DSA Lab05

23K2001

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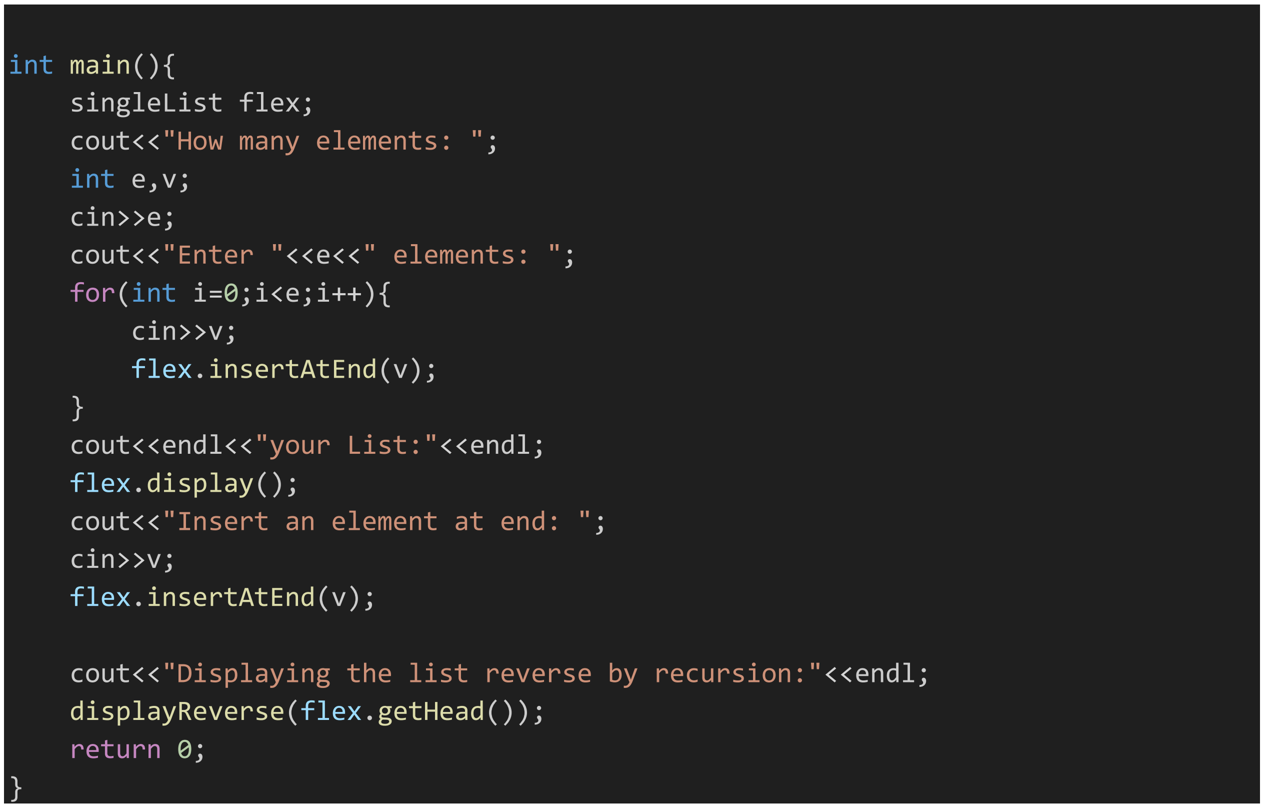
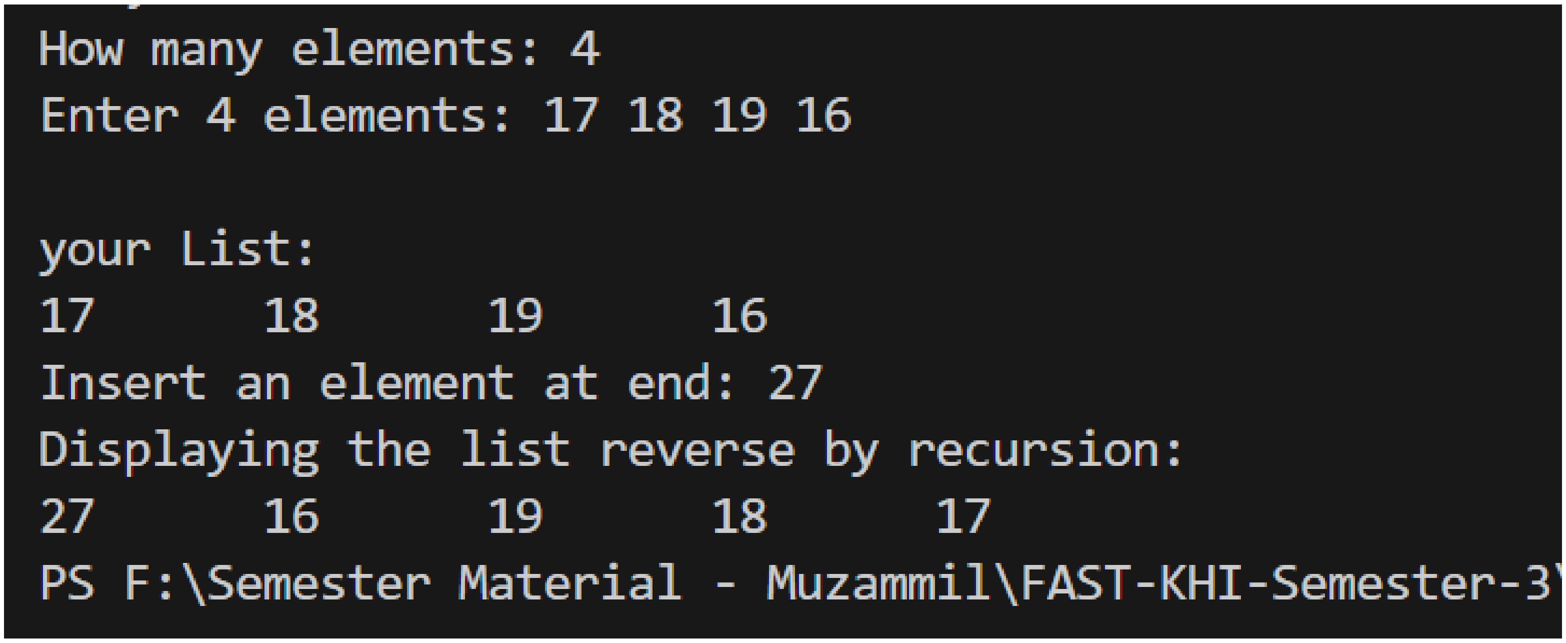
BCS-3J

