QUIZ 2
COMP6048 – Data Structures Even 2019 / 2020
VAR 9

Notes :

1. There are **2 parts** in this quiz, Essay and Case.
2. For essay problem:
   a. You are required to solve it using by ***handwritten on a paper***
   b. Subsequently, your essay answers ***should be converted in 1 pdf file*** using this format: ***nim.pdf***
   c. The lecturers won't accept any answers using word processing application in order to prevent copy-paste answers in a last minute
3. For case problem:
   a. ***The submission code is in .cpp file*** and using this format: ***nim.cpp***
4. All your answers ***either essay (nim.pdf) or case (nim.cpp) should be zipped and submitted through*** the platform that your lecturer set**.** Other than that, the submission won't be accepted for any reasons. ***(Note : Please zip both files using this format: nim.zip)***
5. **Your Quiz will be *marked as 0* if any *plagiarism is found***

I. Essay (60%)

When deleting, always take the replacement value from **rightmost** of **left** children.

Write down every step for insert and delete happen in all simulation tree below.

1. **[20%]** Given Red Black Tree in the figure 1 below:

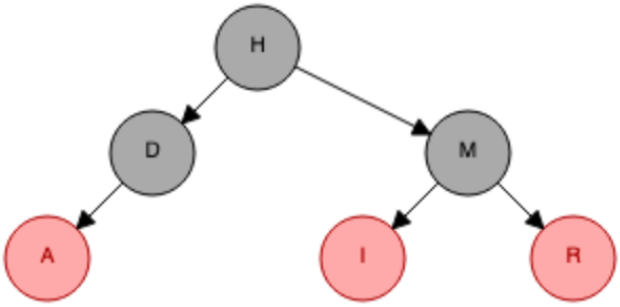

Figure 1 Red Black Tree

a. **[10%]** Please insert the following numbers: **G, J, L, P** and **K** subsequently!

b. **[10%]** Refer to resulting tree in 1(a), please delete the following numbers: **P, M, J, I** and **G** subsequently!

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2. **[20%]** Given B-Tree order 3 in the figure 2 below:

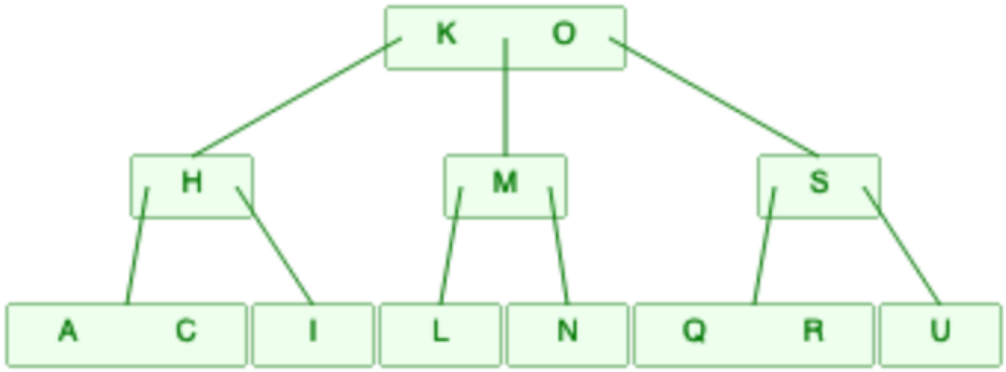

Figure 2 B-Tree Order 3

a. **[10%]** Please insert the following numbers: **Z, B, V, F, and P** subsequently!

b. **[10%]** Refer to resulting tree in 2(a), please delete the following numbers **: F, I, N, B** and **V** subsequently!

3. **[20%]** Transform the undirected Graph shows in figure 3 into a Minimum Spanning Tree using Kruskal's Algorithm. Write step by step using table and result from the table.

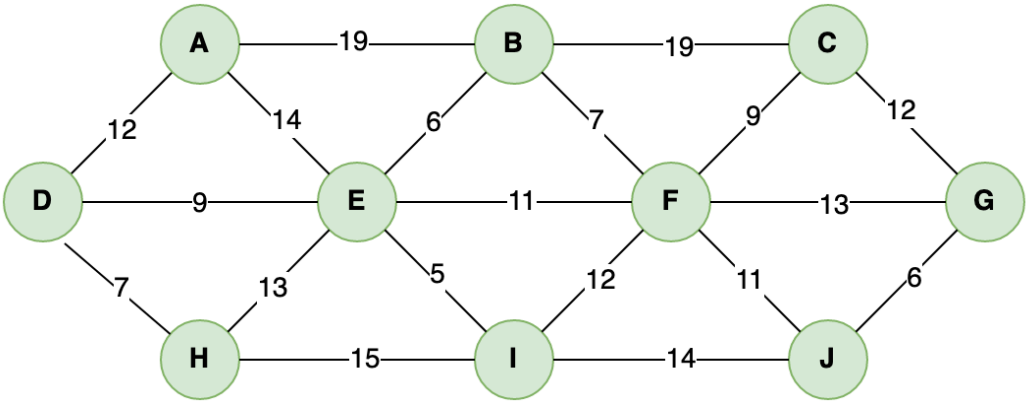

Figure 3 Graph

II. Case (40%)

Thomas has a task to create a small application that needs to store data. An important requirement in the application is to find data quickly. Previously he always used Binary Tree data structure to solve this issue, but Thomas realized that when the user inserts the data in sequence order into the system, this will make the Binary Tree become linear (skewed) that will make the finding process become slower.

