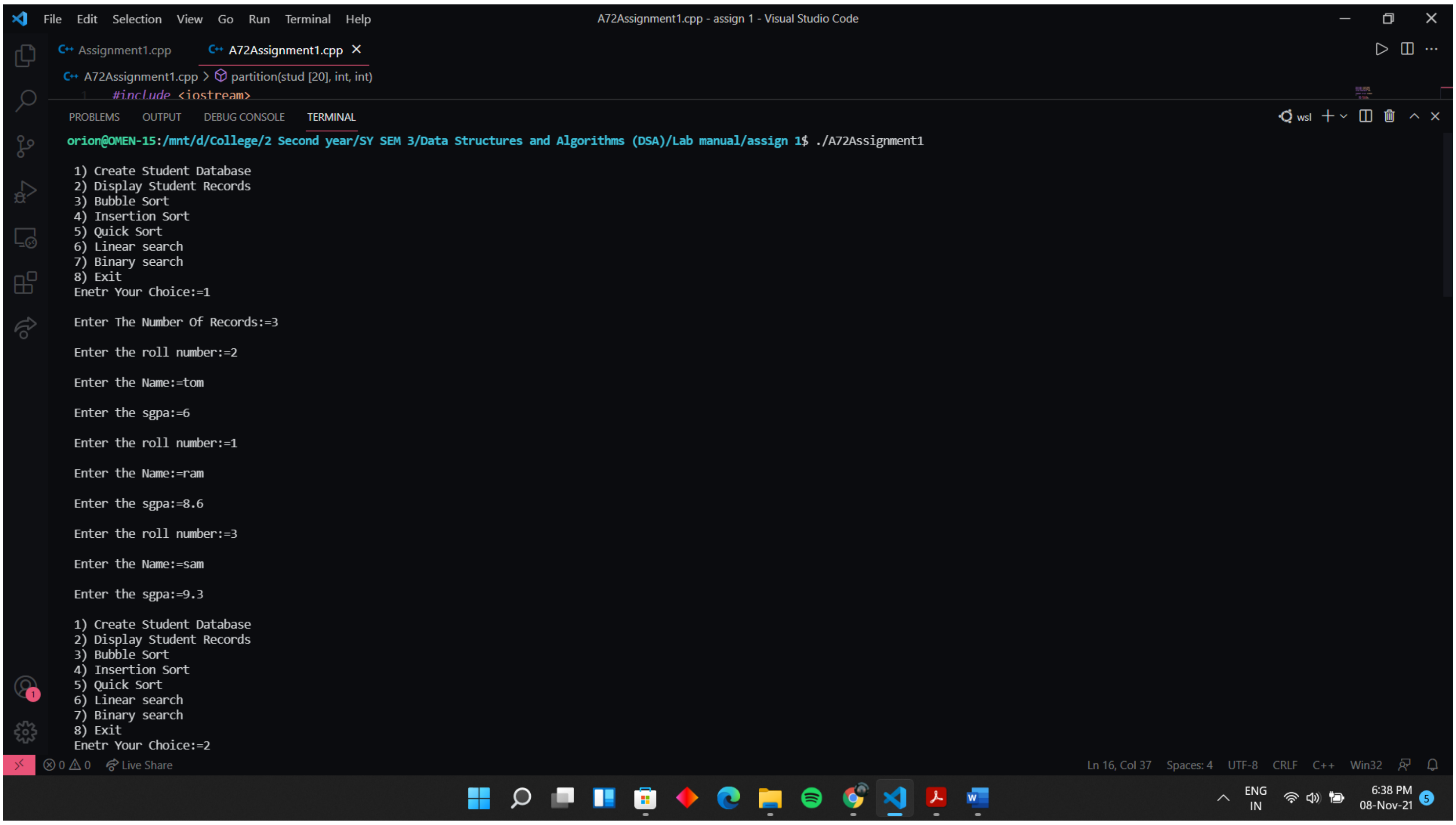
Program :

```
#include <iostream>
#include <string.h>
using namespace std;

typedef struct student
{
    int roll_no;
    char name[20];
    float sgpa;
} stud;
void create(stud s[20], int n);
void display(stud s[20], int n);
void bubble_sort(stud s[20], int n);
void insertionSort(stud s[20], int n);
void quick_sort(stud s[20], int, int);
int partition(stud s[20], int, int);
void search(stud s[20], int n, int key);
int bsearch(stud s[20], char x[20], int low, int high);

int main()
{
    stud s[20];
    int ch, n, key, result;
    char x[20];
    do
    {
        cout << "\n 1) Create Student Database ";
        cout << "\n 2) Display Student Records ";
        cout << "\n 3) Bubble Sort ";
        cout << "\n 4) Insertion Sort ";
        cout << "\n 5) Quick Sort ";
        cout << "\n 6) Linear search ";
        cout << "\n 7) Binary search ";
        cout << "\n 8) Exit ";
        cout << "\n Enetr Your Choice:=";
        cin >> ch;
        switch (ch)
        {
        case 1:
            cout << "\n Enter The Number Of Records:=";
            cin >> n;
            create(s, n);
            break;
        case 2:
            display(s, n);
            break;
        case 3:
            bubble_sort(s, n);
            break;
        case 4:
            insertionSort(s, n);
            break;
        case 5:
            quick_sort(s, 0, n - 1);
            cout << "\n"
                 << "\t"
                 << "Roll No"
                 << "\t"
                 << " Name"
                 << "\t"
                 << "sgpa";
            for (int i = n - 1; i >= n - 10; i--)
            {
                cout << "\n";
                cout << "\t " << s[i].roll_no << "\t " << s[i].name << "\t " << s[i].sgpa;