Q1:

```cpp
//23K2001 Muzammil
#include<iostream>
using namespace std;
class node{
    private:
        int data;
        node* next;
    public:
        node(){next = nullptr;}
        node(int val){
            data = val;
            next = nullptr;
        }

        int getData(){ return data;}
        node* getNext(){return next;}
        void setNext(node* update){next = update;}
};
class singleList{
    private:
        node* head;
        node* tail;
    public:
        singleList(){
            head = nullptr;
            tail = nullptr;
        }
        void display(){
            node* temp = head;
            while(temp!=nullptr)
            {
                cout<<temp->getData()<<"\t";
                temp=temp->getNext();
            }
            cout<<endl;
        }
        node* getHead(){ return head; }

        void insertAtStart(int val)
        {
            node* n = new node(val);
            n->setNext(head);
            head = n;
        }
        void insertAtEnd(int val)
        {
            node* temp = head;
            node* n = new node(val);
            if(head == nullptr){
                head = n;
                tail = n;
            }
            else{
                tail->setNext(n);
                tail = n;
            }
        }
        void insertAtIndex(int index,int val){
            node* update = new node(val);
            node* temp = head;
            node* before = nullptr;
            for(int i=0;i<index-1;i++){
                before = temp;
                temp=temp->getNext();
            }
            before->setNext(update);
            update->setNext(temp);
        }
        void deleteNode(int val){
            node* before = nullptr;
            node* temp = head;
            while(temp->getData()!=val){
                before = temp;
                temp = temp->getNext();
            }
            before->setNext(temp->getNext());
            delete temp;
        }
};

void displayReverse(node* head){
    if(head==nullptr)
    return;

    displayReverse(head->getNext());
    cout<<head->getData()<<"\t";
}
```

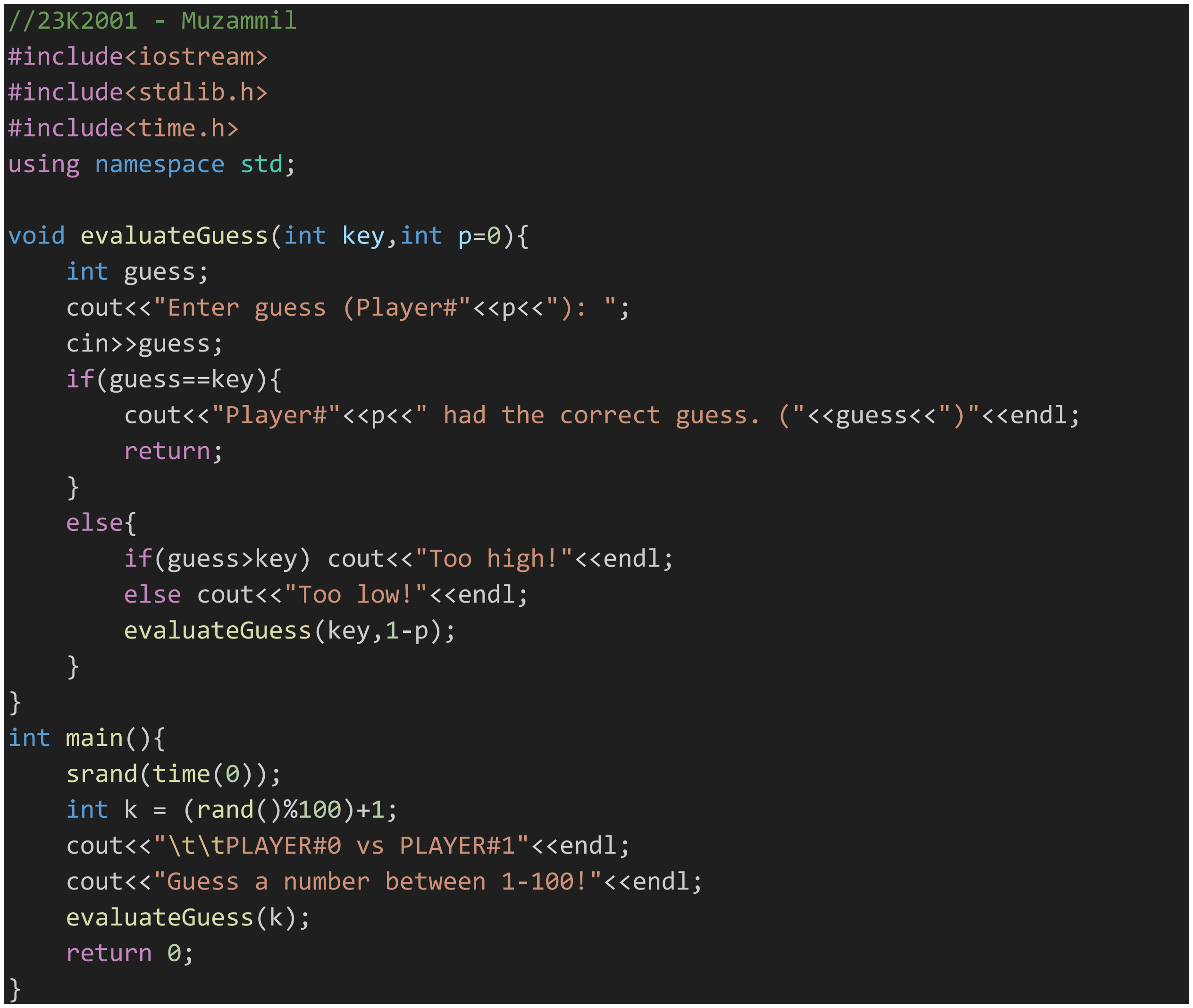


```cpp
int main(){
    singleList flex;
    cout<<"How many elements: ";
    int e,v;
    cin>>e;
    cout<<"Enter "<<e<<" elements: ";
    for(int i=0;i<e;i++){
        cin>>v;
        flex.insertAtEnd(v);
    }
    cout<<endl<<"your List:"<<endl;
    flex.display();
    cout<<"Insert an element at end: ";
    cin>>v;
    flex.insertAtEnd(v);

    cout<<"Displaying the list reverse by recursion:"<<endl;
    displayReverse(flex.getHead());
    return 0;
}
```

