4.8,3.4,1.6,0.2,Setosa
4.8,3,1.4,0.1,Setosa
```

Open AnalyzeIris.py and solve the following parts. **While opening the files, please do not use any path specific to your computer. When you have the .csv and .py files in the same folder, you don't need to specify the path, you can directly open the file you want using its name.**

Part A: (15 pts)

Write a function called read_iris(filename) to read the data from the given csv file into a list of lists.

- The return value should be a list of lists such that:
  - Each list should be in the form:
    [sepal_length, sepal_width, petal_length, petal_width, variety]
- Convert sepal_length, sepal_width, petal_length, petal_width to float. Variety should be string.
- Your matrix should not include the header you have in the csv file.

Partial output when the matrix is printed to console (full matrix is quite large):

```
[[5.1, 3.5, 1.4, 0.2, 'Setosa'], [4.9, 3.0, 1.4, 0.2, 'Setosa'], [4.7, 3.2,
1.3, 0.2, 'Setosa'], [4.6, 3.1, 1.5, 0.2, 'Setosa'], [5.0, 3.6, 1.4, 0.2,
'Setosa'], [5.4, 3.9, 1.7, 0.4, 'Setosa'], [4.6, 3.4, 1.4, 0.3, 'Setosa'],
[5.0, 3.4, 1.5, 0.2, 'Setosa'], [4.4, 2.9, 1.4, 0.2, 'Setosa'], [4.9, 3.1,
1.5, 0.1, 'Setosa'], [5.4, 3.7, 1.5, 0.2, 'Setosa'], [4.8, 3.4, 1.6, 0.2,
'Setosa'], [4.8, 3.0, 1.4, 0.1, 'Setosa'], [4.3, 3.0, 1.1, 0.1, 'Setosa'],
[5.8, 4.0, 1.2, 0.2, 'Setosa'], [5.7, 4.4, 1.5, 0.4, 'Setosa'], [5.4, 3.9,
1.3, 0.4, 'Setosa'], [5.1, 3.5, 1.4, 0.3, 'Setosa'], [5.7, 3.8, 1.7, 0.3,
'Setosa'], [5.1, 3.8, 1.5, 0.3, 'Setosa'], [5.4, 3.4, 1.7, 0.2, 'Setosa'],
```

Part B: (15 pts)

Write a function called avg_versicolor(lst) to calculate and record the average values for sepal_length and petal_length for 'Versicolor' species.

- Input lst should be the result you obtained from Part A.
- Let the average sepal length for Versicolor species be *avg_sepal_length* and the average petal length for Versicolor species be *avg_petal_length*. Your return value should be a dictionary including 'Versicolor' as the key, and the tuple (*avg_sepal_length, avg_petal_length*) as the value associated with this key. Your avg_sepal_length and avg_petal_length values should be floats – do not round them.

Your output should be as follows:

```
{'Versicolor': (5.936, 4.26)}
```

Q3: Exception Log - 25 pts

In software systems, it is common to maintain a "log file" that records events, errors or exceptions that occur while the software is running. The log file is periodically reviewed by system administrators to check for abnormal behavior, unusual events, cyberattacks, etc.

In this question, you will implement code to maintain an "exception log file" to record exceptions that occur in a simple Python function.

Open ExceptionLog.py and find the function divide_elementwise(a, b). This function:

- Takes as input two matrices a and b (in list of lists representation)
- Performs element-wise division: divide a[i][j] by b[i][j]
- A caveat: a and b originally contain string elements, therefore the strings are converted to floats by divide_elementwise before division is performed.

You may assume a and b are square matrices (number of rows = number of columns).

There are multiple exceptions that may occur in divide_elementwise. You should modify the divide_elementwise function that is given to you so that these exceptions are handled. Furthermore, you should ensure that the appropriate exception log messages are appended to a file called exceptionlog.txt .

Here are the potential exceptions and how you should handle them:

- A string element cannot be converted to float since it contains text (not a number).
