

Final Exam Sample

This is a sample of the kinds of questions you can expect for the final exam.

1. Give and briefly explain an example of a solution that uses recursion.
2. Define:
 - a. Tree
 - b. Interior node
 - c. Binary tree
 - d. Complete binary tree
 - e. Balanced binary tree
 - f. Leaf node
 - g. AVL tree
 - h. BST
3. For a given general tree, what characteristic of the tree gives the maximum number of steps required to find any particular node? What about for a Balanced BST?
4. Given 5 unique elements to store in a **binary tree**:
 - a. What is the worst case for the height of the tree after adding all the elements?
 - b. What is the best case for the height of the tree after adding all the elements?
 - c. With a BST and input in sorted order, what is the expected height of the tree after adding all the elements?
5. What is the expected time complexity for a merge sort?
6. Write the pseudo code to do a breadth-first traversal of a binary tree.
7. Write the pseudo code to do a pre-order traversal of a binary tree.
8. Give an example, other than searching, of a use for a depth-first traversal of a binary tree.
9. Given the following in-order traverse and pre-order traverse draw the BST that results from it:
 - a. In-order: 1, 2, 3, 4, 5, 6, 7, 8, 9
 - b. Pre-order: 5, 1, 3, 2, 4, 7, 6, 9, 8
 - c. Who are the left and right children of 2?
 - d. Is the resulting tree complete?
 - e. Is the resulting tree full?
 - f. Is the resulting tree balanced?

10. Build **BSTs** out of the following sequences:
- 1, 2, 3, 4, 5. Is the resulting BST balanced? Is it complete? Is it full?
 - 3, 20, 0, 25, 7, 1. Is the resulting BST balanced? Is it complete? Is it full?
 - 7, 10, 5, 1, 9, 11, 6. Is the resulting BST balanced? Is it complete? Is it full?
11. Build a minheap out of the following sequence: 8, 6, 0, 1, 4, 17, 3, 21.
12. In class, we discussed an AVL tree to produce a balanced BST:
- Does it always produce a perfectly balanced tree?
 - What does it do to achieve balance?
 - After the tree is balanced, does it preserve the property of being a BST?
 - What did the structure add to each node to aid in the balancing?
13. Build the graph resulting from the following adjacency matrix and answer the following questions:
- Is the graph directed, undirected, or weighted?
 - Is there a cycle in this graph?
 - Is the graph complete?
 - Is the graph connected?
 - Give the set of vertices and the set of edges for this graph

	0	1	2	3
0	0	1	0	1
1	0	0	1	0
2	1	1	0	0
3	0	0	0	0

$G(V, E)$

14. Knowing that a tree is a special case of graphs, and knowing that graphs can be directed or undirected, cyclic or acyclic, connected, and complete. Define a tree in terms of a graph.
15. Draw the undirected graph that is represented as follows
- Vertices:** {1, 2, 3, 4, 5, 6, 7}
- Edges:** {(1, 2), (1, 4), (2, 3), (2, 4), (3, 7), (4, 7), (4, 6), (5, 6), (5, 7), (6, 7)}
16. List all of the cycles you can find in the previous graph
17. Draw the hash table that results from adding the following integers (34 45 3 87 65 32 1 12 17) to a hash table using a table of size 11 and using the division method (as the hash function) and linked chaining.