Program 14:

(a) Write a program to implement the SCAN elevator disk scheduling algorithm. The program should give detail about each disk movement from starting head position (input from the user) and calculate average head movement.

(b) Write a program to implement the LOOK elevator disk scheduling algorithm. The program should give detail about each disk movement from starting head position (input from the user) and calculate average head movement.

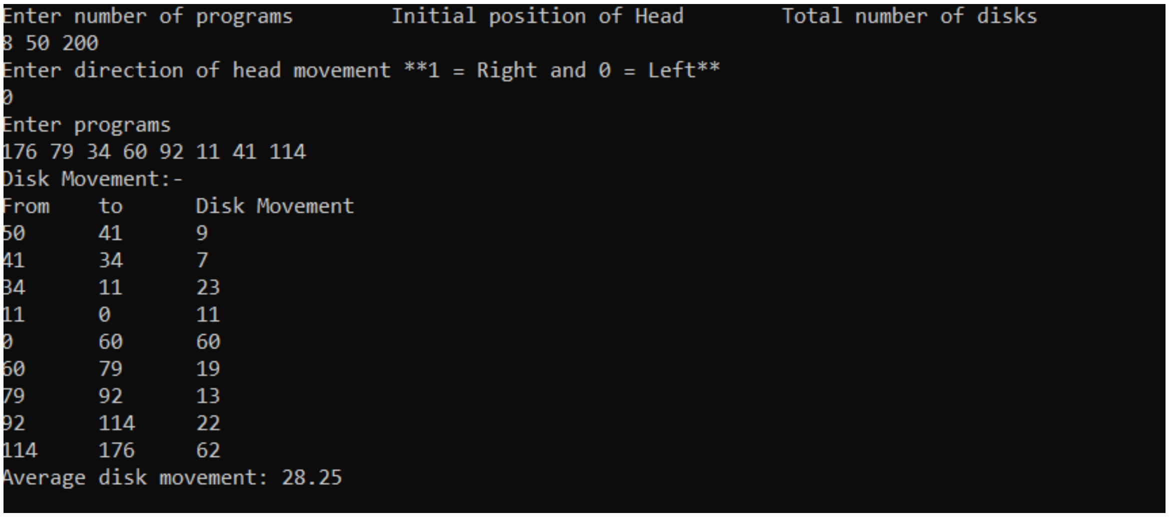
Answer:

(a) <u>Source code:</u>

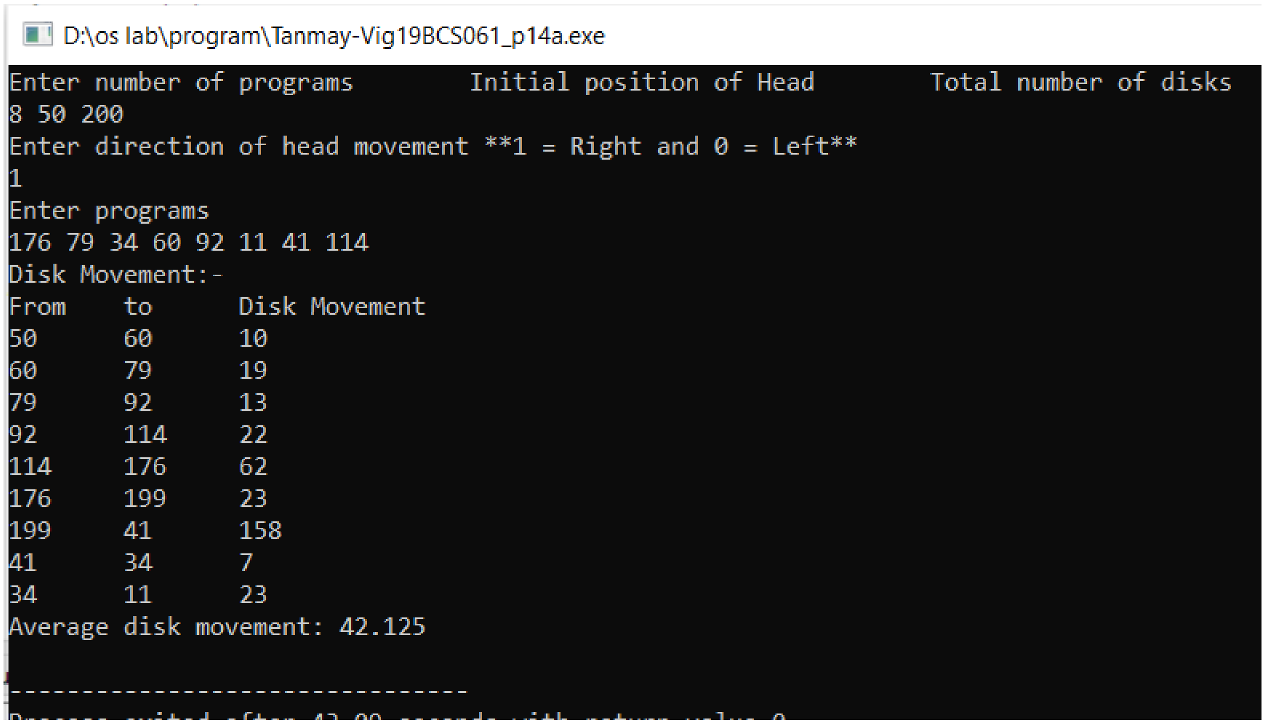
```
#include <iostream>
#include <vector>
#include <cmath>
#include <algorithm>


using namespace std;
int search_(vector<int> programs,int lo, int hi, int x){// find point where arr[mid]<=head && arr[mid+1]>head
if(lo<hi){
   int mid=(hi-lo)/2;
   if(programs[mid]==x){
        return mid;
    }else if(programs[mid]<x){
        if((mid+1)==(int)programs.size() || programs[mid+1]>x) return mid;
        else search_(programs,lo,mid-1,x);
    }else{
        if((mid)==0 || programs[mid-1]<x) return mid;
        else search_(programs,mid+1,hi,x);
    }
}
return -1;
}

int piv(vector<int> &arr, int lo, int hi){
    int i=lo, p=arr[hi];
    for (int j=lo; j<=hi;j++){
        if(arr[j]<p){
            swap(arr[j],arr[i]);
            i+=1;
        }
    }
    swap(arr[hi],arr[i]);
    return i;
}

void sort_(vector<int> &arr,int lo, int hi){
    if(lo<hi){
        int p=piv(arr,lo,hi);
        sort_(arr,lo,p-1);
        sort_(arr,p+1,hi);
    }
}

int left_move(vector<int> programs,int ind,int pos){
    int sum=0;
    for(int i=ind;i>=0;i--){
        sum+=abs(programs[i]-pos);
        cout<<pos<<"\t"<<programs[i]<<"\t"<<abs(programs[i]-pos)<<endl;
        pos=programs[i];
    }
    return sum;
}

int right_move(vector<int> programs, int ind, int pos){
    int sum=0;
    for(int i=ind+1;i<programs.size();i++){
        sum+=abs(programs[i]-pos);
        cout<<pos<<"\t"<<programs[i]<<"\t"<<abs(programs[i]-pos)<<endl;
        pos=programs[i];
    }
    return sum;
```

```
}

int algo(vector<int> programs,int pos,int dir,int disk){
    int sum=0,diff, n=(int)programs.size();

    cout<<"Disk Movement:-"<<endl;
    cout<<"From\tto\tDisk Movement"<<endl;

    sort_(programs,0,n-1); //sorting
    int ind=search_(programs,0,n-1,pos); //searching nearest index(0 based)
    if(programs[ind]>pos) ind-=1;

    if(dir==0){
        // for left side
        sum+=left_move(programs,ind, pos);
        //to zero
        sum+=programs[0];
        cout<<programs[0]<<"\t"<<0<<"\t"<<programs[0]<<endl;

        //for right
        sum+=right_move(programs,ind,0);
    }else{
        // for left side
        sum+=right_move(programs,ind, pos);
        //to end
        sum+=(disk-1-programs[n-1]);
        cout<<programs[n-1]<<"\t"<<disk-1<<"\t"<<disk-1-programs[n-1]<<endl;

        //for right
        sum+=left_move(programs,ind,disk-1);
    }
    return sum;
}
int main()
{
    int n,pos,dir,disk;
    cout << "Enter number of programs\tInitial position of Head\tTotal number of disks"<<endl;
    cin>>n>>pos>>disk;
    cout << "Enter direction of head movement **1 = Right and 0 = Left**"<<endl;
    cin>>dir;
    vector<int> programs(n);
    cout<<"Enter programs"<<endl;
    for (int i=0; i<n;i++){
        cin>>programs[i];
    }
    int total_movements=algo(programs,pos,dir,disk);
    total_movements=(float)total_movements;
    cout<<"Average disk movement: "<<total_movements/(float)n<<endl;
    return 0;
}
```

Output:



```
Enter number of programs        Initial position of Head        Total number of disks
8 50 200
Enter direction of head movement **1 = Right and 0 = Left**
0
Enter programs
176 79 34 60 92 11 41 114
Disk Movement:-
From    to      Disk Movement
50      41      9
41      34      7
34      11      23
11      0       11
0       60      60
60      79      19
79      92      13
92      114     22
114     176     62
Average disk movement: 28.25
```