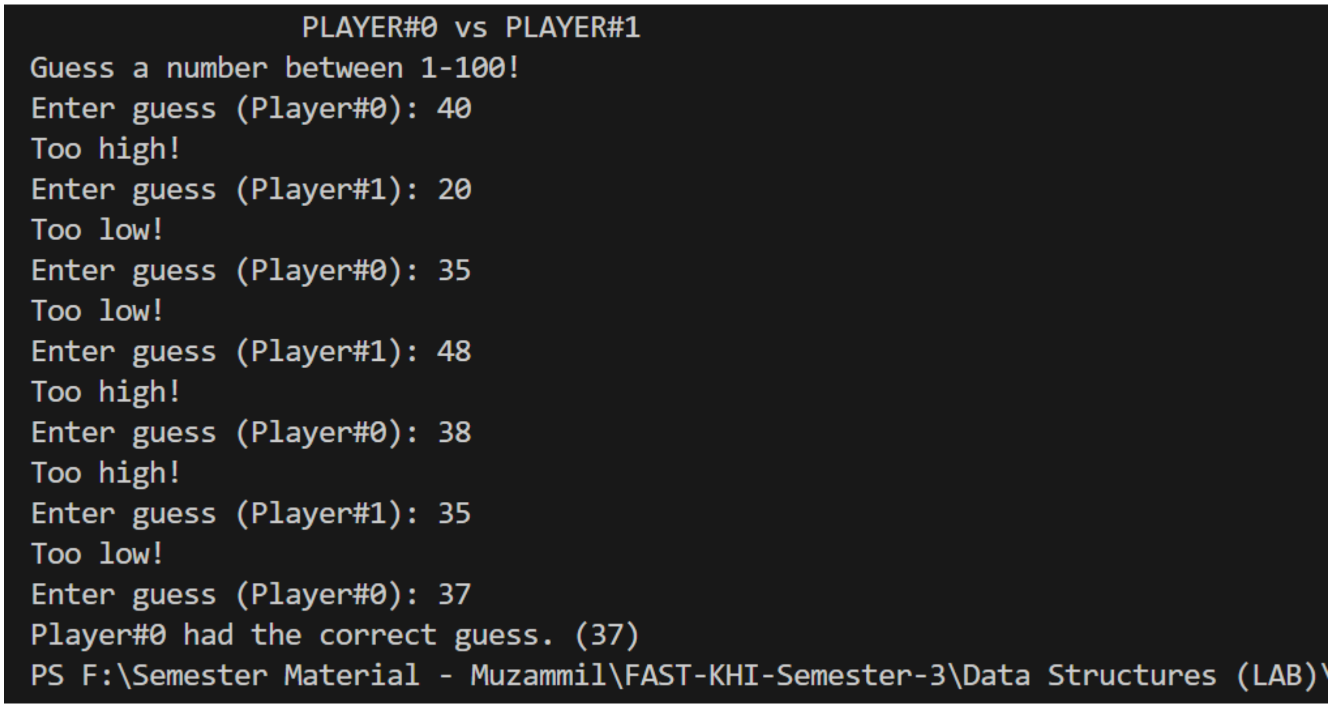


```
How many elements: 4
Enter 4 elements: 17 18 19 16

your List:
17      18      19      16
Insert an element at end: 27
Displaying the list reverse by recursion:
27      16      19      18      17
PS F:\Semester Material - Muzammil\FAST-KHI-Semester-3
```

Q2:



```cpp
//23K2001 - Muzammil
#include<iostream>
#include<stdlib.h>
#include<time.h>
using namespace std;

void evaluateGuess(int key,int p=0){
    int guess;
    cout<<"Enter guess (Player#"<<p<<"): ";
    cin>>guess;
    if(guess==key){
        cout<<"Player#"<<p<<" had the correct guess. ("<<guess<<")"<<endl;
        return;
    }
    else{
        if(guess>key) cout<<"Too high!"<<endl;
        else cout<<"Too low!"<<endl;
        evaluateGuess(key,1-p);
    }
}
int main(){
    srand(time(0));
    int k = (rand()%100)+1;
    cout<<"\t\tPLAYER#0 vs PLAYER#1"<<endl;
    cout<<"Guess a number between 1-100!"<<endl;
    evaluateGuess(k);
    return 0;
}
```

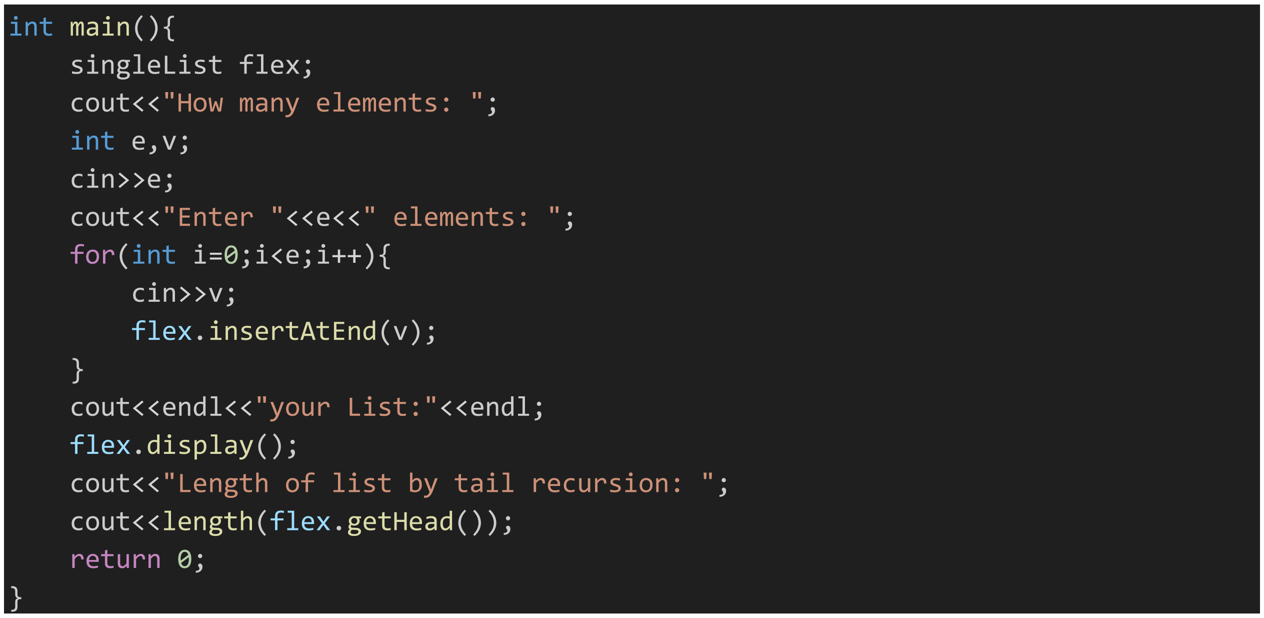


```
                PLAYER#0 vs PLAYER#1
Guess a number between 1-100!
Enter guess (Player#0): 40
Too high!
Enter guess (Player#1): 20
Too low!
Enter guess (Player#0): 35
Too low!
Enter guess (Player#1): 48
Too high!
Enter guess (Player#0): 38
Too high!
Enter guess (Player#1): 35
Too low!
Enter guess (Player#0): 37
Player#0 had the correct guess. (37)
PS F:\Semester Material - Muzammil\FAST-KHI-Semester-3\Data Structures (LAB)\
```