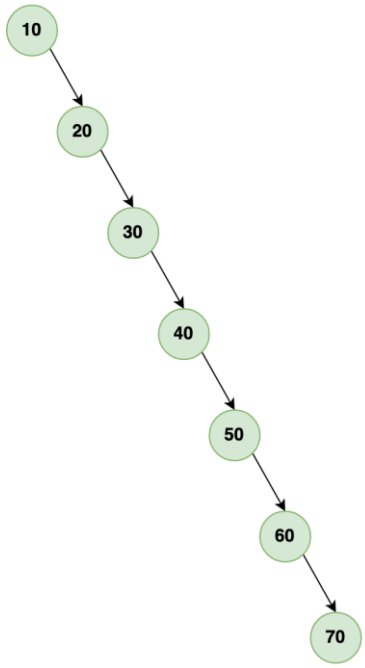

Figure 4 Binary Search Tree

As depicted above, if the user wants to search number **60**. The system needs 6 steps to find the value when using Binary Search Tree. Thomas learned from the internet that there is another data structure called **AVL Tree** that can solve his problem, with the same use case it only needs 2 steps to find the value.

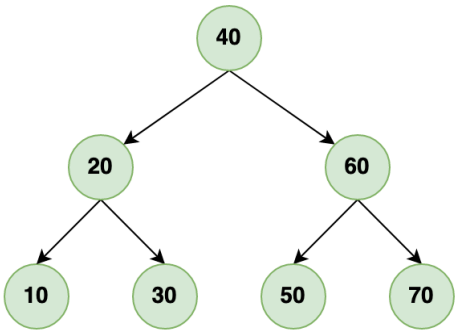

Figure 5 AVL Tree

Your task is to create a simple AVL tree application that can help Thomas understand the concept before he implements this data structure on his project. The application has 4 menus, there are:

- **Add Number**

  This menu has the functionality of adding a number into AVL Tree. The user will be asked by the application to input a number that will be recorded by the application. If the number already exists the system will ignore and assume the process is completed.

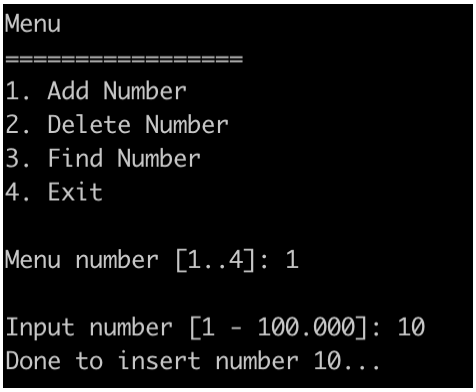

Figure 6 Add Number Menu

- **Delete Number**

  This menu has the functionality of deleting a number from AVL Tree. The user will be asked by the application to input a number that will be deleted by the application. If the number is not found, the application will assume the process is completed.

  Please note that you are obligated to use the leftmost child of the right subtree for the replacement of the deletion process.

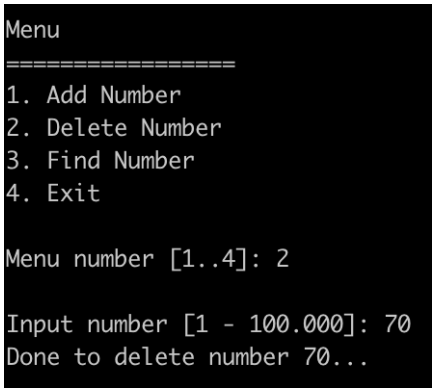

Figure 7 Delete Number Menu

- **Find Number**

  This menu has the functionality of deleting a number from AVL Tree. The user will be asked by the application to input a number that needs to be found by the application. The system will display how many steps are needed by the system to find the data. If the number is not found, the application will show a message **"Number is not found…"**.

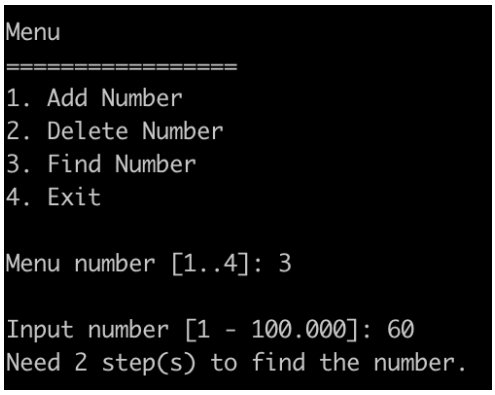

Figure 8 Find Number Menu

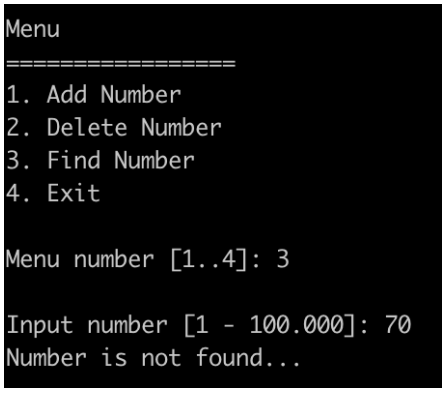

Figure 9 Prompt When Number is not Found

- **Exit**

  This menu has a functionality to allow the user to end the system. The application will **remove** all data from the AVL tree.

-- Good Luck --