            }
            break;
        case 6:
            cout << "\n Enter the sgpa which u want to search:=";
            cin >> key;
            search(s, n, key);
            break;
        case 7:
            cout << "\n Enter the name of student which u want to search:=";
            cin >> x;
            insertionSort(s, n);
            result = bsearch(s, x, 0, (n - 1));
            if (result == -1)
            {
                cout << " \n Student name you want to search for is not present ! \n";
            }
            else
            {
                cout << " \n The student is present :\t" << s[result].name;
            }
            break;
        case 8:
            return 0;
        default:
            cout << "\n Invalid choice !! Please enter your choice again." << endl;
        }
    } while (ch != 8);
}
void create(stud s[20], int n)
{
    int i;
    for (i = 0; i < n; i++)
    {
        cout << "\n Enter the roll number:=";
        cin >> s[i].roll_no;
        cout << "\n Enter the Name:=";
        cin >> s[i].name;
        cout << "\n Enter the sgpa:=";
        cin >> s[i].sgpa;
    }
}
void display(stud s[20], int n)
{
    int i;
    cout << "\n"
         << "\t"
         << "Roll No"
         << "\t"
         << " Name"
         << "\t"
         << "sgpa";
    for (i = 0; i < n; i++)
    {
        cout << "\n";
        cout << "\t " << s[i].roll_no << "\t " << s[i].name << "\t " << s[i].sgpa;
    }
}
//bubble sort to sort in ascending order on roll number void bubble_sort(stud s[20],int n)
void bubble_sort(stud s[20], int n)
{
    int i, j;
    stud temp;
    {
        for (i = 1; i < n; i++)
        {
            for (j = 0; j < n - i; j++)
