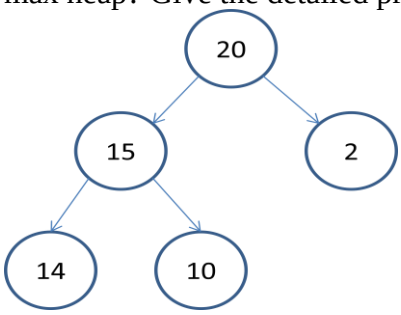
CSC326 Homework 4

1. Heap
   1) What is the definition of a min heap?
   2) When we insert an element, 5, to the following max heap, what would be the resulting max heap? Give the detailed procedure.



   3) Based on 2), when we remove the root element in the max heap, what would be the resulting max heap? Give the detailed procedure.
   4) Describe how HeapSort works. Then use the example 20 10 5 15 35 30 25 to show how heapsort is working. Only show the major steps.
   5) What is the running time(big O concept) of heapsort for n elements? Explain how this running time is derived.

2. Binary Tree and Binary Search Tree.
   1) Reconstruct a binary tree based on its in-order traversal and its pre-order traversal
      Pre-order 12 5 2 9 18 15 13 17 19
      In-order 2 5 9 12 13 15 17 18 19

   2) What is the maximum number of nodes in a binary tree whose height is h? What is the minimum number of nodes? Give an example for each.

   3) Give a tree class definition as follows:

```
class Tree{
  public: ...
        TreeNode* max(TreeNode*);
  private:
        struct TreeNode{
              int data;
              TreeNode* leftChild;
              TreeNode* rightChild;
        }
        TreeNode *root;
}
```

      Implement the member function *max()* to return a pointer to the max element of the binary tree.