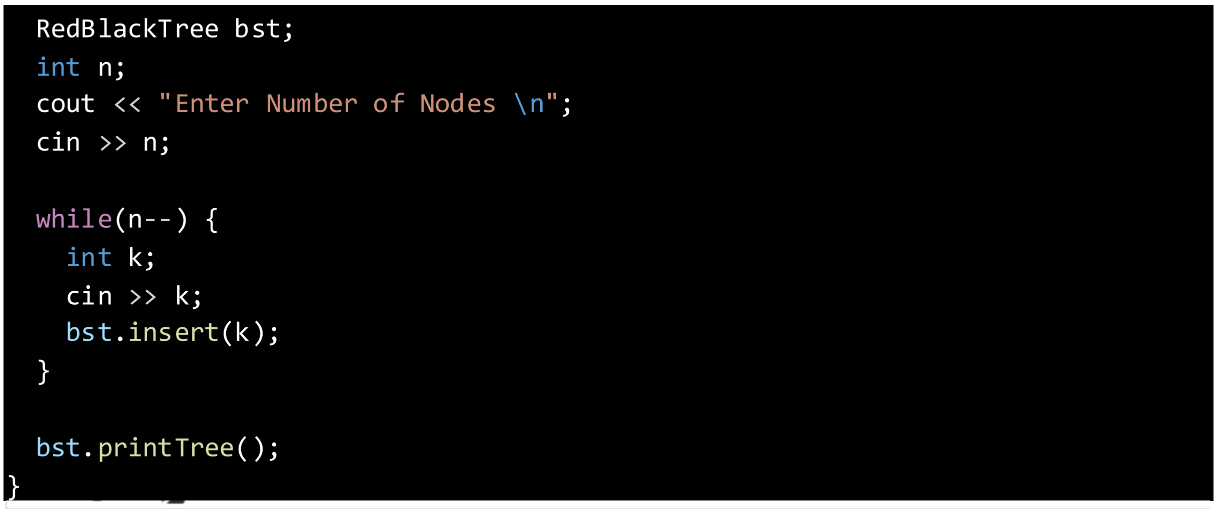
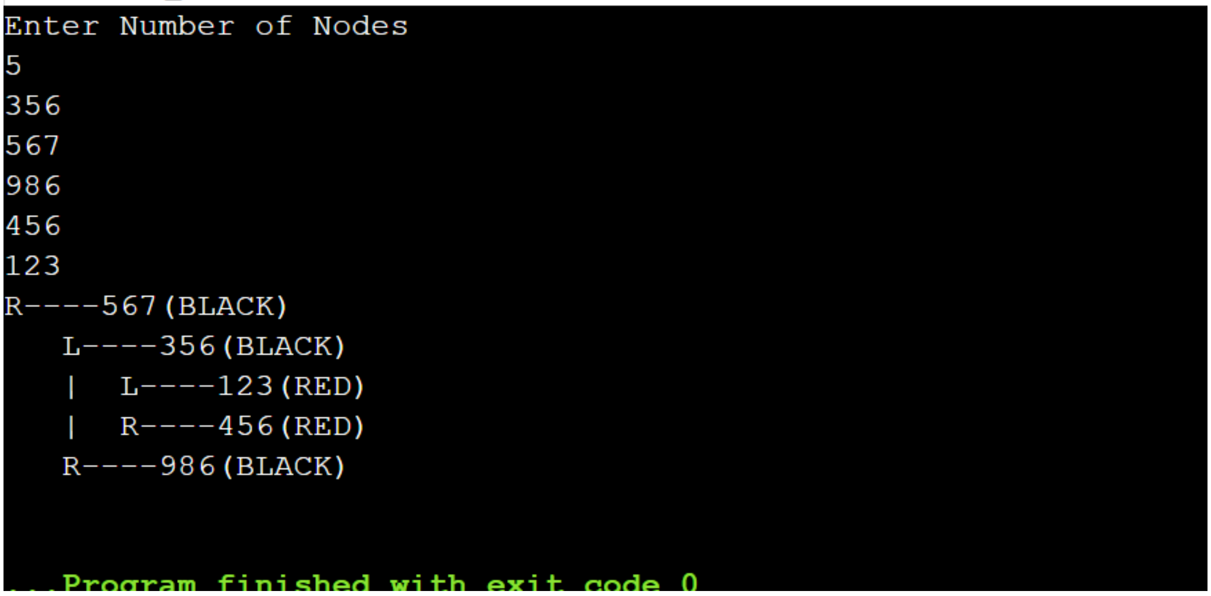
```cpp
#include <iostream>
using namespace std;

struct Node {
  int data;
  Node *parent;
  Node *left;
  Node *right;
  int color;
};

typedef Node *NodePtr;

class RedBlackTree {
   private:
  NodePtr root;
  NodePtr TNULL;

  void initializeNULLNode(NodePtr node, NodePtr parent) {
    node->data = 0;
    node->parent = parent;
    node->left = nullptr;
    node->right = nullptr;
    node->color = 0;
  }

  void rbTransplant(NodePtr u, NodePtr v) {
    if (u->parent == nullptr) {
      root = v;
    } else if (u == u->parent->left) {
      u->parent->left = v;
    } else {
      u->parent->right = v;
    }
    v->parent = u->parent;
  }

  // For balancing the tree after insertion
  void insertFix(NodePtr k) {
    NodePtr u;
    while (k->parent->color == 1) {
      if (k->parent == k->parent->parent->right) {
        u = k->parent->parent->left;
        if (u->color == 1) {
          u->color = 0;
          k->parent->color = 0;
          k->parent->parent->color = 1;
          k = k->parent->parent;
      } else {
        if (k == k->parent->left) {
          k = k->parent;
          rightRotate(k);
        }
        k->parent->color = 0;
        k->parent->parent->color = 1;
        leftRotate(k->parent->parent);
      }
    } else {
      u = k->parent->parent->right;

      if (u->color == 1) {
        u->color = 0;
        k->parent->color = 0;
        k->parent->parent->color = 1;
        k = k->parent->parent;
      } else {
        if (k == k->parent->right) {
          k = k->parent;
          leftRotate(k);
        }
        k->parent->color = 0;
        k->parent->parent->color = 1;
        rightRotate(k->parent->parent);
      }
    }
    if (k == root) {
      break;
    }
  }
  root->color = 0;
}

void printHelper(NodePtr root, string indent, bool last) {
  if (root != TNULL) {
    cout << indent;
    if (last) {
      cout << "R----";
      indent += "   ";
    } else {
      cout << "L----";
      indent += "|  ";
    }

    string sColor = root->color ? "RED" : "BLACK";
    cout << root->data << "(" << sColor << ")" << endl;
    printHelper(root->left, indent, false);
    printHelper(root->right, indent, true);
  }
}

 public:
RedBlackTree() {
  TNULL = new Node;
  TNULL->color = 0;
  TNULL->left = nullptr;
  TNULL->right = nullptr;
  root = TNULL;
}

NodePtr minimum(NodePtr node) {
  while (node->left != TNULL) {
    node = node->left;
  }