            {
                if (s[j].roll_no > s[j + 1].roll_no)
                {
                    temp = s[j];
                    s[j] = s[j + 1];
                    s[j + 1] = temp;
                }
            }
        }
    }
}

// insertion sort to sort on names in ascending order void insertionSort(stud s[20], int n)
void insertionSort(stud s[20], int n)
{
    int i, j;
    stud key;
    for (i = 1; i < n; i++)
    {
        key = s[i];
        j = i - 1;
        /* Move elements of arr[0..i-1], that are greater than key, to one position ahead of
their current position */
        while (j >= 0 && strcmp(s[j].name, key.name) > 0)
        {
            s[j + 1] = s[j];
            j = j - 1;
        }
        s[j + 1] = key;
    }
}
//Quick sort to sort on sgpa
void quick_sort(stud s[20], int l, int u)
```

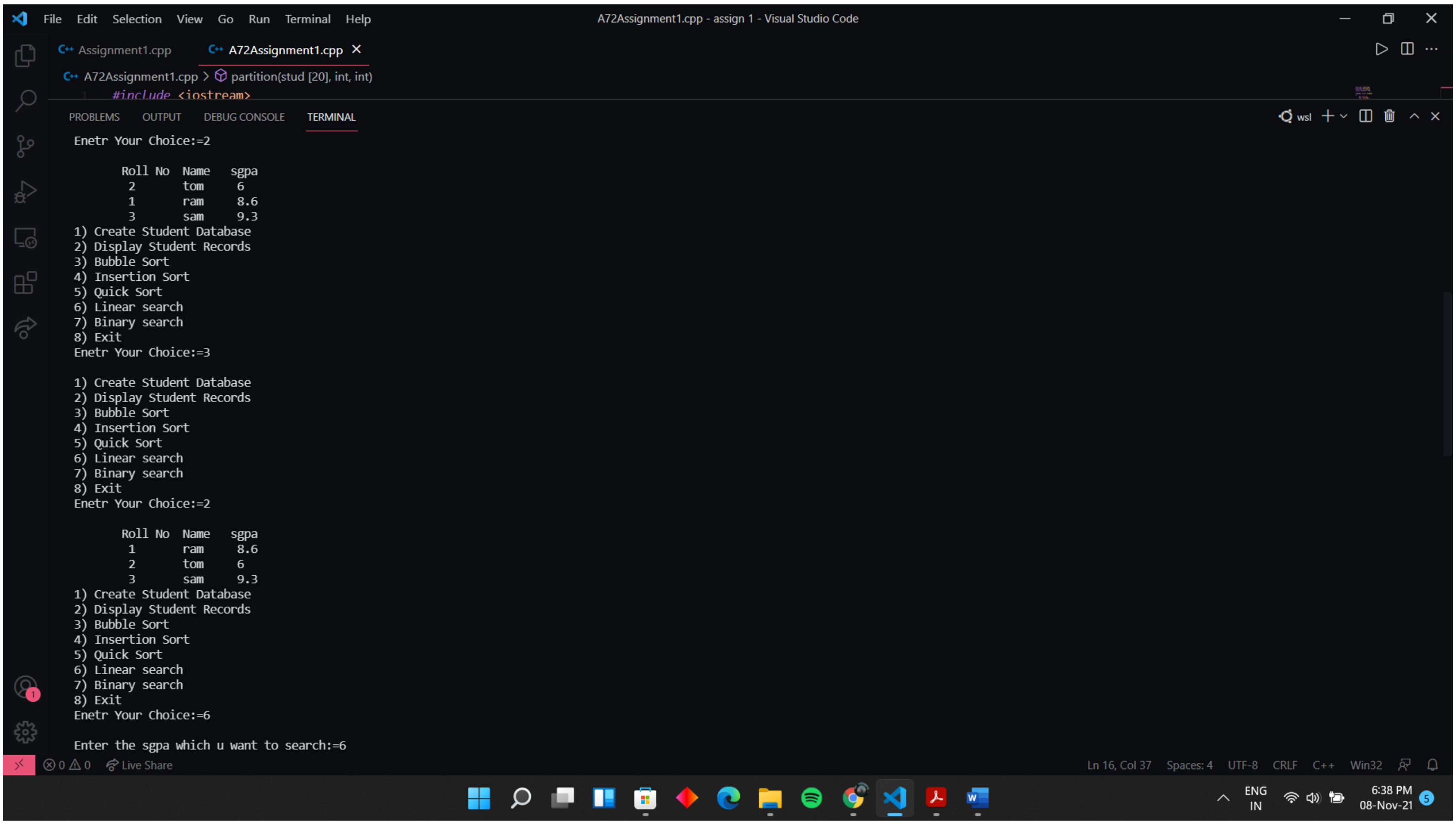
```
{
    int j;
    if (l < u)
    {
        j = partition(s, l, u);
        quick_sort(s, l, j - 1);
        quick_sort(s, j + 1, u);
    }
}
int partition(stud s[20], int l, int u)
{
    int i, j;
    stud temp, v;
    v = s[l];
    i = l;
    j = u + 1;
    do
    {
        do
            i++;
        while (s[i].sgpa < v.sgpa && i <= u);
        do
            j--;
        while (v.sgpa < s[j].sgpa);
        if (i < j)
        {
            temp = s[i];
            s[i] = s[j];
            s[j] = temp;
        }
    } while (i < j);
    s[l] = s[j];
    s[j] = v;
    return (j);

    // s[l] = s[j];
    // s[j] = v;
    // return (j);
}

// linear search for sgpa if more than one student having same sgpa print all of them
void search(stud s[20], int n, int key)
{
    int i;
    cout << "\n"
         << "\t"
         << "Roll No"
         << "\t"
