

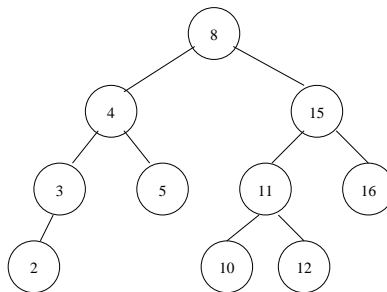
**Graduate Comprehensive Exam
Data Structures and Algorithms
Fall 1998**

Total: 100 points. Good Luck.

1. (10 pts) Using the big-O notation, estimate the running time of `proc(N)` in terms of `N`. Explain your answer.

```
void proc(int x)
{
    if (x > 1)
    {
        proc(x / 2);
        proc(x / 2);
        for (int i = 0; i < x; i++)
            // some constant-time operation here
    }
}
```

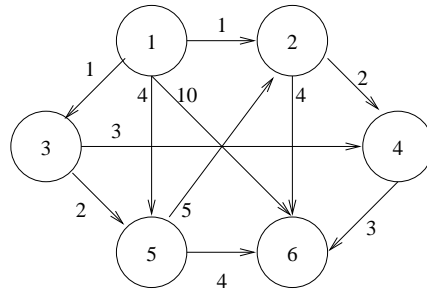
2. (10 pts) For the following AVL-tree, show your steps (intermediate trees) for the following two *successive* operations:



- (a) Insert 13 and
- (b) Then insert 1.

3. (40 pts) A *palindrome* is a word that reads the same forward and backward. For example, “1991”, “level”, “BOB”, and “ABBA”. Write a function (in C/C++ or pseudocode in sufficient details) that checks if a character string is a palindrome
- (a) iteratively (no recursion)
 - (b) recursively (with recursion)

4. (25 pts) Given the following graph:



- Perform a depth-first search starting from Node 1 and show the ordering of the visited nodes (children are visited in ascending order).
- Perform a breadth-first search starting from Node 1 and show the ordering of the visited nodes (children are visited in ascending order).
- Perform a topological ordering/sort, show your steps.

5. (15 pts) Given these numbers: 8 3 6 2 7 9 5, perform Treesort (in ascending order) and draw the tree after each iteration when a number is sorted.