CST 370 – Spring 2020
Homework 2
Due: 02/07/2020 (Thursday) (11:55 PM)

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How to turn in?

* Write your answer to the question 1 and 2 and submit it on the iLearn. Note that we **accept only a PDF** file. Do not submit a different file format. Also, don't forget to write your name and class ID at the top of your homework document.

* For the questions 3 and 4, you should submit two source programs (**hw2_1.cpp** and **hw2_2.cpp**) on the iLearn. Note that you can use the Java for the homework such as **hw2_1.java** and **hw2_2.java**.

* Thus, you have to submit three files (one PDF file and two source files) on the iLearn.

1. Assume that you should search a number in a list of *n* numbers. How can you take advantage of the fact that **the list is known to be sorted**? Give separate answers for the following two cases.

(a) A list represented in an array. With an array, you can do a simply binary search.

(b) A list represented in a linked list. With a linked list, you can use the contains function. Otherwise, you need to traverse every element until you've "skipped" the number you were looking for.

2. Assume that you have **10** identical-looking balls and a two-pan balance scale with no weights. One of the balls is a fake, but you don't know whether it is lighter or heavier than the genuine balls, which all weigh the same. Describe your idea to determine in the minimum number of weighings whether the fake ball is lighter or heavier than the others. In the problem, you **don't need to identify the fake ball itself**. It's good enough for you to **just say "It's heavier or lighter"**. Present the minimum number of weighings and your answer clearly.

2 weighings. Weigh 3 random balls vs. 3 other random balls. 2 possible scenarios, they are different weights or they are equal weights.

Scenario A) If they are different weights, one of the 6 weighed balls must be the fake. And the unweighed 4 balls must be real. Set one side of the scale aside and weigh 3 new balls from the 4 untouched group. Two possible outputs.

   Scenario A1) If they are different weights, 1 of the 3 balls that stayed on the scale must be the fake. If that group was heavier, the fake is heavier, if the group is lighter, the fake is lighter.
   Scenario A2). If they are the same weight, 1 of the 3 balls taken off the scale must be a fake. If that group was heavier, the fake is heavier, if the group is lighter, the fake is lighter.

Scenario B). If there are the same weight. All 6 balls on the scale must be real and 1 of the 4 unweighed balls must be the fake. Weigh those 4 against any of the 4 that were just weighed. If the group of previously unweighed balls is heavier, the fake is heavier, if the group is lighter, the fake is lighter.

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This is the HackerRank link:

3. Write a program called **hw2_1.cpp (or hw2_1.java)** that reads a positive integer number from a user and displays the reverse of the number. For the program, you can assume that the input number is in the range of the typical "int" data type.

Sample Run 0: Assume that the user typed the following number.

        1234321

This is the correct output.

        1234321

Sample Run 1: Assume that the user typed the following number.

        425

This is the correct output.

        524

Sample Run 2: Assume that the user typed the following number.

        1200

This is the correct output. Note that the reverse of 1200 is not 0021. It should be 21 because we should remove the leading zeros.

        21

4. Write a program called **hw2_2.cpp (or hw2_2.java)** that reads two timestamps of two events from a user and displays the difference between the two timestamps. For the program, you can assume that each timestamp is composed of the hour (0 ~ 23), minute (0 ~ 59), and second (0 ~ 59) format. Your program should present the difference from the second event (= second timestamp) to the first event (= first timestamp). Note that **the second event always happens after the first event** and your program should display the time difference of the events.

Sample Run 0: Assume that the user typed the following two lines.

```
18:45:30
20:50:59
```

This is the correct output of your program.

```
02:05:29
```

Sample Run 1: Assume that the user typed the following two lines.

```
20:18:59
04:25:17
```

This is the correct output of your program.

```
08:06:18
```

Sample Run 2: Assume that the user typed the following two lines.

```
02:00:25
15:30:00
```

This is the correct output of your program.

```
13:29:35
```