         << " Name"
         << "\t"
         << "sgpa";
    for (i = 0; i < n; i++)
    {
        // if (key == s[i].sgpa)
        if (s[i].sgpa == key)
        {
            cout << "\n\t " << s[i].roll_no << "\t " << s[i].name << "\t " << s[i].sgpa;
        }
    }
}
int bsearch(stud s[20], char x[20], int low, int high)
{
    int mid;
    while (low <= high)
    {
        mid = (low + high) / 2;
        if (strcmp(x, s[mid].name) == 0)
        {
            return mid;
        }
        else if (strcmp(x, s[mid].name) < 0)
        {
            high = mid - 1;
        }
        else
        {
            low = mid + 1;
        }
    }
    return 0;
}
```

Output:



File Edit Selection View Go Run Terminal Help
A72Assignment1.cpp - assign 1 - Visual Studio Code
Assignment1.cpp
A72Assignment1.cpp
A72Assignment1.cpp > partition(stud [20], int, int)
#include <iostream>
PROBLEMS OUTPUT DEBUG CONSOLE TERMINAL
wsl
Ln 16, Col 37 Spaces: 4 UTF-8 CRLF C++ Win32
Live Share
ENG IN
6:38 PM 08-Nov-21

```
orion@OMEN-15:/mnt/d/College/2 Second year/SY SEM 3/Data Structures and Algorithms (DSA)/Lab manual/assign 1$ ./A72Assignment1

 1) Create Student Database
 2) Display Student Records
 3) Bubble Sort
 4) Insertion Sort
 5) Quick Sort
 6) Linear search
 7) Binary search
 8) Exit
 Enetr Your Choice:=1

 Enter The Number Of Records:=3

 Enter the roll number:=2

 Enter the Name:=tom

 Enter the sgpa:=6

 Enter the roll number:=1

 Enter the Name:=ram

 Enter the sgpa:=8.6

 Enter the roll number:=3

 Enter the Name:=sam

 Enter the sgpa:=9.3

 1) Create Student Database
 2) Display Student Records
 3) Bubble Sort
 4) Insertion Sort
 5) Quick Sort
 6) Linear search
 7) Binary search
 8) Exit
 Enetr Your Choice:=2
