Homework 2

Introduction to Data Structures and OO

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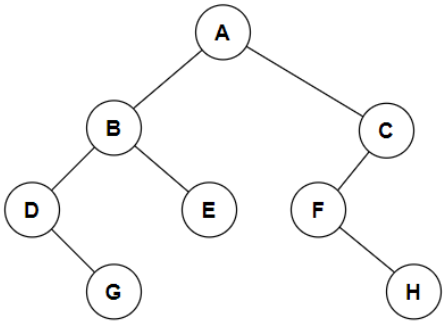
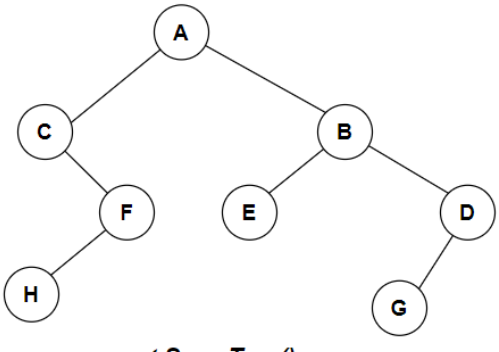
Due: 26/04/2022; 13:00 PM

1. Develop and test a complete C++ template class for linked queues.

2. Write a C++ function, named as *SwapTree()*, that swaps the left and right children of every node of a binary tree. An example below.



t



t.SwapTree()

3. Prove that the level-order traversal of a forest and that of its corresponding binary tree do not necessarily yield the same result.

4. Prove that every binary tree is uniquely defined by its preorder and inorder sequences.

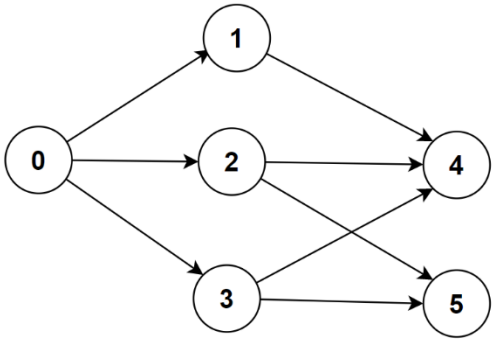
5. Show that the sum of the degree of vertices of an undirected graph is twice the number of edges.

6. Draw the complete undirected graphs on one, two, three, four, and five vertices. Prove that the number of edges in an *n-vertex* complete graph is *n(n-1)/2*.

7. Write a complete C++ function for breath-first search under the assumption that graphs are represented using adjacency lists. Test the correctness of your function using suitable graphs.

8. Show that the number of spanning trees in a complete graph with n vertices is at least $2^{n-1} - 1$.

9. Define an iterator class *TopoIterator* in C++ for iterating through the vertices of a directed acyclic graph in topological order.



Topological order: 0,3,2,1,4,5.

10. Using the directed graph of the figure below, explain 1) why *ShortestPath* will not work properly. 2) What is the shortest path between vertices 0 and 6?