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Data Structure Lab

CEN-391

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Program 11

Code :-

#include <iostream>

using namespace std;

struct LinkedList

{

    int data;

    LinkedList \*next;

};

LinkedList \*Create\_NewNode()

{

    LinkedList \*newnode = (LinkedList \*)malloc(sizeof(LinkedList));

    cout << "Enter The Element : ";

    cin >> newnode->data;

    newnode->next = nullptr;

    return newnode;

}

void Display(LinkedList \*Head, int size)

{

    cout << "Display...\n";

    if (size == 0)

    {

        cout << "Linked List Is Empty!\n";

        return;

    }

    cout << "Head";

    while (Head)

    {

        cout << "->" << Head->data << "";

        Head = Head->next;

    }

    cout << "<-Tail\n";

}

void Insert\_At\_Beginning(LinkedList \*&Head, LinkedList \*&Tail, int &size)

{

    cout << "Insert At Beginning Operation Is Selected... \n";

    LinkedList \*newnode = Create\_NewNode();

    if (newnode == nullptr)

    {

        cout << "Memory Not Assigned!\n";

        return;

    }

    size++;

    if (Head == nullptr)

    {

        Head = newnode;

        Tail = newnode;

    }

    else

    {

        newnode->next = Head;

        Head = newnode;

    }

    Display(Head, size);

}

void Insert\_At\_End(LinkedList \*&Head, LinkedList \*&Tail, int &size)

{

    cout << "Insert At End Operation Is Selected... \n";

    LinkedList \*newnode = Create\_NewNode();

    if (size == 0)

    {

        size++;

        Head = newnode;

        Tail = newnode;

        Display(Head, size);

        return;

    }

    if (newnode == nullptr)

    {

        cout << "Memory Not Assigned!\n";

        return;

    }

    size++;

    Tail->next = newnode;

    Tail = Tail->next;

    Display(Head, size);

}

void Insert\_At\_Given\_Position(LinkedList \*&Head, LinkedList \*&Tail, int &size)

{

    cout << "Insert At Given Position Operation Is Selected... \n";

    int k;

    cout << "Enter The Positon Between [0," << size << "] : ";

    cin >> k;

    if (k > size || k < 0)

    {

        cout << "Invalid Position!\n";

        return;

    }

    if (k == 0)

        Insert\_At\_Beginning(Head, Tail, size);

    else if (k == size)

        Insert\_At\_End(Head, Tail, size);

    else

    {

        size++;

        LinkedList \*Current = Head, \*newnode = Create\_NewNode();

        while (k > 1)

        {

            Current = Current->next;

            k--;

        }

        newnode->next = Current->next;

        Current->next = newnode;

        Display(Head, size);

    }

}

void Delete\_At\_Beginning(LinkedList \*&Head, LinkedList \*&Tail, int &size)

{

    cout << "Delete At Beginning Operation Is Selected... \n";

    if (size == 0)

    {

        cout << "Linked List Underflow!\n";

        return;

    }

    size--;

    LinkedList \*todelete = Head;

    Head = Head->next;

    delete todelete;

    if (size == 0)

    {

        Head == nullptr;

        Tail == nullptr;

    }

    Display(Head, size);

}

void Delete\_At\_End(LinkedList \*&Head, LinkedList \*&Tail, int &size)

{

    cout << "Delete At End Operation Is Selected... \n";

    if (size == 0)

    {

        cout << "Linked List Underflow!\n";

        return;

    }

    size--;

    LinkedList \*Current = Head, \*todelete = Tail;

    while (Current != Tail && Current->next != Tail)

    {

        Current = Current->next;

    }

    Tail = Current;

    Tail->next = nullptr;

    cout << Current->data << "\n";

    delete todelete;

    if (size == 0)

    {

        Head == nullptr;

        Tail == nullptr;

    }

    Display(Head, size);

}

void Delete\_At\_Given\_Position(LinkedList \*&Head, LinkedList \*&Tail, int &size)

{

    cout << "Delete At Given Position Operation Is Selected... \n";

    if (size == 0)

    {

        cout << "Linked List Underflow!\n";

        return;