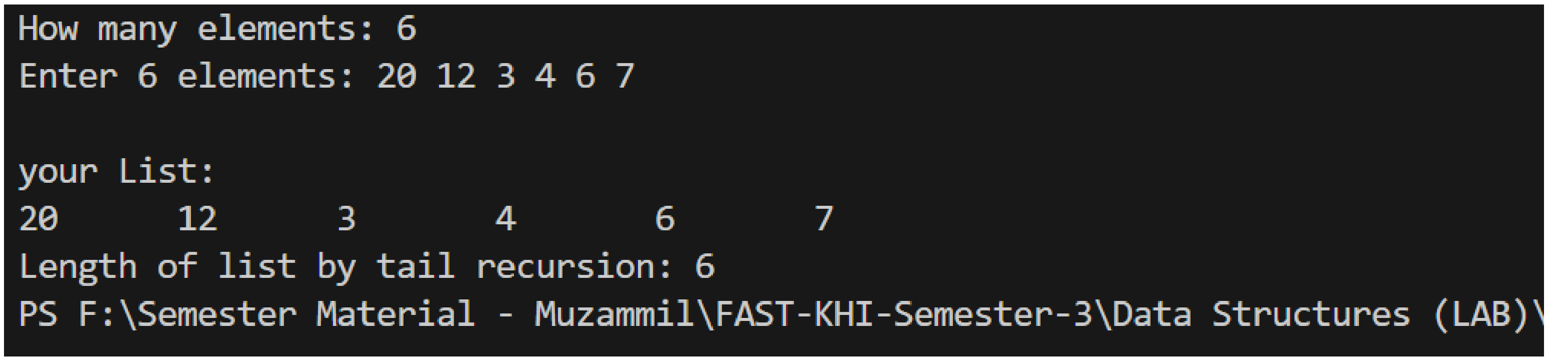
Q3:

```cpp
//23K2001 Muzammil
#include<iostream>
using namespace std;
class node{
    private:
        int data;
        node* next;
    public:
        node(){next = nullptr;}
        node(int val){
            data = val;
            next = nullptr;
        }

        int getData(){ return data;}
        node* getNext(){return next;}
        void setNext(node* update){next = update;}
};
class singleList{
    private:
        node* head;
        node* tail;
    public:
        singleList(){
            head = nullptr;
            tail = nullptr;
        }
        void display(){
            node* temp = head;
            while(temp!=nullptr)
            {
                cout<<temp->getData()<<"\t";
                temp=temp->getNext();
            }
            cout<<endl;
        }
        node* getHead(){ return head; }

        void insertAtStart(int val)
        {
            node* n = new node(val);
            n->setNext(head);
```

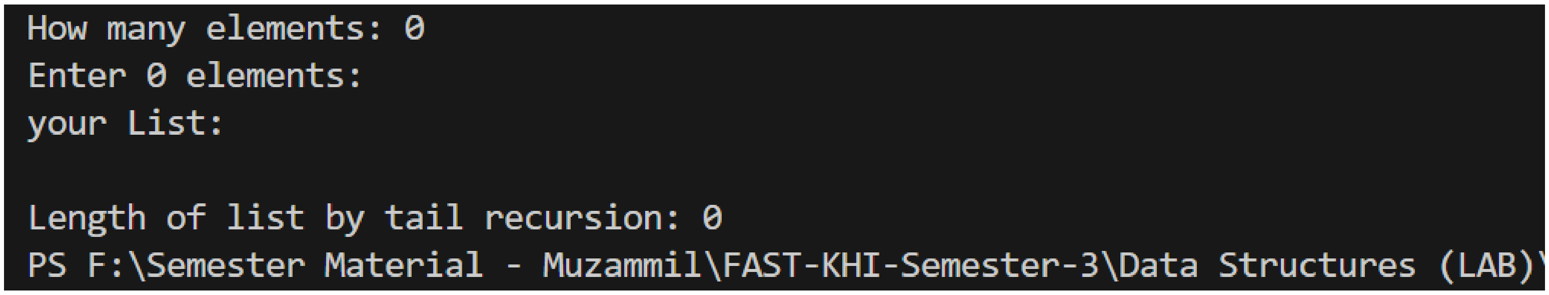
```
      head = n;
    }
    void insertAtEnd(int val)
    {
      node* temp = head;
      node* n = new node(val);
      if(head == nullptr){
        head = n;
        tail = n;
      }
      else{
        tail->setNext(n);
        tail = n;
      }
    }
    void insertAtIndex(int index,int val){
      node* update = new node(val);
      node* temp = head;
      node* before = nullptr;
      for(int i=0;i<index-1;i++){
        before = temp;
        temp=temp->getNext();
      }
      before->setNext(update);
      update->setNext(temp);
    }
    void deleteNode(int val){
      node* before = nullptr;
      node* temp = head;
      while(temp->getData()!=val){
        before = temp;
        temp = temp->getNext();
      }
      before->setNext(temp->getNext());
      delete temp;
    }
};

int length(node* head,int c=0){
  if(head==nullptr)
  return c;

  return length(head->getNext(),c+1);
}
```



```cpp
int main(){
    singleList flex;
    cout<<"How many elements: ";
    int e,v;
    cin>>e;
    cout<<"Enter "<<e<<" elements: ";
    for(int i=0;i<e;i++){
        cin>>v;
        flex.insertAtEnd(v);
    }
    cout<<endl<<"your List:"<<endl;
    flex.display();
    cout<<"Length of list by tail recursion: ";
    cout<<length(flex.getHead());
    return 0;
}
```



```
How many elements: 6
Enter 6 elements: 20 12 3 4 6 7

your List:
20      12      3       4       6       7
Length of list by tail recursion: 6
PS F:\Semester Material - Muzammil\FAST-KHI-Semester-3\Data Structures (LAB)
```



```
How many elements: 0
Enter 0 elements:
your List:

Length of list by tail recursion: 0
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```
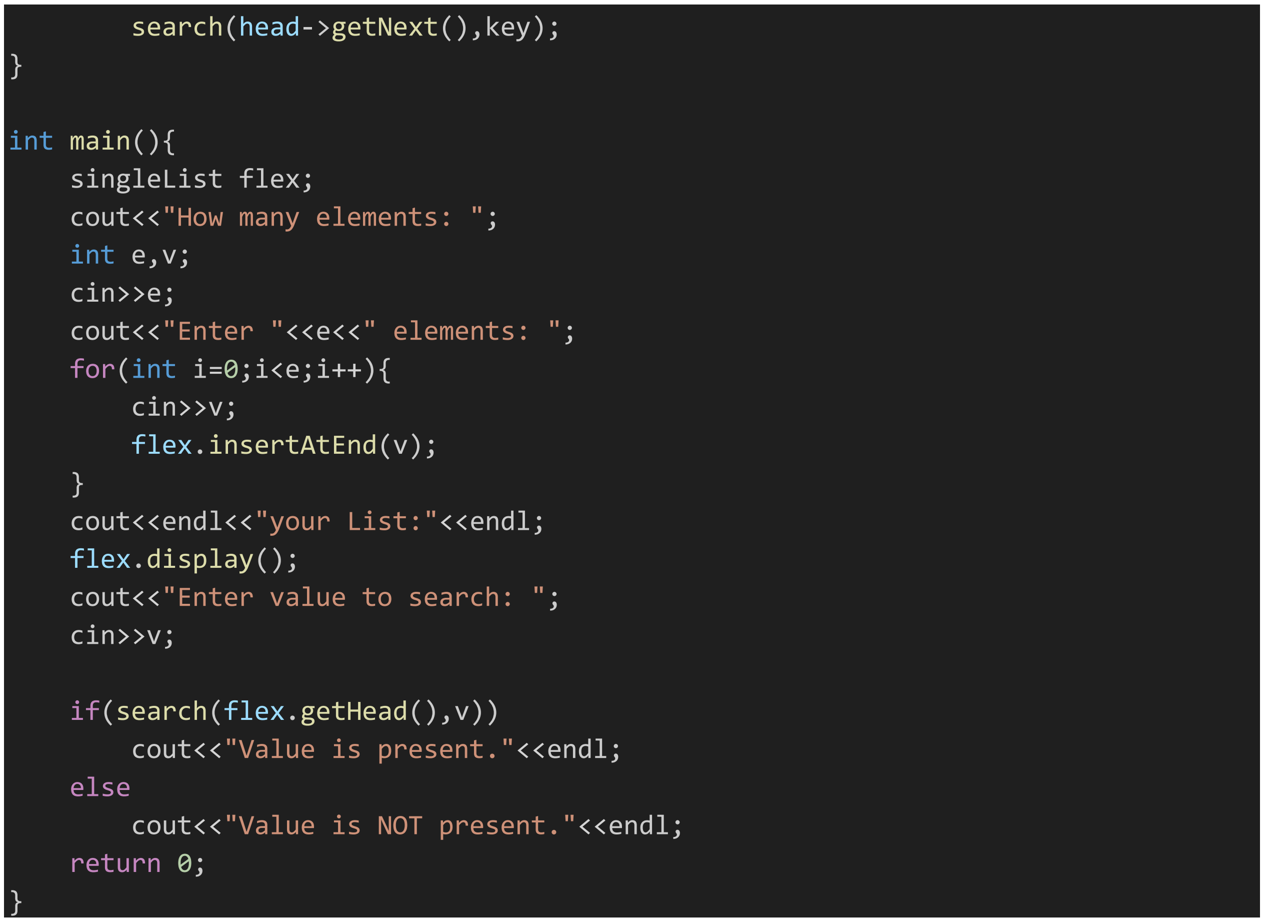
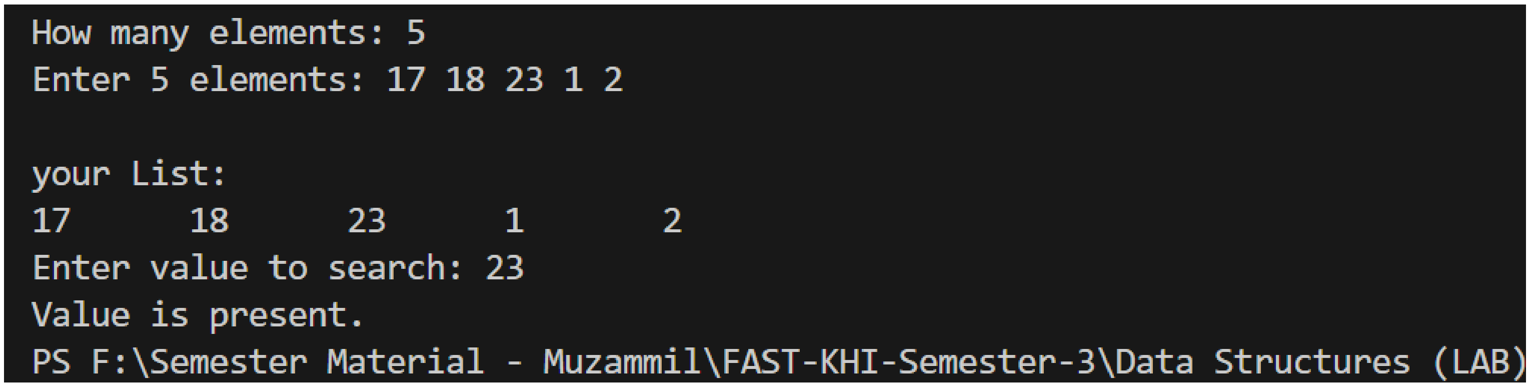

Q4:

```cpp
//23K2001 Muzammil
#include<iostream>
using namespace std;
class node{
    private:
        int data;
        node* next;
    public:
        node(){next = nullptr;}
        node(int val){
            data = val;
            next = nullptr;
        }

        int getData(){ return data;}
        node* getNext(){return next;}
        void setNext(node* update){next = update;}
};
class singleList{
    private:
        node* head;
        node* tail;
    public:
        singleList(){
            head = nullptr;
            tail = nullptr;
        }
        void display(){
            node* temp = head;
            while(temp!=nullptr)
            {
                cout<<temp->getData()<<"\t";
                temp=temp->getNext();
            }
            cout<<endl;
        }
        node* getHead(){ return head; }

        void insertAtStart(int val)
        {
            node* n = new node(val);
            n->setNext(head);
            head = n;
        }
        void insertAtEnd(int val)
        {
            node* temp = head;
            node* n = new node(val);
            if(head == nullptr){
                head = n;
                tail = n;
            }
            else{
                tail->setNext(n);
                tail = n;
            }
        }
        void insertAtIndex(int index,int val){
            node* update = new node(val);
            node* temp = head;
            node* before = nullptr;
            for(int i=0;i<index-1;i++){
                before = temp;
                temp=temp->getNext();
            }
            before->setNext(update);
            update->setNext(temp);
        }
        void deleteNode(int val){
            node* before = nullptr;
            node* temp = head;
            while(temp->getData()!=val){
                before = temp;
                temp = temp->getNext();
            }
            before->setNext(temp->getNext());
            delete temp;
        }
};

bool search(node* head,int key){
    if(head==nullptr)
    return false;

    if(head->getData()==key)
        return true;
    else
```



```cpp
        search(head->getNext(),key);
}

int main(){
    singleList flex;
    cout<<"How many elements: ";
    int e,v;
    cin>>e;
    cout<<"Enter "<<e<<" elements: ";
    for(int i=0;i<e;i++){
        cin>>v;
        flex.insertAtEnd(v);
    }
    cout<<endl<<"your List:"<<endl;
    flex.display();
    cout<<"Enter value to search: ";
    cin>>v;

    if(search(flex.getHead(),v))
        cout<<"Value is present."<<endl;
    else
        cout<<"Value is NOT present."<<endl;
    return 0;
}
```