D:\os lab\program\Tanmay-Vig19BCS061_p14a.exe

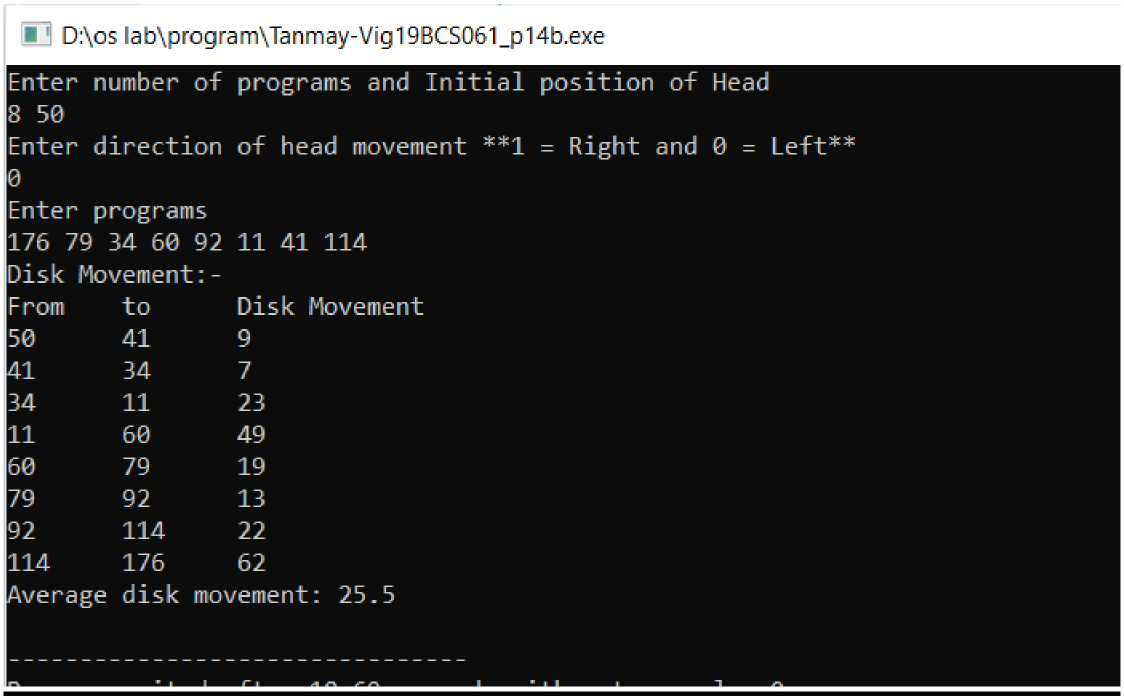
```
Enter number of programs        Initial position of Head        Total number of disks
8 50 200
Enter direction of head movement **1 = Right and 0 = Left**
1
Enter programs
176 79 34 60 92 11 41 114
Disk Movement:-
From    to      Disk Movement
50      60      10
60      79      19
79      92      13
92      114     22
114     176     62
176     199     23
199     41      158
41      34      7
34      11      23
Average disk movement: 42.125


--------------------------------
Process exited after 43.09 seconds with return value 0
```

(b) Source code:

```
#include <iostream>

#include <vector>

#include <cmath>

#include <algorithm>

using namespace std;
```

