UE20CS207 - DATA STRUCTURES AND ITS APPLICATIONS LABORATORY

30th August to 4th September 2021

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RECURSION(5 + 5 MARKS)

(i) Write a recursive function to search for a substring within a given string. Return True if substring is found, else return false
Ex: input :
string : This is our first DS Lab

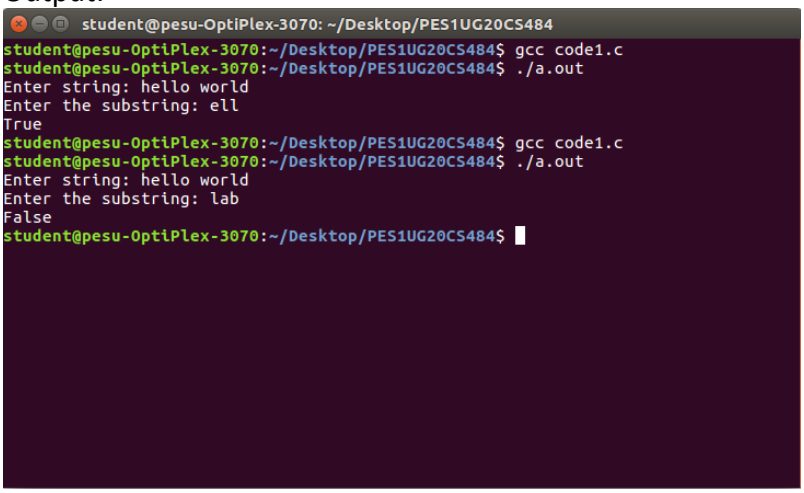
substring : DS output : True

string : This is our first DS Lab substring : DBMS
output : False

Input:

```c
#include<stdio.h>
#include<string.h>
#include<stdio_ext.h>

int substr(char*, char*);
int main()
{
        char str[100];
        char sub_str[100];
        printf("Enter string: ");
        scanf("%s",str);
        __fpurge(stdin);
        printf("Enter the substring: ");
        scanf("%s",sub_str);
        __fpurge(stdin);
        if(substr(str,sub_str))
                printf("True\n");
        else
                printf("False\n");
        return 0;
}

int substr(char *string,char *sub)
{
        int len_str=strlen(string);
        int len_sub=strlen(sub);

        if(len_str<len_sub)
                return 0;
        else
        if(strncmp(string,sub,len_sub)==0)
                return 1;
        else return substr(string+1,sub);

}
```

Output:



(ii) Write a recursive function to generate all permutations of a given text Ex : input : ABC, output : ABC,ACB, BAC, BCA, CAB, CBA

```c
#include <stdio.h>
#include <string.h>

void makePermutations(char*,char*);
void charPerm(char*,int,int);

int main()
{
    char str[100];
    printf("Enter the string \n");
    scanf("%s",str);
    printf("\n\n Pointer : Generate permutations of a given string :\n");
    int n = strlen(str);
    printf(" The permutations of the string are : \n");
    charPerm(str, 0, n-1);
     printf("\n\n");
    return 0;
}

void makePermutations(char *c1, char *c2)
{
    char tmp;
    tmp = *c1;
    *c1 = *c2;
    *c2 = tmp;
}

void charPerm(char *c, int start, int end)
{
   int i;
   if (start == end)
     printf("%s \n", c);
   else
   {
       for (i = start; i <= end; i++)
       {
          makePermutations((c+start), (c+i));
          charPerm(c, start+1, end);
          makePermutations((c+start), (c+i));
       }
   }
}
```

Output:

```
student@pesu-OptiPlex-3070: ~/Desktop/PES1UG20CS484
student@pesu-OptiPlex-3070:~/Desktop/PES1UG20CS484$ gcc perm.c
student@pesu-OptiPlex-3070:~/Desktop/PES1UG20CS484$ ./a.out
Enter the string
ABC


 Pointer : Generate permutations of a given string :
 The permutations of the string are :
ABC
ACB
BAC
BCA
CBA
CAB


student@pesu-OptiPlex-3070:~/Desktop/PES1UG20CS484$
```

STRUCTURE AND DYNAMIC MEMORY ALLOCATION (10 MARKS)

1). Write a C program to create a record for few students containing the student details as SRN, Name, semester, marks for 5 subjects. Each subject should have a code associated with it
a. Compute the class average marks in a particular subject.
b. Sort the students based on SRN.

Input:

```c
#include <stdio.h>
#include<stdlib.h>
#include<string.h>
struct details
{
    float marks[5];
    char subcode[5][10];
};
typedef struct details DET;
struct student  {
    char srn[14];
    char name[50];
    int sem;
    DET d;
};
typedef struct student STUD;
int main()
{
    STUD *s=(STUD*)malloc(sizeof(STUD));
    int c='Y';
    int i=0;
    char code[10];
    while(c=='Y')
    {
        printf("Enter the SRN: ");
        scanf("%s",(s+i)->srn);
        fflush(stdin);
        printf("Enter the Name: ");
        scanf("%s",(s+i)->name);
        fflush(stdin);
        printf("Enter the sem: ");
        scanf("%d",&((s+i)->sem));
        fflush(stdin);
        for(int j=0;j<5;j++)
        {
            printf("Enter the marks: ");
            scanf("%f",&((s+i)->d.marks[j]));

            printf("Enter the subject code: ");
            scanf("%s",((s+i)->d.subcode[j]));
            //printf("%s",(s+i)->d.subcode[j]);
            fflush(stdin);
        }
        printf("Do you wish to enter more data(Y/N): ");
        c=getchar();
        fflush(stdin);
        if(c=='Y')
        {
            i++;
            s=(STUD*)realloc(s,sizeof(STUD)*(i+1));
        }
    }
    printf("Enter the subject code you want average for: ");
    scanf("%s",code);
    fflush(stdin);
    float sum=0.0;
    int count=0;
    for(int j=0;j<=i;j++)
    {
        for(int k=0;k<5;k++)
        if(!strcmp((s+j)->d.subcode[k],code))
        {
            sum=sum+(s+j)->d.marks[k];
            count++;
        }

    }
    char t[100];
    printf("%f\n",(float)(sum/count));
    for(int j=0;j<i;j++)
    {
        for(int k=0;k<(i-j);k++)
        {
            if((strcmp((s+k)->srn,(s+k+1)->srn))>0)
            {
                strcpy(t,(s+k)->srn);
                strcpy((s+k)->srn,(s+k+1)->srn);
                strcpy((s+k+1)->srn,t);
            }
        }
    }
    printf("After sorting the students are: ");
    for(int j=0;j<=i;j++)
    {
        printf("%s\n",(s+j)->srn);
    }

    return 0;
}
```