```
How many elements: 5
Enter 5 elements: 17 18 23 1 2

your List:
17      18      23      1       2
Enter value to search: 23
Value is present.
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```
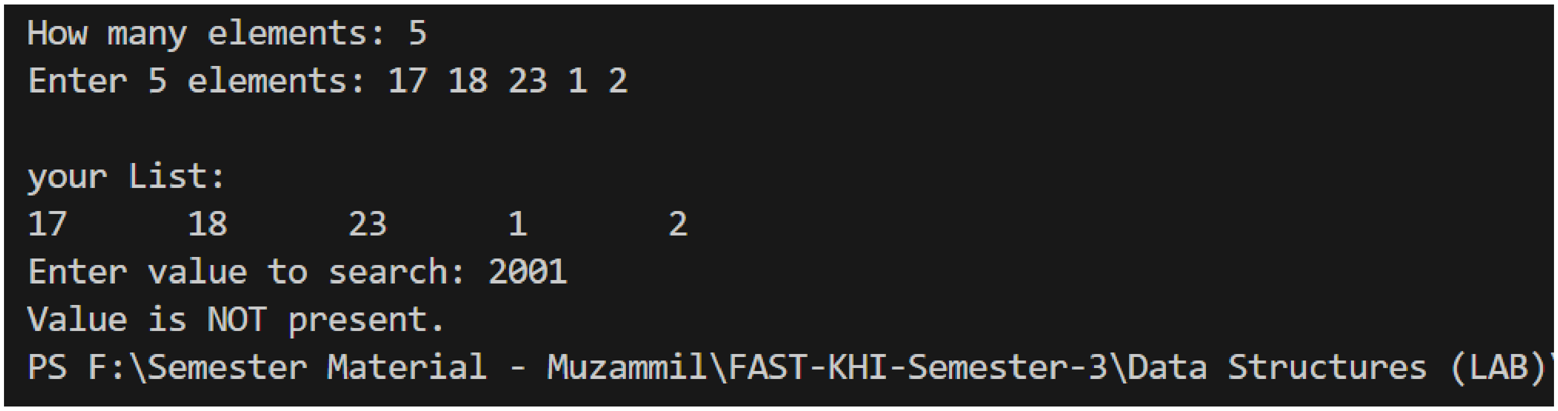
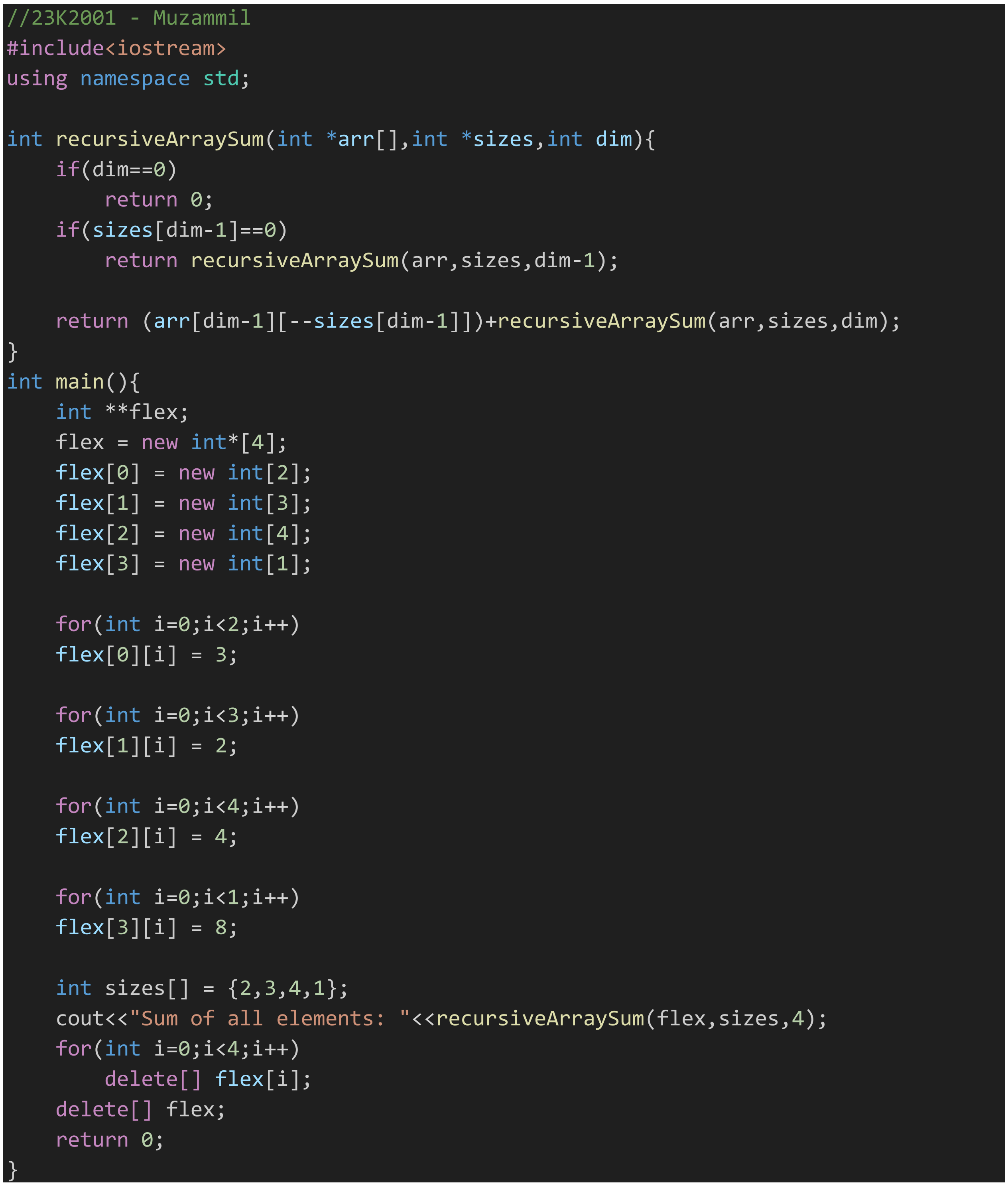
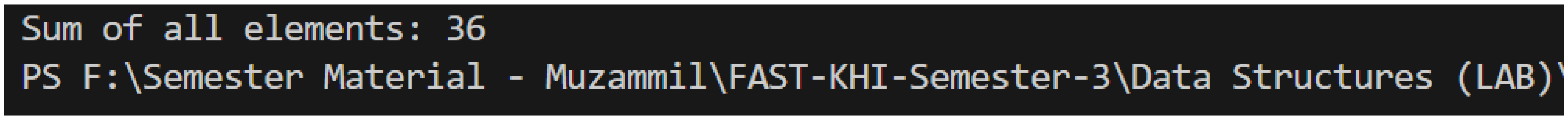



```
How many elements: 5
Enter 5 elements: 17 18 23 1 2

your List:
17      18      23      1       2
Enter value to search: 2001
Value is NOT present.
PS F:\Semester Material - Muzammil\FAST-KHI-Semester-3\Data Structures (LAB)
```

Q5:



