```
#include <iostream>
#include <cstdlib>
#include "llcpInt.h"
using namespace std;

int FindListLength(Node* headPtr)
{
   int length = 0;

   while (headPtr != 0)
   {
      ++length;
      headPtr = headPtr->link;
   }

   return length;
}

bool IsSortedUp(Node* headPtr)
{
   if (headPtr == 0 || headPtr->link == 0) // empty or 1-node
      return true;
   while (headPtr->link != 0) // not at last node
   {
      if (headPtr->link->data < headPtr->data)
         return false;
      headPtr = headPtr->link;
   }
   return true;
}

void InsertAsHead(Node*& headPtr, int value)
{
   Node *newNodePtr = new Node;
   newNodePtr->data = value;
   newNodePtr->link = headPtr;
   headPtr = newNodePtr;
}

void InsertAsTail(Node*& headPtr, int value)
{
   Node *newNodePtr = new Node;
   newNodePtr->data = value;
   newNodePtr->link = 0;
   if (headPtr == 0)
      headPtr = newNodePtr;
   else
   {
      Node *cursor = headPtr;

      while (cursor->link != 0) // not at last node
         cursor = cursor->link;
      cursor->link = newNodePtr;
   }
}
```

```
void InsertSortedUp(Node*& headPtr, int value)
{
   Node *precursor = 0,
        *cursor = headPtr;

   while (cursor != 0 && cursor->data < value)
   {
      precursor = cursor;
      cursor = cursor->link;
   }

   Node *newNodePtr = new Node;
   newNodePtr->data = value;
   newNodePtr->link = cursor;
   if (cursor == headPtr)
      headPtr = newNodePtr;
   else
      precursor->link = newNodePtr;

   ////////////////////////////////////////////////////////
   /* using-only-cursor (no precursor) version
   Node *newNodePtr = new Node;
   newNodePtr->data = value;
   //newNodePtr->link = 0;
   //if (headPtr == 0)
   //   headPtr = newNodePtr;
   //else if (headPtr->data >= value)
   //{
   //   newNodePtr->link = headPtr;
   //   headPtr = newNodePtr;
   //}
   if (headPtr == 0 || headPtr->data >= value)
   {
      newNodePtr->link = headPtr;
      headPtr = newNodePtr;
   }
   //else if (headPtr->link == 0)
   //   head->link = newNodePtr;
   else
   {
      Node *cursor = headPtr;
      while (cursor->link != 0 && cursor->link->data < value)
         cursor = cursor->link;
      //if (cursor->link != 0)
      //   newNodePtr->link = cursor->link;
      newNodePtr->link = cursor->link;
      cursor->link = newNodePtr;
   }

   ////////////////// commented lines removed /////////////////

   Node *newNodePtr = new Node;
   newNodePtr->data = value;
   if (headPtr == 0 || headPtr->data >= value)
```

```
   {
      newNodePtr->link = headPtr;
      headPtr = newNodePtr;
   }
   else
   {
      Node *cursor = headPtr;
      while (cursor->link != 0 && cursor->link->data < value)
         cursor = cursor->link;
      newNodePtr->link = cursor->link;
      cursor->link = newNodePtr;
   }
   */
   ////////////////////////////////////////////////////////
}

bool DelFirstTargetNode(Node*& headPtr, int target)
{
   Node *precursor = 0,
        *cursor = headPtr;

   while (cursor != 0 && cursor->data != target)
   {
      precursor = cursor;
      cursor = cursor->link;
   }
   if (cursor == 0)
   {
      cout << target << " not found." << endl;
      return false;
   }
   if (cursor == headPtr) //OR precursor == 0
      headPtr = headPtr->link;
   else
      precursor->link = cursor->link;
   delete cursor;
   return true;
}

bool DelNodeBefore1stMatch(Node*& headPtr, int target)
{
   if (headPtr == 0 || headPtr->link == 0 || headPtr->data == target) return
false;
   Node *cur = headPtr->link, *pre = headPtr, *prepre = 0;
   while (cur != 0 && cur->data != target)
   {
      prepre = pre;
      pre = cur;
      cur = cur->link;
   }
   if (cur == 0) return false;
   if (cur == headPtr->link)
   {
      headPtr = cur;
      delete pre;
```

```
   }
   else
   {
      prepre->link = cur;
      delete pre;
   }
   return true;
}

void ShowAll(ostream& outs, Node* headPtr)
{
   while (headPtr != 0)
   {
      outs << headPtr->data << "  ";
      headPtr = headPtr->link;
   }
   outs << endl;
}

void FindMinMax(Node* headPtr, int& minValue, int& maxValue)
{
   if (headPtr == 0)
   {
      cerr << "FindMinMax() attempted on empty list" << endl;
      cerr << "Minimum and maximum values not set" << endl;
   }
   else
   {
      minValue = maxValue = headPtr->data;
      while (headPtr->link != 0)
      {
         headPtr = headPtr->link;
         if (headPtr->data < minValue)
            minValue = headPtr->data;
         else if (headPtr->data > maxValue)
            maxValue = headPtr->data;
      }
   }
}

double FindAverage(Node* headPtr)
{
   if (headPtr == 0)
   {
      cerr << "FindAverage() attempted on empty list" << endl;
      cerr << "An arbitrary zero value is returned" << endl;
      return 0.0;
   }
   else
   {
      int sum = 0,
          count = 0;

      while (headPtr != 0)
      {
```

```
         ++count;
         sum += headPtr->data;
         headPtr = headPtr->link;
      }

      return double(sum) / count;
   }
}

void ListClear(Node*& headPtr, int noMsg)
{
   int count = 0;

   Node *cursor = headPtr;
   while (headPtr != 0)
   {
      headPtr = headPtr->link;
      delete cursor;
      cursor = headPtr;
      ++count;
   }
   if (noMsg) return;
   clog << "Dynamic memory for " << count << " nodes freed"
        << endl;
}

// definition of PromoteTarget
void PromoteTarget(Node*& head, int value)
{
    if(head == 0)
    {
      Node *newNode = new Node;
      newNode->data = value;
      newNode->link = 0;
      if (head == 0)
         head = newNode;
      else
      {
         Node *cursor = head;

         while (cursor->link != 0)
            cursor = cursor->link;
         cursor->link = newNode;
      }
      return;
    }

    Node* first = head;
    Node* curr = head->link;
    Node* prev = head;
    bool found = false;

    if(head->data == value && curr == NULL)
    {
      return;
```

```
    }


    while(curr != 0)
    {
       if(head->data == value)
       {
         found = true;
       }

       if(curr->data == value && prev != NULL)
       {
          found = true;
          prev->link = curr->link;
          curr->link = first;
          head = curr;
          first = head;
          curr = prev->link;
          continue;
       }
       else
       {
         prev = curr;
         curr = curr->link;
       }
    }

    if(!found)
    {
      Node *newNode = new Node;
      newNode->data = value;
      newNode->link = 0;
      if (head == 0)
         head = newNode;
      else
      {
         Node *cursor = head;

         while (cursor->link != 0)
            cursor = cursor->link;
         cursor->link = newNode;
      }
      return;
    }

}
```