```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wsl
0 0 Live Share
Ln 16, Col 37 Spaces: 4 UTF-8 CRLF C++ Win32
ENG IN
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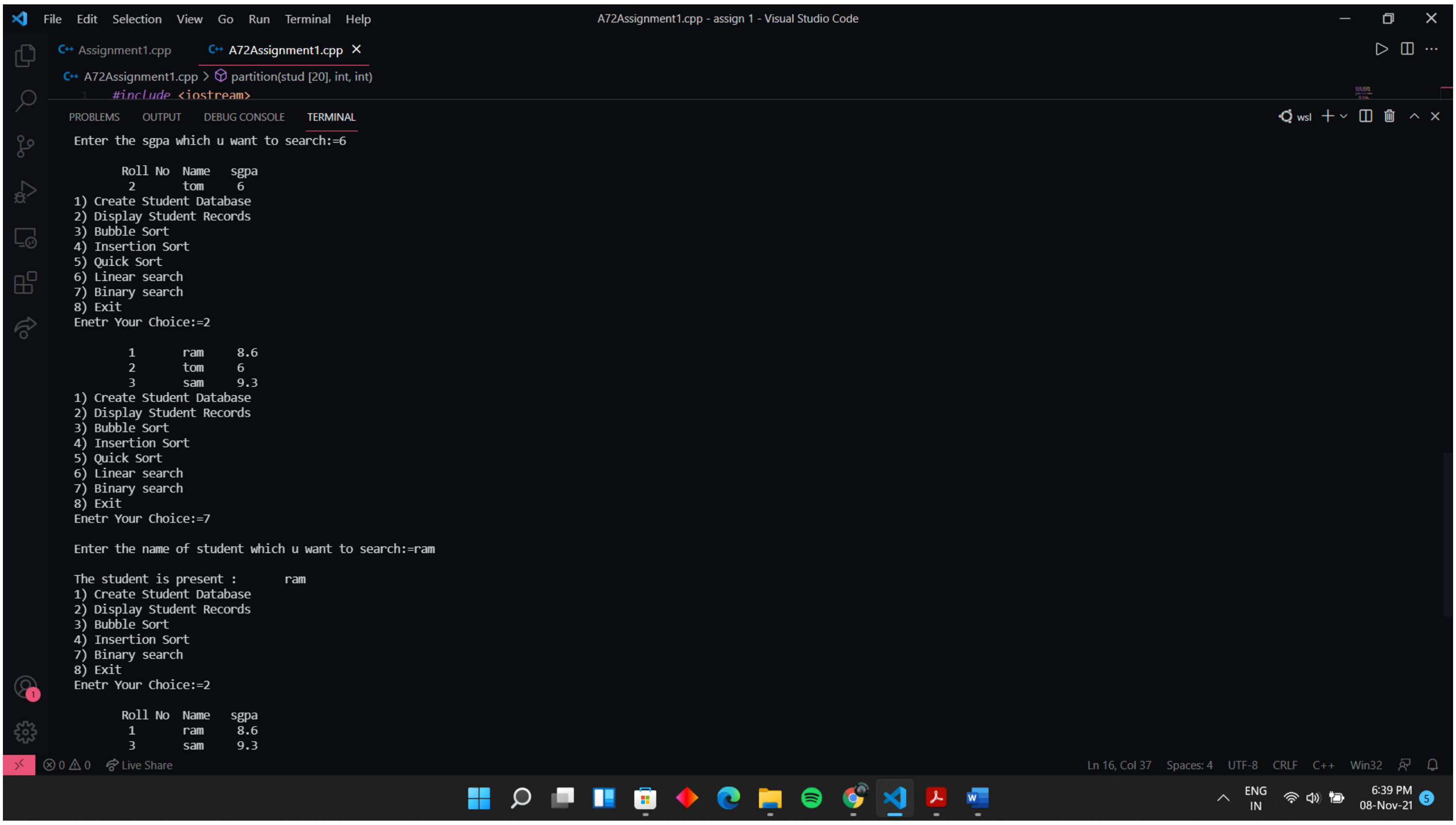
```
Enetr Your Choice:=2

       Roll No  Name   sgpa
        2       tom     6
        1       ram     8.6
        3       sam     9.3
1) Create Student Database
2) Display Student Records
3) Bubble Sort
4) Insertion Sort
5) Quick Sort
6) Linear search
7) Binary search
8) Exit
Enetr Your Choice:=3

1) Create Student Database
2) Display Student Records
3) Bubble Sort
4) Insertion Sort
5) Quick Sort
6) Linear search
7) Binary search
8) Exit
Enetr Your Choice:=2

       Roll No  Name   sgpa
        1       ram     8.6
        2       tom     6
        3       sam     9.3
1) Create Student Database
2) Display Student Records
3) Bubble Sort
4) Insertion Sort
5) Quick Sort
6) Linear search
7) Binary search
8) Exit
Enetr Your Choice:=6

Enter the sgpa which u want to search:=6
```


File Edit Selection View Go Run Terminal Help
A72Assignment1.cpp - assign 1 - Visual Studio Code
Assignment1.cpp
A72Assignment1.cpp
A72Assignment1.cpp > partition(stud [20], int, int)
#include <iostream>
PROBLEMS OUTPUT DEBUG CONSOLE TERMINAL
wsl
0 0 Live Share
Ln 16, Col 37 Spaces: 4 UTF-8 CRLF C++ Win32
ENG IN
6:39 PM 08-Nov-21

```
Enter the sgpa which u want to search:=6

       Roll No  Name   sgpa
        2       tom     6
1) Create Student Database
2) Display Student Records
3) Bubble Sort
4) Insertion Sort
5) Quick Sort
6) Linear search
7) Binary search
8) Exit
Enetr Your Choice:=2

        1       ram     8.6
        2       tom     6
        3       sam     9.3
1) Create Student Database
2) Display Student Records