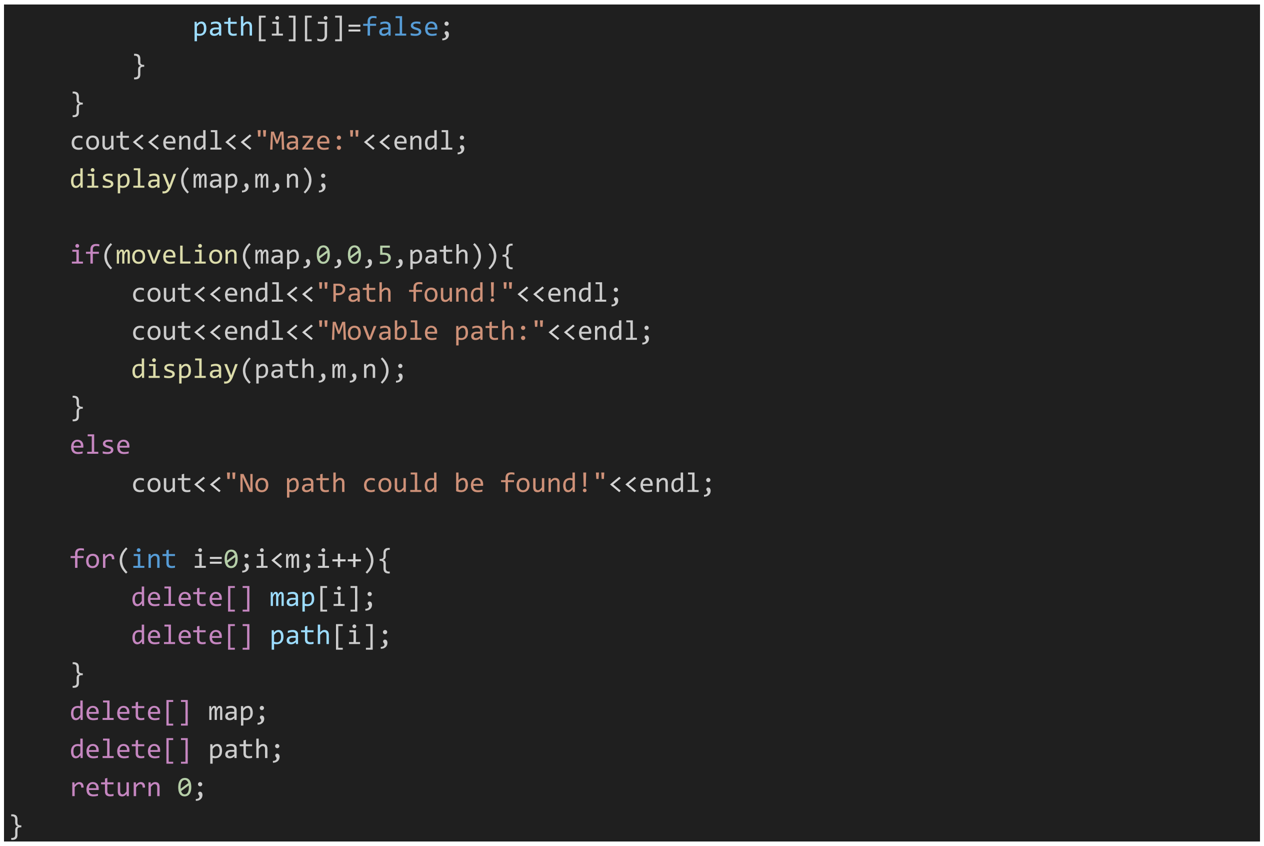
```cpp
//23K2001 - Muzammil
#include<iostream>
using namespace std;

int recursiveArraySum(int *arr[],int *sizes,int dim){
    if(dim==0)
        return 0;
    if(sizes[dim-1]==0)
        return recursiveArraySum(arr,sizes,dim-1);

    return (arr[dim-1][--sizes[dim-1]])+recursiveArraySum(arr,sizes,dim);
}
int main(){
    int **flex;
    flex = new int*[4];
    flex[0] = new int[2];
    flex[1] = new int[3];
    flex[2] = new int[4];
    flex[3] = new int[1];

    for(int i=0;i<2;i++)
    flex[0][i] = 3;

    for(int i=0;i<3;i++)
    flex[1][i] = 2;

    for(int i=0;i<4;i++)
    flex[2][i] = 4;

    for(int i=0;i<1;i++)
    flex[3][i] = 8;

    int sizes[] = {2,3,4,1};
    cout<<"Sum of all elements: "<<recursiveArraySum(flex,sizes,4);
    for(int i=0;i<4;i++)
        delete[] flex[i];
    delete[] flex;
    return 0;
}
```



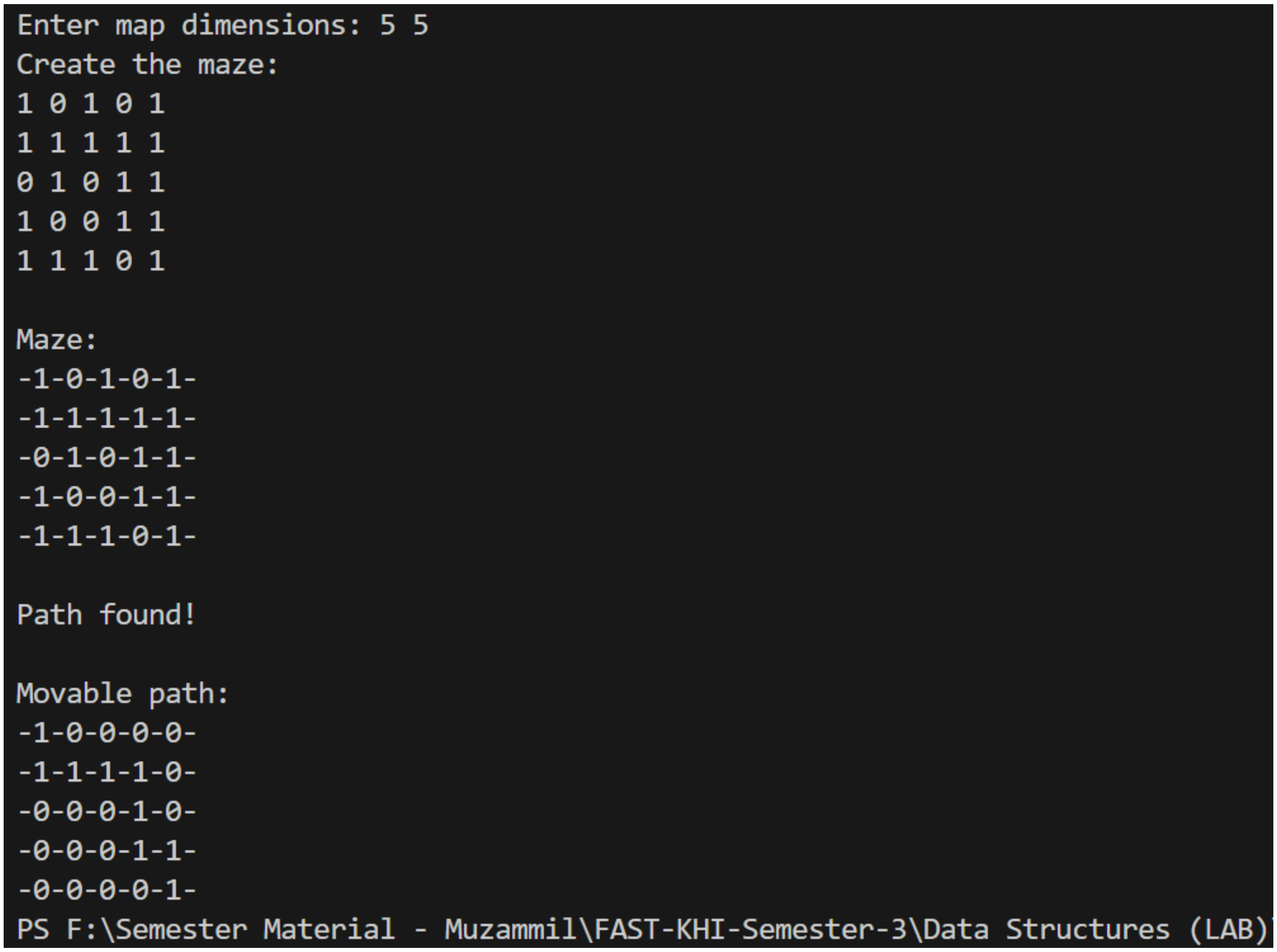
```
Sum of all elements: 36
PS F:\Semester Material - Muzammil\FAST-KHI-Semester-3\Data Structures (LAB)
```

