CSE221: Algorithms
Lab Assignment 01
Summer 2023

Submission Guidelines:

1. You can code all of them either in Python, Java or CPP. But you should choose a specific language for all tasks.

2. For each task write separate python files like task1.py, task3.py and so on.

3. For each problem, take input from files called "inputX.txt", and output at "outputX.txt", where X is the task number. So, for problem 2, in your code, the input file is basically this, "input2.txt". Same for the output file.

4. Finally zip all the files and rename this zip file as per this format: LabSectionNo_ID_CSE221LabAssignmentNo_Summer2023.zip. [Example: LabSection01_21101XXX_CSE221LabAssignment01_Summer2023.zip]

5. You MUST follow all the guidelines, and naming/file/zipping convention stated above. Failure to do so will result in a straight 50% mark deduction.

6. Don't copy from your friends. For plagiarism you will get 0.

Task 1:

a) You are given a file **"input1a.txt".** The first line of the input file will contain an integer **T**, representing the number of test cases. The next T lines will contain an integer **N**. You have to calculate if the number is Odd or Even. For each test case print the expected output. All the results must be compiled in a single file, **"output1a.txt."**

Sample Input File	Sample Output File
5 10 19 7	10 is an Even number. 19 is an Odd number. 7 is an Odd number.

	3 is an Odd number.
3	
	100 is an Even number.
100	

b) You are given a file **"input1b.txt".** The first line of the input file will contain an integer **T**, representing the number of test cases. The next T lines will contain a single arithmetic expression. Each arithmetic expression will start with the prefix "calculate". It is guaranteed that the expression will have exactly two operands and one operator.

Calculate the result of each expression. Your output format should exactly match with the sample output format. All the results must be compiled in a single file, **"output1b.txt**."

Sample Input File	Sample Output File
15	
	The result of 67 + 41 is 108
calculate 67 + 41	
	The result of 85 / 5 is 17.0
calculate 85 / 5	
	The result of 13 - 56 is -43
calculate 13 - 56	
	The result of 99 - 95 is 4
calculate 99 - 95	
	The result of 3 / 10 is 0.3
calculate 3 / 10	
	The result of 12 * 19 is 228
calculate 12 * 19	
	The result of 14 - 6 is 8
calculate 14 - 6	
	The result of 3 * 88 is 264
calculate 3 * 88	
	The result of 45 * 68 is 3060
calculate 45 * 68	
	The result of 81 - 0 is 81
calculate 81 - 0	
	The result of 77 + 40 is 117
calculate 77 + 40	
	The result of 8 * 84 is 672
calculate 8 * 84	
	The result of 73 - 22 is 51
calculate 73 - 22	
	The result of 85 - 86 is -1
calculate 85 - 86	
	The result of 28 * 58 is 1624

calculate 28 * 58

Task 2:

Here is the code of bubble sort. Its run time complexity is $\theta(n^2)$. Change the code in a way so that its time complexity is $\theta(n)$ for the **best-case** scenario.

You have to **explain how you have achieved the** $\theta(n)$ for the **best-case** scenario **in a comment block of your code.**

```
def bubbleSort(arr):
    for i in range(len(arr)-1):
        for j in range(len(arr)-i-1):
            if arr[j] > arr[j+1]:
                arr[j], arr[j+1] = arr[j+1], arr[j]
```

Input 1: 5 3 2 1 4 5	Output 1: 1 2 3 4 5
Input 2: 6 5 10 15 20 25 30	Output 2: 5 10 15 20 25 30

For the input 2, your code should run at θ(n).

Please note, you have to take the input from an input2.txt file, and show the output in an output2.txt file.

Task 3:

Suppose you are given a task to rank the students. You have gotten the marks and id of the students. Now your task is to rank the students based on their marks using a sorting algorithm.

However, you have to keep in mind that your sorting algorithms perform the minimum number of swapping operations.

Input:

The first line of the input file will contain an integer **N (1 ≤ N ≤ 1000)**. The second line will contain N integers, representing the Student ID, Si (**1 ≤** Si **≤ 1000**). The next line will contain the N integer, Sm (**1 ≤** Sm **≤ 1000**), which denotes the obtained mark of the corresponding students.

Output:

You have to show the Student Id and obtained marks in descending order based on their obtained mark. If two or more students get the same mark, then students with the lower ID will get prioritized. See the input and output for a better understanding.

Input 1:

```
7
7 4 9 3 2 5 1
40 50 50 20 10 10 10
```

Output 1:

```
ID: 4 Mark: 50
ID: 9 Mark: 50
ID: 7 Mark: 40
ID: 3 Mark: 20
ID: 1 Mark: 10
ID: 2 Mark: 10
ID: 5 Mark: 10
```

Input 2:

```
4
7 2 5 3
80 60 80 50
```

Output 2:

```
ID: 5 Mark: 80
ID: 7 Mark: 80
ID: 2 Mark: 60
ID: 3 Mark: 50
```

Please note, you have to take the input from an input3.txt file, and show the output in an output3.txt file

Task 4:

You have been recently recruited as the Software Engineer at Jumanji Railway Software System. You have a big task at hand. You will be given the N **(1 ≤ N ≤ 100)** schedule of the train. The next N line will contain the name of the train and the departure time. See the input format for better understanding.

Your task is to write a sorting algorithm that will group the trains in the lexicographical order based on the name of the trains. If two or more trains have the same name, then the train with the latest departure time will get prioritized. If there is still a tie, then the train which comes first in the input file will come first.

Sample Input	Sample Output
13 ABCD will departure for Mymensingh at 00:30 DhumketuExpress will departure for Chittagong at 02:30 SubornoExpress will departure for Chittagong at 14:30 ABC will departure for Dhaka at 17:30 ShonarBangla will departure for Dhaka at 12:30 SubornoExpress will departure for Rajshahi at 14:30 ABCD will departure for Chittagong at 01:00 SubornoExpress will departure for Dhaka at 11:30 ABC will departure for Barisal at 03:00 PadmaExpress will departure for Chittagong at 20:30 ABC will departure for Khulna at 03:00 ABCE will departure for Sylhet at 23:05 PadmaExpress will departure for Dhaka at 19:30	ABC will departure for Dhaka at 17:30 ABC will departure for Barisal at 03:00 ABC will departure for Khulna at 03:00 ABCD will departure for Chittagong at 01:00 ABCD will departure for Mymensingh at 00:30 ABCE will departure for Sylhet at 23:05 DhumketuExpress will departure for Chittagong at 02:30 PadmaExpress will departure for Chittagong at 20:30 PadmaExpress will departure for Dhaka at 19:30 ShonarBangla will departure for Dhaka at 12:30 SubornoExpress will departure for Chittagong at 14:30 SubornoExpress will departure for Rajshahi at 14:30 SubornoExpress will departure for Dhaka at 11:30

Please note, you have to take the input from an input4.txt file, and show the output in an output4.txt file.