Tutorial: Binary Trees

1. (**levelOrderTraversal**) Write an iterative C function levelOrderTraversal prints a level-by-level traversal of the binary tree using a **queue**, starting at the root node level. Note that you should **only** use `enqueue ()` or `dequeue ()` operations when you add or remove integers from the queue. Remember to empty the queue at the beginning, if the queue is not empty.

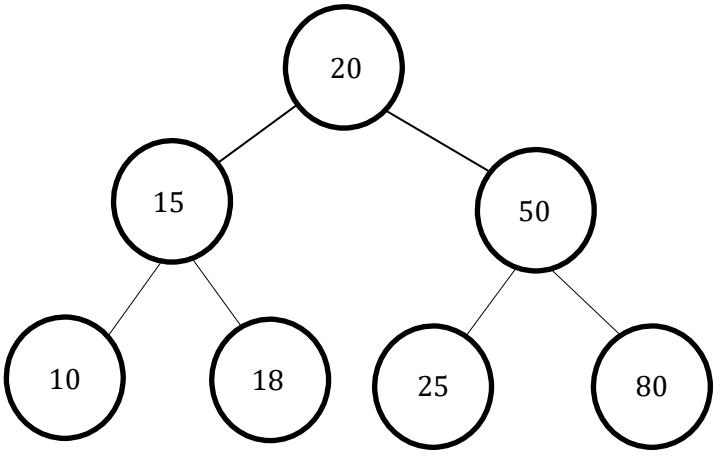
   The function prototype is given as follows:

   ```
   void levelOrderIterative(BSTNode *root);
   ```

   Following is the detailed algorithm:

   ```
   1) Create an empty queue q
   2) If tree is not empty, then Enqueue root to the Queue
   3) Repeat until Queue is empty
          a) Dequeue node's data from the queue and print it
          b) Enqueue node's left child to the q
          c) Enqueue node's right child to the  q
   ```

   Let's consider the below tree for example.



Level-order Tree Traversal: **20 15 50 10 18 25 80**

2. (**preOrderIterative**) Write an iterative C function `preOrderIterative()` that prints the pre-order traversal of a binary search tree using **a stack**. Note that you should **only** use `push()` or `pop()` operations when you add or remove integers from the stack. Remember to empty the stack at the beginning, if the stack is not empty.

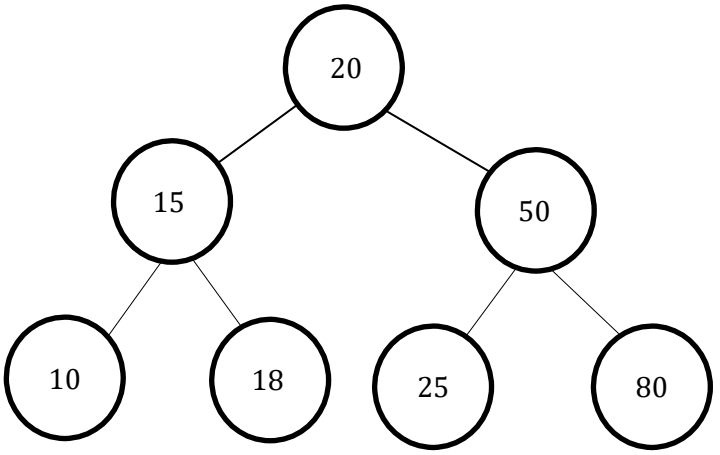
   The function prototype is given as follows:

   ```
   void preOrderIterative(BSTNode *root);
   ```

   Following is the detailed algorithm:

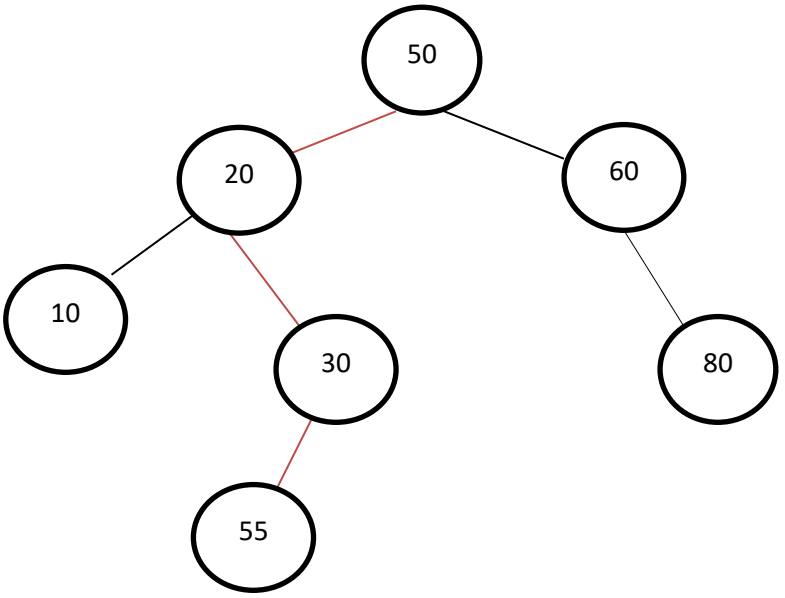
   ```
   1) Create an empty stack nodeStack and push root node to stack.
   2) Do following while nodeStack is not empty.
        a) Pop an item from stack and print it.
        b) Push right child of popped item to stack
        c) Push left child of popped item to stack

      Right child is pushed before left child to make sure that
      left subtree is processed first.
   ```

Let's consider the below tree for example.



Preorder Tree Traversal: **20 15 10 18 50 25 80**

3. (**maxDepth)** Write a c function to find the maximum depth of a binary tree.



The function prototype is given as follows:

```
int maxDepth(BTNode *node);
```

Some sample inputs and outputs sessions are given below:

```
1: Create a binary tree.

2: Find the maximum depth of the binary tree.

0: Quit;


Please input your choice(1/2/0): 1

Input an integer that you want to add to the binary tree. Any Alpha
value will be treated as NULL.
```

```
Enter an integer value for the root: 50
Enter an integer value for the Left child of 50: 20
Enter an integer value for the Right child of 50: 60
Enter an integer value for the Left child of 20: 10
Enter an integer value for the Right child of 20: 30
Enter an integer value for the Left child of 10: a
Enter an integer value for the Right child of 10: a
Enter an integer value for the Left child of 30: 55
Enter an integer value for the Right child of 30: a
Enter an integer value for the Left child of 55: a
Enter an integer value for the Right child of 55: a
Enter an integer value for the Left child of 60: a
Enter an integer value for the Right child of 60: 80
Enter an integer value for the Left child of 80: a
Enter an integer value for the Right child of 80: a
The resulting binary tree is: 10 20 55 30 50 60 80

Please input your choice(1/2/0): 2
Find the maximum depth of the binary tree: 3
Please input your choice(1/2/0): 0
```

4. Given a binary search tree and a "target" value, search the tree to see if it contains the target. The basic pattern of the searchNode() occurs in many recursive tree algorithms: deal with the base case where the tree is empty, deal with the current node, and then use recursion to deal with the subtrees.

The function prototype is given as follows:

```
BTNode *searchNode(BTNode *root, int key);
```