Programming for Data Analytics – Lab 3

Note: When completing these exercises all the code you write should appear within functions.

Question 1.

Please note that you should write a function called main. You will call each of the functions you write below from this main function.

(i)

Write a function called powerV1. When you call this function (from your main function) it should ask the user for a base number and a power number. It should then print out the result of raising the base number to the power of the second number. Sample output below:

```
Please enter base number: 3
Please enter power number: 2
The value 3 raised to the power of 2 is : 9
```

(ii)

You are going to write a variant of the program described in question (i). Your main function should ask the user to input two int values. The first will specify the base number and the second should specify power number. You will then called a function called powerV2. This function will take in two int values as parameters (the base and power numbers). The function will simply print the value of the base number raised to the power value.

(iii)

Write a variant of the function defined in part(ii) called powerV3. This function will take in two int values as parameters. The first will specify the base number and the second should specify power number. The function will calculate value of the base number raised to the power value and will **return** this value. Verify the function works correctly by storing the result returned from the powerV3 function in a variable and printing out the variable.

Question 2.

(i)

Write a calculator. The program should first ask the user for two separate numerical values. It should then give the user an option to perform one of four operations: addition, subtraction, division or multiplication. Therefore, if the user selects multiplication then your program should print out the product of the two values. You should write a different function for performing each operation. For example the sum function will take in two int numerical parameters and return the result. The following is sample output from this program.

```
Please enter a numerical value: 12
Please enter a numerical value: 10
Would you like to perform:
1: Addition
2. Subtraction
3. Multiplication
4 Division
> 3
Multiplication of 12 and 10 is 120
```

(ii)

Alter the program you wrote for part (i) so that it will repeatedly ask the user to enter two numbers and select an operation until they wish to exit. A user can exit by entering y/n when asked to select the operation they want to perform (See sample output on the next page).

```
Please enter a numerical value: 12
Please enter a numerical value: 10
Would you like to perform:
1: Addition
2. Subtraction
3. Multiplication
4 Division
> 3
Multiplication of 12 and 10 is 120
Would you like to perform another operation y\n? y
Please enter an integer value: 20
Please enter an integer value: 3
Would you like to perform:
1: Addition
2. Subtraction
3. Multiplication
4 Division
> 1
Addition of 20 and 2 is 23
Would you like to perform another operation y\n? n
Thank you for using our calculator.
```

Question 3.

Write a guessing game for a user. This program should initially generate a random number between 1 and 100.

It should then repeatedly ask the user to guess the random number.

Each time the user enters a guess the program should tell them that their guess was too high, too low or correct.

When the user finally guesses the correct number the program should tell the user how many guesses they made before arriving at the correct number.

Your program should make use of the following methods:

- generateRandomNumber. This function will generate a random number between 0 100 and return the result.
- askUser. This function will ask the user to enter a guess and will return the result
- checkGuess. This function will take in the users guess and the random number as parameters and will return True if the user entered the correct value and False otherwise.

```
Program has generated a random number:
Please enter your guess: 50
Too high
Please enter your guess: 25
Too low
Please enter your guess: 38
Correct. You made a total of 3 guesses.
```

Question 4.

Write a program that asks the user to enter the rainfall for the first X months of the year into a list, where X is an int value between 1 and 12. (Obtaining the rainfall input from the user should be done using a loop).

The program should calculate and display:

- The average monthly rainfall
- The highest rainfall value received
- The lowest rainfall value received
- The months where the rainfall exceeded the average

The following is a sample output of this program.

```
How many months of data do you wish to enter: 6
Please enter rainfall for January 83.6
Please enter rainfall for Feb 46.6
Please enter rainfall for March 97.1
Please enter rainfall for April 46.4
Please enter rainfall for May 61.4
Please enter rainfall for June 164.5
Highest rainfall value: 164.5
Lowest rainfall value: 46.4
Average is 83.2666666667
Months that exceeded average: January March June
```

Question 5. (optional)

This excise is mainly based on rainfall data in Cork for each month over the past half century. In the folder you will find a file called CorkRainfall.txt and a file called DublinRainfall.txt. This is a space delimited file.

Each line of the file contains the following precipitation information pertaining to a specific month and year:

- Year
- Month (1 = Jan, 2 = Feb, 3 = March, etc.)
- Total Rainfall (Millimetres)
- Most Rainfall in a Day (Millimetres)
- Rain days (0.2mm or More) (Number)

Please use **NumPy** to answer the following questions. The objective of this task is to familiarize yourself with the operation of NumPy (there is no need to incorporate error checking).

(i) Print out the max 'Most Rainfall in a Day' value and the average 'Most Rainfall in a Day' value for the Cork data (that is, obtain the maximum value contained in this column of data and the average value in this column of data).

(ii) Display all unique years for which there is data in the dataset (you can use np.unique) Ask the user to select a specific year and output the total number of Rain Days per month for that year (that is, add up all the total number of Rain Days column for each month of that year).

(iii) Calculate the wettest month of the year in Cork based on the "Total Rainfall" value. The month that has the highest cumulative "Total Rainfall" value across all years should be classified as the wettest. Your code should print out the month and the cumulative total rainfall value for that month.

(iv) This question focuses on the Number of Rain days column. The user is asked to enter a maximum threshold value for the number of rain days. Your code should then output the percentage of the time (percentage of rows in the dataset) where the number of rain days is less than or equal to the threshold value. For example, if a user enters a maximum threshold value of 6, then your code should output the percentage of rows where the number of rain days fell between the threshold value of 6.

(v) Calculate the average 'total rainfall' value for the summer months (June, July and August) and the Autumn months (Sept, Oct, Nov).

(vi) Read in the contents of the file DublinRainfall.txt into a NumPy array. Append the all rows from the Dublin array to the Cork NumPy array. Calculate the average number of raindays for the new array and write the new NumPy array to a CSV file.