

# INSTRUCTIONS - PRACTICAL EXAM – CSD201

Read the instructions below carefully before start coding.

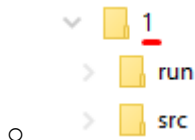
---

Students are **ONLY** allowed to use:

- Software tools must be used: **NetBeans IDE 8.x** and **Java JDK 1.8**.
- His / her own study materials like presentation slides, notes, sample codes, program examples, electronic books stored on his / her computer only.
- For distance learning: Google Meet, Hangout (for Exam Monitoring Purpose).

## Instructions

- Step 1: run “Clean and Build Project” (Shift+F11) to create **dist** folder and **.jar** file.
- Step 2: Prepare to submit answer:
  - For each question (e.g., question **1**), please create two sub-folders: **run** and **src**.
  - Copy \*.**jar** file into **run** folder
  - Compress source code into **.zip**, then copy **.zip** file into **src** folder.
- Step 2: Submit solution for each question:
  - Choose question number (e.g., **1**) in PEA software, and then attach corresponding solution folder (e.g., **1**). Click Submit button to finish submitting this question.



## Notes

- **Do not use accented Vietnamese** when writing comments in programs.
  - Solutions will be marked by Automated Marking Software.
  - **If at least one of the above requirements is not followed, the exam will get ZERO.**
- 

## Question 1: (3 marks)

Write a program to build a binary search tree by inserting  $N$  ( $1 \leq N \leq 100$ ) integer values into the BST one by one. Note that the nodes **have no duplicate values**.

Your task is to Print Levels of all nodes in the BST.

*For example,*

- Create a BST tree by successively adding to the tree  $N$  integer values as follows: 7, 9, 4, 1, 12, 6, 10.

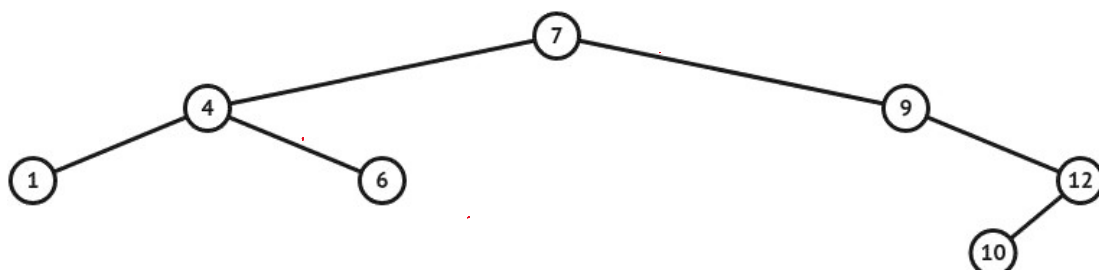


Figure 1. The BST that created by inserting 7, 9, 4, 1, 12, 6, 10 one by one

**The input:** are stored in the *ex09\_input.txt* text file:

The first line contains a positive integer  $N$  ( $1 \leq N \leq 100$ ) which is the number of integer values to insert into the BST.

The second line containing  $N$  integers that will be inserted into the BST one by one, each number separated by at least one space.



**The output:** the results need to be saved to the *ex09\_output.txt* text file:  
Only one line contains levels of all nodes in the BST, each value with its level separated by commas.

Sample Input 1	Sample Output 1
7	7[0], 4[1], 1[2], 6[2], 9[1], 12[2], 10[3]
7 9 4 1 12 6 10	

Sample Input 2	Sample Output 2
9	10[0], 7[1], 6[2], 2[3], 4[4], 18[1], 13[2]
10 7 6 2 18 13 2 6 4	

### Question 2: (4 marks)

A country has **N cities** numbered from **0 to N-1**. The government is planning to **construct a power grid to connect all cities with the lowest cost possible**.

Some power line routes have already been surveyed, and each route has a **different construction cost**. Your task is to determine **the set of power lines to be built** so that all cities are connected with **the minimum total cost**.

Your task is to write a program to determine a subset of connections that ensures all locations are linked while minimizing the total cost.

*For example,*

- Giving the edge list that used to represent undirected graph as follow:

```

8 16
0 1 5
0 2 3
0 5 11
1 2 5
1 6 7
1 7 11
2 3 11
2 4 1
2 5 7
3 4 11
3 6 11
4 5 1
4 6 5
4 7 7

```

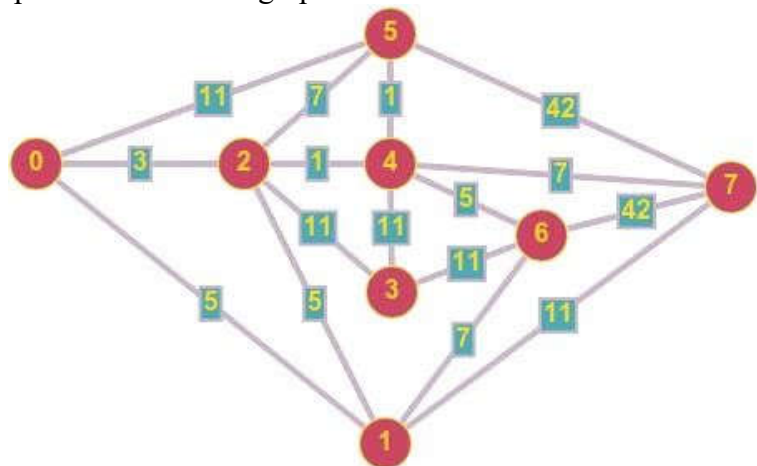


Figure 1. The undirected graph that created by giving adjacency matrix



5 7 42  
6 7 42

- The MST is shown as figure 2 and the weight of minimum spanning tree is 33:

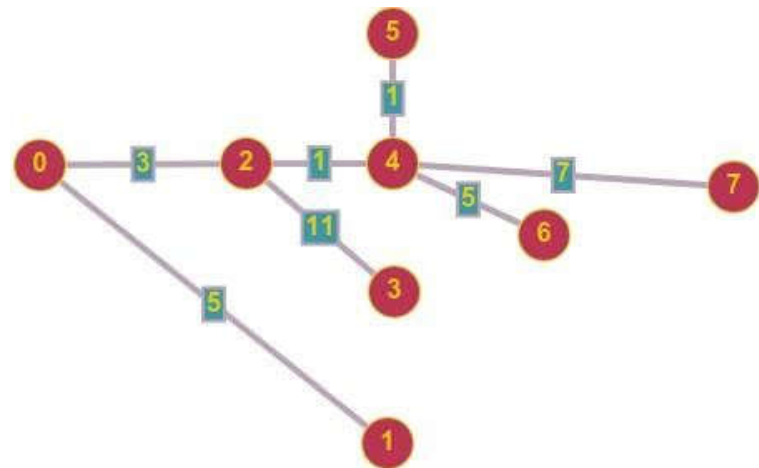


Figure 2. The weight of minimum spanning tree is 33

**The input:** are stored in the *input.txt* text file:

- **The first line** contains two integers:
  - **N** ( $1 \leq N \leq 1000$ )  $\rightarrow$  Number of cities.
  - **M** ( $1 \leq M \leq 10^5$ )  $\rightarrow$  Number of possible power lines.
- **The next M lines**, each containing three integers **u v w**:
  - **u, v** ( $0 \leq u, v < N$ )  $\rightarrow$  Two cities that can be connected.
  - **w** ( $1 \leq w \leq 10^6$ )  $\rightarrow$  Construction cost of the power line between **u and v**.

**The output:** the results need to be saved to the *output.txt* text file:

- A single integer: **The minimum total cost to connect all cities.**
- If it is not possible to connect all cities, output **"Impossible"**.

Sample Input 1	Sample Output 1
6 9 0 1 4 0 2 4 1 2 2 1 3 5 2 3 1 2 4 3 3 4 8 3 5 6	16



4 5 7	
-------	--

Sample Input 2	Sample Output 2
5 3 0 1 10 2 3 5 3 4 8	Impossible

### Question 3: (3 marks)

Write a program to build a binary search tree by inserting  $N$  ( $1 \leq N \leq 100$ ) integer values into the BST one by one. Note that the nodes **have no duplicate values**.

Your task is to Print height of all nodes in the BST.

For example,

- Create a BST tree by successively adding to the tree  $N$  integer values as follows: 7, 9, 4, 1, 12, 6, 10.

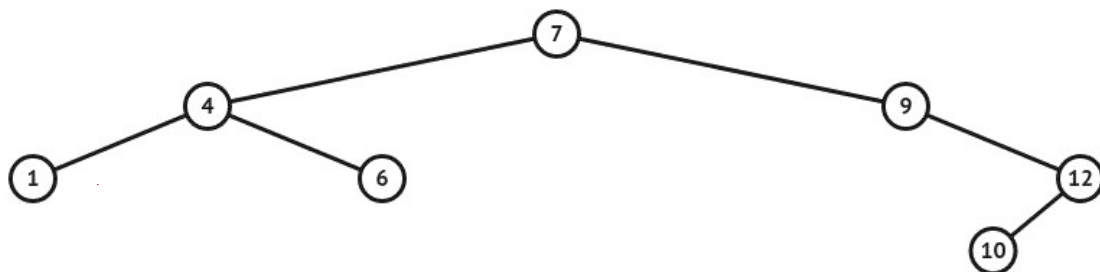


Figure 1. The BST that created by inserting 7, 9, 4, 1, 12, 6, 10 one by one

**The input:** are stored in the *ex10\_input.txt* text file:

The first line contains a positive integer  $N$  ( $1 \leq N \leq 100$ ) which is the number of integer values to insert into the BST.

The second line containing  $N$  integers that will be inserted into the BST one by one, each number separated by at least one space.

**The output:** the results need to be saved to the *ex10\_output.txt* text file: Only one line contains height of all nodes in the BST, each value with its height separated by commas.

Sample Input 1	Sample Output 1
7 7 9 4 1 12 6 10	7[3], 4[1], 1[0], 6[0], 9[2], 12[1], 10[0]

Sample Input 2	Sample Output 2
9 10 7 6 2 18 13 2 6 4	10[4], 7[3], 6[2], 2[1], 4[0], 18[1], 13[0]