3) Bubble Sort
4) Insertion Sort
5) Quick Sort
6) Linear search
7) Binary search
8) Exit
Enetr Your Choice:=7

Enter the name of student which u want to search:=ram

The student is present :        ram
1) Create Student Database
2) Display Student Records
3) Bubble Sort
4) Insertion Sort
7) Binary search
8) Exit
Enetr Your Choice:=2

       Roll No  Name   sgpa
        1       ram     8.6
        3       sam     9.3
```

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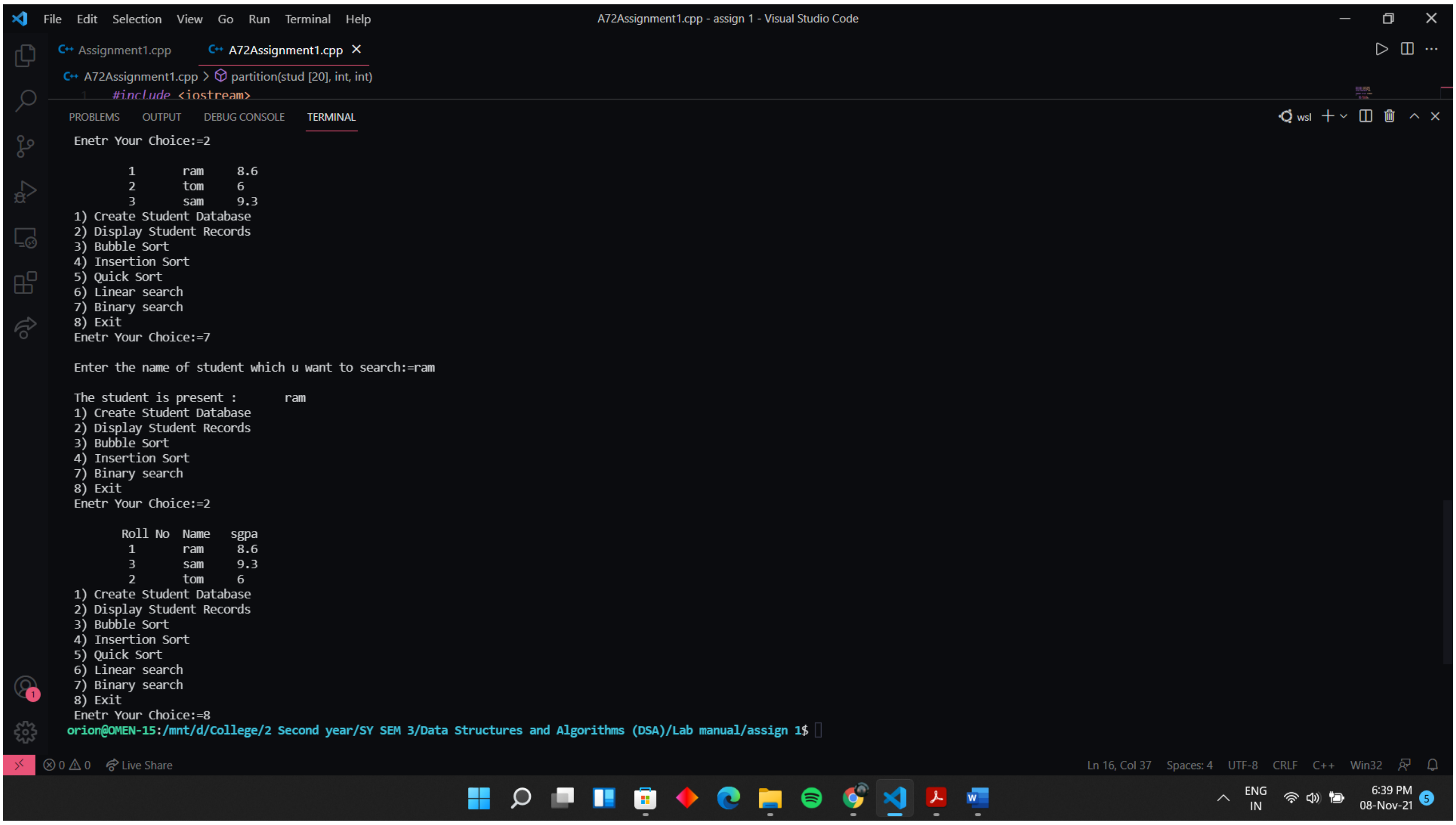

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A72Assignment1.cpp
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OUTPUT
DEBUG CONSOLE
TERMINAL
wsl
Live Share
Ln 16, Col 37 Spaces: 4 UTF-8 CRLF C++ Win32
ENG IN
6:39 PM 08-Nov-21

```
#include <iostream>
```

```
Enetr Your Choice:=2

        1       ram     8.6
        2       tom     6
        3       sam     9.3
1) Create Student Database
2) Display Student Records
3) Bubble Sort
4) Insertion Sort
5) Quick Sort
6) Linear search
7) Binary search
8) Exit
Enetr Your Choice:=7

Enter the name of student which u want to search:=ram

The student is present :        ram
1) Create Student Database
2) Display Student Records
3) Bubble Sort
4) Insertion Sort
7) Binary search
8) Exit
Enetr Your Choice:=2

       Roll No  Name    sgpa
        1       ram     8.6
        3       sam     9.3
        2       tom     6
1) Create Student Database
2) Display Student Records
3) Bubble Sort
4) Insertion Sort
5) Quick Sort
6) Linear search
7) Binary search
8) Exit
Enetr Your Choice:=8
orion@OMEN-15:/mnt/d/College/2 Second year/SY SEM 3/Data Structures and Algorithms (DSA)/Lab manual/assign 1$
```

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