

**CST 370 – Fall 2019**  
**Homework 2**  
**Due: 09/12/2019 (Thursday) (11:55 PM)**

Name: \_\_\_\_\_ Hamza Saleem \_\_\_\_\_

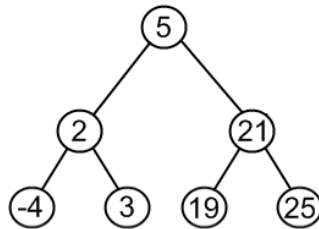
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**How to turn in?**

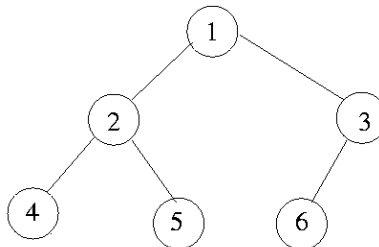
- Write your answer to the questions 1, 2, 3, and 4 and submit it on the iLearn. Note that we **accept only a PDF** file. Do not submit a different file format. And also, don't forget to write your name and class ID at the top of your homework document.
- For the questions 5 and 6, you should submit your C++ source files (**hw2\_1.cpp** and **hw2\_2.cpp**) on the iLearn.
- So, you have to submit three files (one PDF file and two C++ source files) on the iLearn.

1. For the following two questions, indicate your answer (= either true or false) clearly.

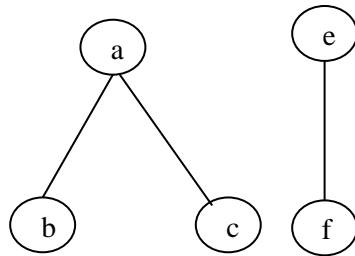
(a) Is this a binary search tree? (**True**/False)



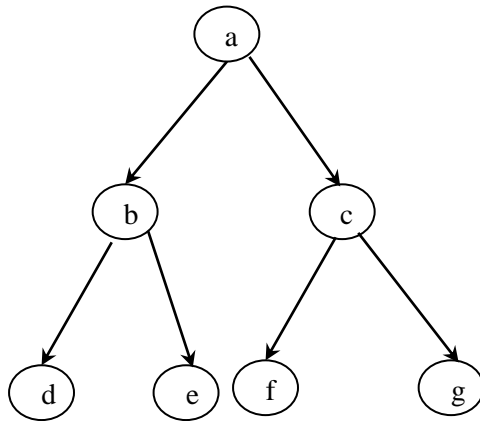
(b) Is this a binary search tree? (True/**False**)



2. (a) Based on our textbook's definition, is this a graph? (True/False)



(b) Based on our textbook's definition, is this a graph? (True/False)



3. 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.

**I will start search from the middle and will compare if number is small, go left but if number is bigger than middle number then go right and do same until, we find the number.**

(b) A list represented in a linked list.

**IN Linked list you cannot take such advantage because you have to go through every single node for the address of the next node so its not really useful to have sorted numbers in linked list.**

4. 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.

**On the best case scenario, we can figure it out in 3 weighing. We do 4v4 and lets say if they are equal we compare other two balls one by one with a ball from the 4v4 balls. On the other had if 4v4 is not equal then we will take one set of 4 and do 2v2 and if that is equal we will check the other 4 and if they are not equal we will consider heavy side with 1v1 if they are same then that means our ball is lighter else our ball is heavier.**

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There are two programming problems in the homework.

This is the HackerRank link: <https://www.hackerrank.com/cst370-f19-hw2>

5. Write a C++ program called **hw2\_1.cpp** that reads a positive integer number from a user and displays all binary numbers from 0 to the number. For the program, you can assume that **the input number is a number between 0 and 100**.

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

5

This is the correct output of your program.

```
000
001
010
011
100
101
```

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

0

This is the correct output of your program.

0

**Sample Run 3:** Assume that the user typed the following number.

3

This is the correct output of your program.

```
00
01
10
11
```

6. Write a C++ program called **hw2\_2.cpp** 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 1:** 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 2:** 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 3:** 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
```