Q6:

```cpp
//23K2001 - Muzammil
#include<iostream>
using namespace std;

bool moveLion(bool *maze[],int x,int y,int s,bool **sol){
    if(x==s-1 && y==s-1){
        sol[x][y]=1;
        return true;
    }
    if((x<s && y<s && maze[x][y]==1) ? true : false){
        sol[x][y]=1;
        if(moveLion(maze,x+1,y,s,sol))
            return true;
        if(moveLion(maze, x, y+1, s, sol))
            return true;
    }
    sol[x][y]=0;
    return false;
}
void display(bool **arr,int r,int c){
    for(int i=0;i<r;i++){
        cout<<"-";
        for(int j=0;j<c;j++)
            cout<<arr[i][j]<<"-";
        cout<<endl;
    }
}
int main(){
    bool **map, **path;
    int m,n;
    cout<<"Enter map dimensions: ";
    cin>>m>>n;
    map = new bool*[m];
    path = new bool*[m];
    for(int i=0;i<m;i++){
        map[i] = new bool[n];
        path[i] = new bool[n];
    }
    cout<<"Create the maze:"<<endl;
    for(int i=0;i<m;i++){
        for(int j=0;j<n;j++){
            cin>>map[i][j];
```



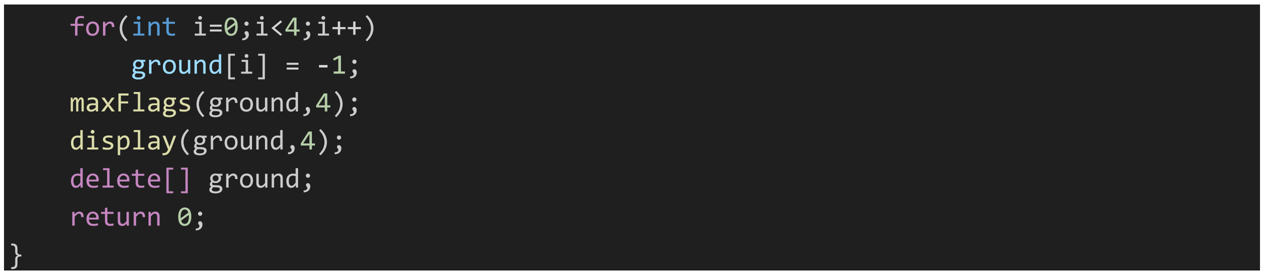
```cpp
            path[i][j]=false;
        }
    }
    cout<<endl<<"Maze:"<<endl;
    display(map,m,n);

    if(moveLion(map,0,0,5,path)){
        cout<<endl<<"Path found!"<<endl;
        cout<<endl<<"Movable path:"<<endl;
        display(path,m,n);
    }
    else
        cout<<"No path could be found!"<<endl;

    for(int i=0;i<m;i++){
        delete[] map[i];
        delete[] path[i];
    }
    delete[] map;
    delete[] path;
    return 0;
}
```



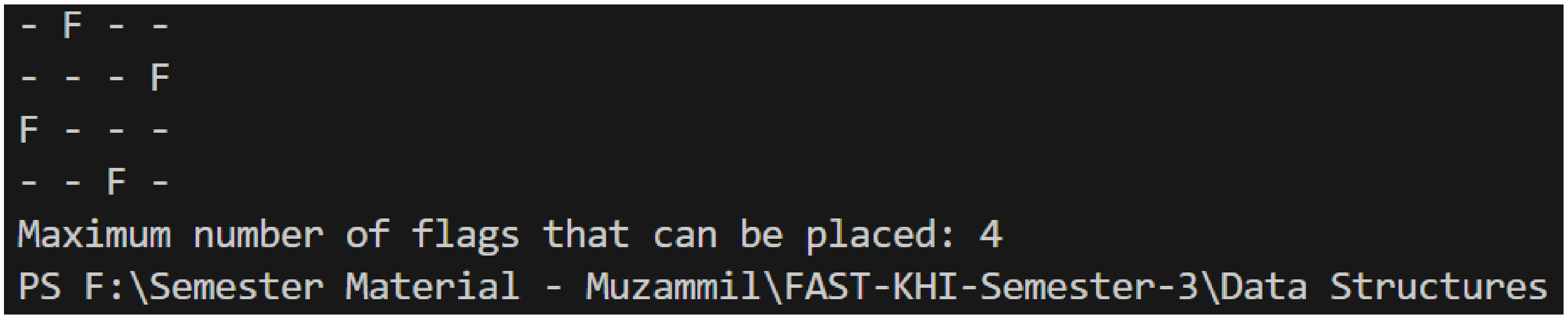
```
Enter map dimensions: 5 5
Create the maze:
1 0 1 0 1
1 1 1 1 1
0 1 0 1 1
1 0 0 1 1
1 1 1 0 1

Maze:
-1-0-1-0-1-
-1-1-1-1-1-
-0-1-0-1-1-
-1-0-0-1-1-
-1-1-1-0-1-

Path found!

Movable path:
-1-0-0-0-0-
-1-1-1-1-0-
-0-0-0-1-0-
-0-0-0-1-1-
-0-0-0-0-1-
PS F:\Semester Material - Muzammil\FAST-KHI-Semester-3\Data Structures (LAB)
```

Q7:

```cpp
//23K2001 - Muzammil
#include<iostream>
using namespace std;

bool canPlace(int board[],int row,int col){
    for(int i=0; i<row; i++){
        if(board[i]==col || abs(board[i]-col)==abs(i-row))
            return false;
    }
    return true;
}
bool maxFlags(int board[],int n,int row=0){
    if(row==n)
        return true;

    for(int col=0;col<n;col++){
        if(canPlace(board,row,col)){
            board[row] = col;
            if(maxFlags(board,n,row+1))
                return true;

            board[row] = -1;
        }
    }
    return false;
}
void display(int *arr,int n){
    int f=0;
    for(int i=0;i<n;i++){
        for(int j=0;j<n;j++){
            if(arr[i]==j){
                cout<<"F ";
                f++; }
            else
                cout<<"- ";
        }
        cout<<endl;
    }
    cout<<"Maximum number of flags that can be placed: "<<f<<endl;
}
int main(){
    int* ground=new int[4];
```



```
    for(int i=0;i<4;i++)
        ground[i] = -1;
    maxFlags(ground,4);
    display(ground,4);
    delete[] ground;
    return 0;
}
```



```
- F - -
- - - F
F - - -
- - F -
Maximum number of flags that can be placed: 4
PS F:\Semester Material - Muzammil\FAST-KHI-Semester-3\Data Structures
```