    }

    int k;

    cout << "Enter The Positon Between [0," << size - 1 << "] : ";

    cin >> k;

    if (k >= size || k < 0)

    {

        cout << "Invalid Position!\n";

        return;

    }

    if (k == 0)

        Delete\_At\_Beginning(Head, Tail, size);

    else if (k == size - 1)

        Delete\_At\_End(Head, Tail, size);

    else

    {

        size--;

        LinkedList \*Current = Head, \*todelete = nullptr;

        while (k > 1)

        {

            Current = Current->next;

            k--;

        }

        todelete = Current->next;

        Current->next = todelete->next;

        delete todelete;

        if (size == 0)

        {

            Head == nullptr;

            Tail == nullptr;

        }

        Display(Head, size);

    }

}

void Total\_Element(int size)

{

    cout << "Total Elements Operation Is Selected... \n";

    cout << "Total Elements In Queue : " << size << endl;

}

void Search\_Element(LinkedList \*Head, int size)

{

    cout << "Search Element Operation Is Selected... \n";

    if (size == 0)

    {

        cout << "Linked List Is Empty!\n";

        return;

    }

    int search;

    cout << "Enter The Element You Want To Search : ";

    cin >> search;

    int isMulti = 0;

    cout << "Do You Want To Search For Single/Multiple Occurence [0/1] : ";

    cin >> isMulti;

    int Position = 0;

    bool Find = false;

    while (Head)

    {

        if (Head->data == search)

        {

            Find = true;

            cout << Position << " ";

            if (isMulti == false)

                break;

        }

        Position++;

        Head = Head->next;

    }

    if (Find == false)

    {

        cout << "\nElement Not Found!\n";

    }

    else

    {

        cout << "\n"

             << search << " Is Found At Above Positon In Linked List\n";

    }

}

void Bars()

{

    cout << "---------------------------------------------------------------\n";

}

bool Options(LinkedList \*&Head, LinkedList \*&Tail, int &size)

{

    int opt;

    cin >> opt;

    Bars();

    switch (opt)

    {

    case 1:

        Insert\_At\_Beginning(Head, Tail, size);

        break;

    case 2:

        Insert\_At\_End(Head, Tail, size);

        break;

    case 3:

        Insert\_At\_Given\_Position(Head, Tail, size);

        break;

    case 4:

        Delete\_At\_Beginning(Head, Tail, size);

        break;

    case 5:

        Delete\_At\_End(Head, Tail, size);

        break;

    case 6:

        Delete\_At\_Given\_Position(Head, Tail, size);

        break;

    case 7:

        Total\_Element(size);

        break;

    case 8:

        Search\_Element(Head, size);

        break;

    case 9:

        Display(Head, size);

        break;

    case 10:

        return 0;

        break;

    default:

        cout << "Invalid Input!\nTry Again!\n\n";

    }

    Bars();

    return 1;

}

void Menu()

{

    cout << "\n\_\_\_\_\_Operations\_On\_Singly\_Linked\_List\_\_\_\_\_ \n";

    cout << "1.Insert At Beginning. \n";

    cout << "2.Insert At End. \n";

    cout << "3.Insert At Given Position. \n";

    cout << "4.Delete At Beginning. \n";

    cout << "5.Delete At End. \n";

    cout << "6.Delete At Given Position. \n";

    cout << "7.Total No Of Elements. \n";

    cout << "8.Search Of Element. \n";

    cout << "9.Display.\n";

    cout << "10.Exit.\n";

    cout << "\nEnter Your Choice : ";

}

int main()

{

    system("cls");

    cout << "\_\_\_Vicky\_Gupta\_20BCS070\_\_\_\n";

    LinkedList \*Head = nullptr, \*Tail = nullptr;

    int size = 0;

    while (true)

    {

        Menu();

        if (!Options(Head, Tail, size))

            break;

    }

    cout << "Exiting...\n";

    Bars();

    return 0;

}

Output :-

Table

Description automatically generated

Table

Description automatically generated

Table

Description automatically generated

Table

Description automatically generated

Table

Description automatically generated

Text

Description automatically generated