    - Determine what exception/error will be raised.
    - Catch the exception corresponding to this particular problem.
    - When the exception is caught, you should append a one-line message to exceptionlog.txt: “Exception! Cannot convert string to float.”
- A division-by-zero occurs.
    - Determine what exception/error will be raised.
    - Catch the exception corresponding to this particular problem.
    - When the exception is caught, you should append a one-line message to exceptionlog.txt: “Exception! Cannot divide by zero.”
- The sizes of a and b are different, e.g., a is NxN matrix but b is MxM where **M ≠ N**:
    - Explicitly check for this condition at the beginning of the function (before division is performed) and raise an exception.
    - Catch the exception corresponding to this problem.
    - When the exception is caught, you should append a one-line message to exceptionlog.txt: “Exception! Matrix sizes are different.”

If divide_elementwise runs without any exceptions, it should append a one-line message to exceptionlog.txt: “divide_elementwise() ran without any exceptions.”

After every execution of divide_elementwise, regardless of whether an exception occurred or not, it should always append a one-line message to exceptionlog.txt: “Exiting divide_elementwise() now.”

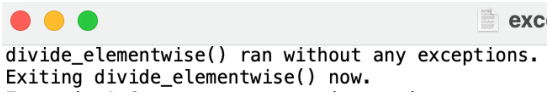
Rewrite divide_elementwise by keeping the original functionality but using a try-except structure to achieve the above exception handling behavior.

IMPORTANT: You must handle all exceptions and write your messages to exceptionlog.txt within divide_elementwise. Do not handle exceptions within the main() function.

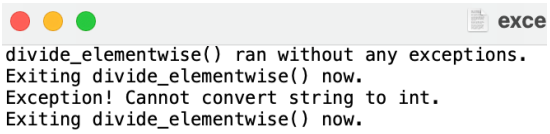
IMPORTANT: In all cases, you must APPEND to exceptionlog.txt. Never overwrite existing information in exceptionlog.txt. For example, if you run the code without commenting out any

of the test cases or without changing the order of the test cases within main() function, your text file will be updated as follows after each case:

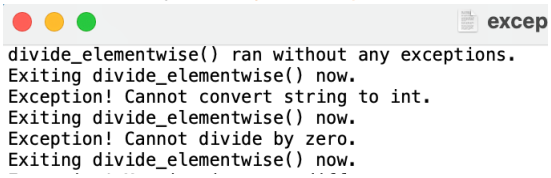
No errors



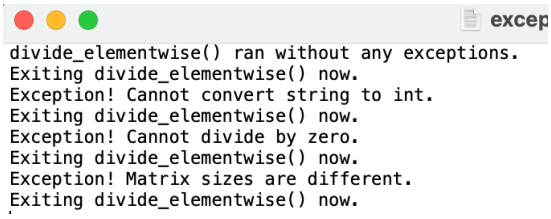
String to int conversion error *(message was appended to the previous .txt file)*



Division by zero *(message was appended to the previous .txt file)*



Different matrix size *(message was appended to the previous .txt file)*



Submission and Grading

Solve each question in its own file. **DO NOT CHANGE THE NAMES OF THE FILES. DO NOT CHANGE THE HEADERS OF THE GIVEN FUNCTIONS (FUNCTION NAMES, FUNCTION PARAMETERS). DO NOT USE TURKISH CHARACTERS.** If you want, you can add helper functions.

When you are finished, compress your Hw3 folder containing all of your answers. The result should be a SINGLE compressed file (file extension must be .zip, or .rar). Upload this compressed file to Blackboard.

Follow instructions, print messages, input-output formats closely. **Your code may be graded by an autograder**, which means any inconsistency will be automatically penalized.

After you submit your Hw3, download it from Blackboard to make sure it is not corrupted and it has the latest version of your code. You are only going to be graded based on your Blackboard submission. **We will not accept homework via e-mail or other means**.

Happy coding! ☺