  return node;
}

NodePtr maximum(NodePtr node) {
  while (node->right != TNULL) {
    node = node->right;
  }
  return node;
}

NodePtr successor(NodePtr x) {
  if (x->right != TNULL) {
    return minimum(x->right);
  }

  NodePtr y = x->parent;
  while (y != TNULL && x == y->right) {
    x = y;
    y = y->parent;
  }
  return y;
}

NodePtr predecessor(NodePtr x) {
  if (x->left != TNULL) {
    return maximum(x->left);
  }

  NodePtr y = x->parent;
  while (y != TNULL && x == y->left) {
    x = y;
    y = y->parent;
  }

  return y;
}

void leftRotate(NodePtr x) {
  NodePtr y = x->right;
  x->right = y->left;
  if (y->left != TNULL) {
    y->left->parent = x;
  }
  y->parent = x->parent;
  if (x->parent == nullptr) {
    this->root = y;
  } else if (x == x->parent->left) {
    x->parent->left = y;
  } else {
    x->parent->right = y;
  }
  y->left = x;
  x->parent = y;
}

void rightRotate(NodePtr x) {
  NodePtr y = x->left;
  x->left = y->right;
  if (y->right != TNULL) {
    y->right->parent = x;
  }
  y->parent = x->parent;
  if (x->parent == nullptr) {
    this->root = y;
  } else if (x == x->parent->right) {
    x->parent->right = y;
  } else {
    x->parent->left = y;
  }
  y->right = x;
  x->parent = y;
}

// Inserting a node
void insert(int key) {
  NodePtr node = new Node;
  node->parent = nullptr;
  node->data = key;
  node->left = TNULL;
```

```
    node->right = TNULL;
    node->color = 1;

    NodePtr y = nullptr;
    NodePtr x = this->root;

    while (x != TNULL) {
      y = x;
      if (node->data < x->data) {
        x = x->left;
      } else {
        x = x->right;
      }
    }

    node->parent = y;
    if (y == nullptr) {
      root = node;
    } else if (node->data < y->data) {
      y->left = node;
    } else {
      y->right = node;
    }

    if (node->parent == nullptr) {
      node->color = 0;
      return;
    }

    if (node->parent->parent == nullptr) {
      return;
    }

    insertFix(node);
  }

  NodePtr getRoot() {
    return this->root;
  }

  void printTree() {
    if (root) {
      printHelper(this->root, "", true);
    }
  }
};

int main() {
```



```cpp
  RedBlackTree bst;
  int n;
  cout << "Enter Number of Nodes \n";
  cin >> n;

  while(n--) {
    int k;
    cin >> k;
    bst.insert(k);
  }

  bst.printTree();
}
```



```
Enter Number of Nodes
5
356
567
986
456
123
R----567(BLACK)
   L----356(BLACK)
   |  L----123(RED)
   |  R----456(RED)
   R----986(BLACK)


...Program finished with exit code 0
```