Total: 100 points. Good Luck.

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

   ```c
   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:

(a) Perform a depth-first search starting from Node 1 and show the ordering of the visited nodes (children are visited in ascending order).

(b) Perform a breadth-first search starting from Node 1 and show the ordering of the visited nodes (children are visited in ascending order).

(c) 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.