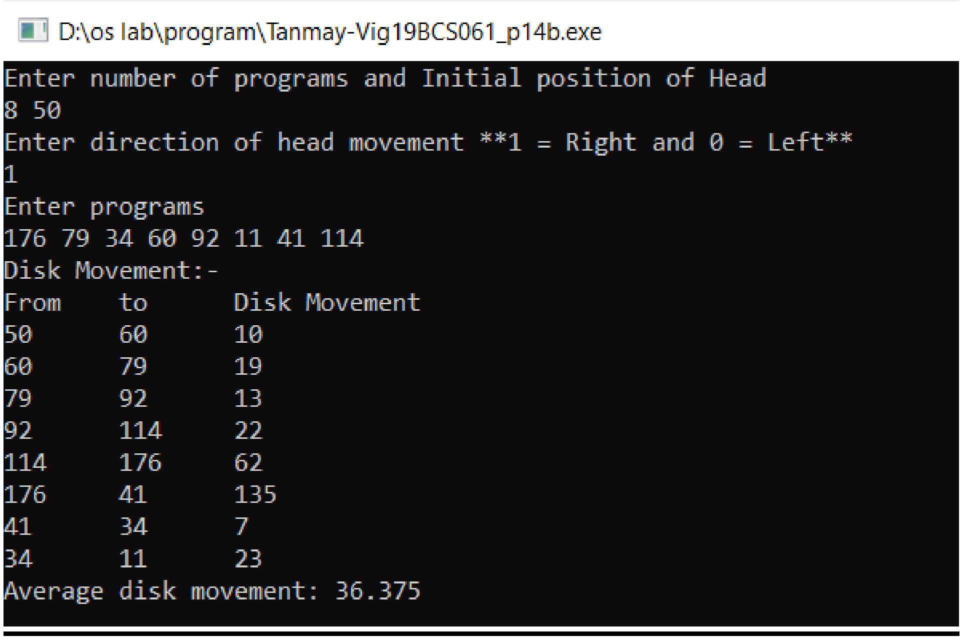
```
int search_(vector<int> programs,int lo, int hi, int x){// find point where arr[mid]<=head && arr[mid+1]>head
if(lo<hi){
    int mid=(hi-lo)/2;
    if(programs[mid]==x){
        return mid;
    }else if(programs[mid]<x){
        if((mid+1)==(int)programs.size() || programs[mid+1]>x) return mid;
        else search_(programs,lo,mid-1,x);
    }else{
        if((mid)==0 || programs[mid-1]<x) return mid;
        else search_(programs,mid+1,hi,x);
    }
}
return -1;
}


int piv(vector<int> &arr, int lo, int hi){
    int i=lo, p=arr[hi];
    for (int j=lo; j<=hi;j++){
        if(arr[j]<p){
            swap(arr[j],arr[i]);
            i+=1;
        }
    }
    swap(arr[hi],arr[i]);
    return i;

}


void sort_(vector<int> &arr,int lo, int hi){

    if(lo<hi){

        int p=piv(arr,lo,hi);

        sort_(arr,lo,p-1);

        sort_(arr,p+1,hi);

    }

}


int left_move(vector<int> programs,int ind,int pos){

    int sum=0;

    for(int i=ind;i>=0;i--){

        sum+=abs(programs[i]-pos);

        cout<<pos<<"\t"<<programs[i]<<"\t"<<abs(programs[i]-pos)<<endl;

        pos=programs[i];

    }

    return sum;

}

int right_move(vector<int> programs, int ind, int pos){

    int sum=0;

    for(int i=ind+1;i<programs.size();i++){

        sum+=abs(programs[i]-pos);

        cout<<pos<<"\t"<<programs[i]<<"\t"<<abs(programs[i]-pos)<<endl;
        pos=programs[i];
    }
    return sum;
}


int algo(vector<int> programs,int pos, int dir){
    int sum=0,diff, n=(int)programs.size();


    cout<<"Disk Movement:-"<<endl;
    cout<<"From\tto\tDisk Movement"<<endl;


    sort_(programs,0,n-1); //sorting
    int ind=search_(programs,0,n-1,pos); //searching nearest index(0 based)
    if(programs[ind]>pos) ind-=1;


    if(dir==0){
        // for left side
        sum += left_move(programs,ind,pos);
        //for right
        sum+= right_move(programs,ind,programs[0]);
    }else{
        //for right
        sum+= right_move(programs,ind,pos);
        // for left side
        sum += left_move(programs,ind,programs[n-1]);
    }
    return sum;
}
int main()
{
    int n,pos,dir;
    cout << "Enter number of programs and Initial position of Head"<<endl;
    cin>>n>>pos;
    cout << "Enter direction of head movement **1 = Right and 0 = Left**"<<endl;
    cin>>dir;
    vector<int> programs(n);
    cout<<"Enter programs"<<endl;
    for (int i=0; i<n;i++){
        cin>>programs[i];
    }
    int total_movements=algo(programs,pos,dir);
    total_movements=(float)total_movements;
    cout<<"Average disk movement: "<<total_movements/(float)n<<endl;
    return 0;
}
```

Output:



D:\os lab\program\Tanmay-Vig19BCS061_p14b.exe

```
Enter number of programs and Initial position of Head
8 50
Enter direction of head movement **1 = Right and 0 = Left**
0
Enter programs
176 79 34 60 92 11 41 114
Disk Movement:-
From    to      Disk Movement
50      41      9
41      34      7
34      11      23
11      60      49
60      79      19
79      92      13
92      114     22
114     176     62
Average disk movement: 25.5

--------------------------------
```



D:\os lab\program\Tanmay-Vig19BCS061_p14b.exe

```
Enter number of programs and Initial position of Head
8 50
Enter direction of head movement **1 = Right and 0 = Left**
1
Enter programs
176 79 34 60 92 11 41 114
Disk Movement:-
From    to      Disk Movement
50      60      10
60      79      19
79      92      13
92      114     22
114     176     62
176     41      135
41      34      7
34      11      23
Average disk movement: 36.375
```