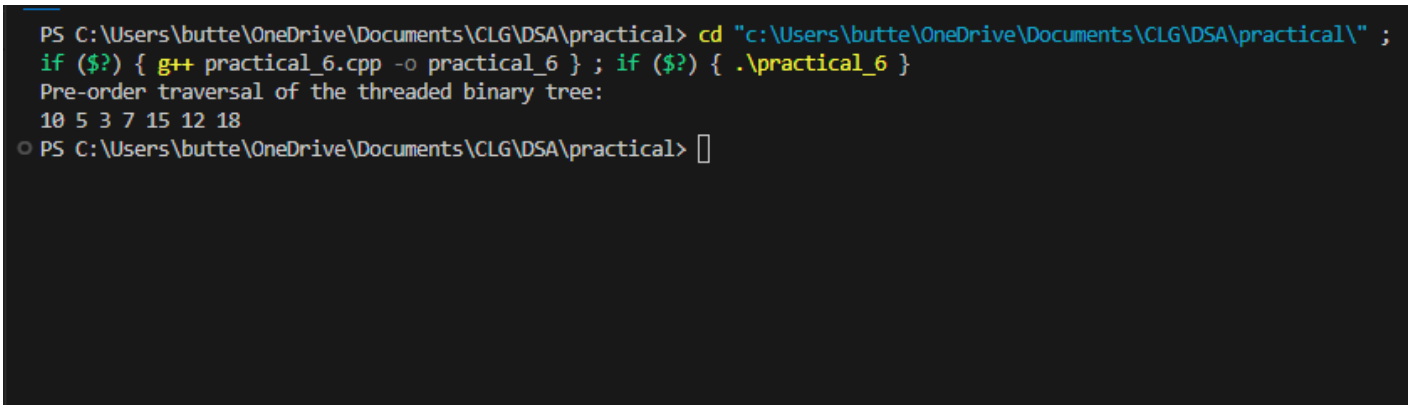
Practical 6
Source Code:-

```
#include <iostream>

struct Node {
  int data;
  Node *left;
  Node *right;
  bool isThreaded; // true if right pointer is a thread

  Node(int val) : data(val), left(nullptr), right(nullptr), isThreaded(false) {}
};

class InOrderThreadedBinaryTree {
private:
  Node *root;

  void insert(Node*& root, int key) {
    if (root == nullptr) {
      root = new Node(key);
      return;
    }

    if (key < root->data) {
      insert(root->left, key);
    } else {
      if (root->isThreaded) {
        Node* temp = root->right;
        root->right = new Node(key);
        root->right->right = temp;
        root->isThreaded = false;
      } else {
        insert(root->right, key);
      }
    }
  }

  void createThreaded(Node* root) {
    if (root == nullptr) return;

    createThreaded(root->left);

    if (root->left != nullptr) {
      Node* prev = root->left;
      while (prev->right != nullptr) {
        prev = prev->right;
      }
      prev->right = root;
      prev->isThreaded = true;
    }

    createThreaded(root->right);
```

```
    }

    void preOrderTraverse(Node* root) {
        if (root == nullptr) return;

        std::cout << root->data << " ";

        if (!root->isThreaded) {
            preOrderTraverse(root->left);
        }

        if (root->right != nullptr && !root->isThreaded) {
            preOrderTraverse(root->right);
        }
    }

public:
    InOrderThreadedBinaryTree() : root(nullptr) {}

    void insert(int key) {
        insert(root, key);
    }

    void createThreads() {
        createThreaded(root);
    }

    void preOrder() {
        preOrderTraverse(root);
    }
};

int main() {
    InOrderThreadedBinaryTree tree;
    tree.insert(10);
    tree.insert(5);
    tree.insert(15);
    tree.insert(3);
    tree.insert(7);
    tree.insert(12);
    tree.insert(18);

    // Create threads for in-order traversal
    tree.createThreads();

    // Pre-order traversal of the threaded binary tree
    std::cout << "Pre-order traversal of the threaded binary tree:\n";
    tree.preOrder();

    return 0;
}
```

Output:-


PS C:\Users\butte\OneDrive\Documents\CLG\DSA\practical> cd "c:\Users\butte\OneDrive\Documents\CLG\DSA\practical\" ;
if ($?) { g++ practical_6.cpp -o practical_6 } ; if ($?) { .\practical_6 }
Pre-order traversal of the threaded binary tree:
10 5 3 7 15 12 18
PS C:\Users\butte\OneDrive\Documents\CLG\DSA\practical>