Output:

```
Last login: Sat Sep 11 09:42:06 on ttys000
vanshikagoel@Vanshikas-MacBook-Air Lab1 % clang q3.c -o q3
vanshikagoel@Vanshikas-MacBook-Air Lab1 % ./q3
Enter the SRN: PES1UG01
Enter the Name: ABC NAME
Enter the sem: 3
Enter the marks: 78
Enter the subject code: UE1A
Enter the marks: 99
Enter the subject code: UE1B
Enter the marks: 87
Enter the subject code: UE1C
Enter the marks: 56
Enter the subject code: UE1D
Enter the marks: 77
Enter the subject code: UE1E
Do you wish to enter more data(Y/N): Y
Enter the SRN: PES1UG02
Enter the Name: XYZ NAME
Enter the sem: 3
Enter the marks: 79
Enter the subject code: 68
Enter the marks: UE1A
Enter the subject code: Enter the marks: 67
Enter the subject code: UE1C
Enter the marks: 90
Enter the subject code: UE1D
Enter the marks: 80
Enter the subject code: UE1E
Do you wish to enter more data(Y/N): Y
Enter the SRN: PES1UG03
Enter the Name: LMN NAME
Enter the sem: 3
Enter the marks: 78
Enter the subject code: UE1A
Enter the marks: 67
Enter the subject code: UE1B
Enter the marks: 45
Enter the subject code: UE1C
Enter the marks: 90
Enter the subject code: UE1D
Enter the marks: 69
Enter the subject code: UE1E
Do you wish to enter more data(Y/N): N
Enter the subject code you want average for: UE1C
66.333336
After sorting the students are: PES1UG01
PES1UG02
PES1UG03
vanshikagoel@Vanshikas-MacBook-Air Lab1 %
```

ASSIGNMENT : (10 MARKS)

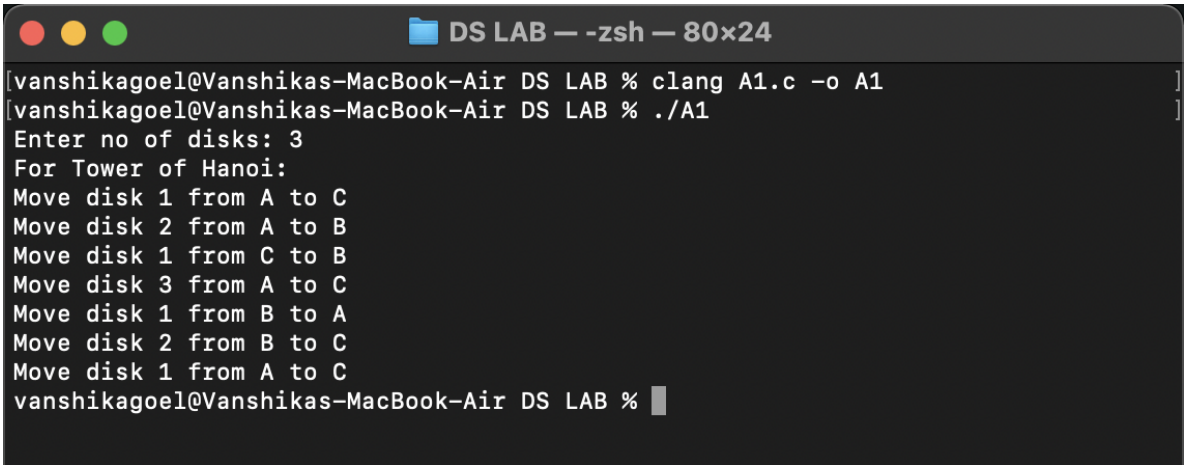
1. Perform Tower of Hanoi using recursion

Input:

```
#include <stdio.h>

void toh(int, char, char, char);

int main()

{

   int n;

   printf("Enter no of disks: ");

   scanf("%d", &n);
```

```
    printf("For Tower of Hanoi: \n");
    toh(n, 'A', 'C', 'B');
    return 0;
}
void toh(int n, char from, char to, char aux)
{
    if (n == 1)
    {
        printf("Move disk 1 from %c to %c \n", from, to);
        return;
    }
    toh(n - 1, from, aux, to);
    printf("Move disk %d from %c to %c \n", n, from, to);
    toh(n - 1, aux, to, from);
}
```

Output:



2. Write a C program to create a record for IPL Players containing the details as player name, team name, no of matches played, runs scored.
a. Display the player details who scored maximum runs in a particular match.
b. Also compute the number of matches played by each player.

Input:

```
#include<stdio.h>
```

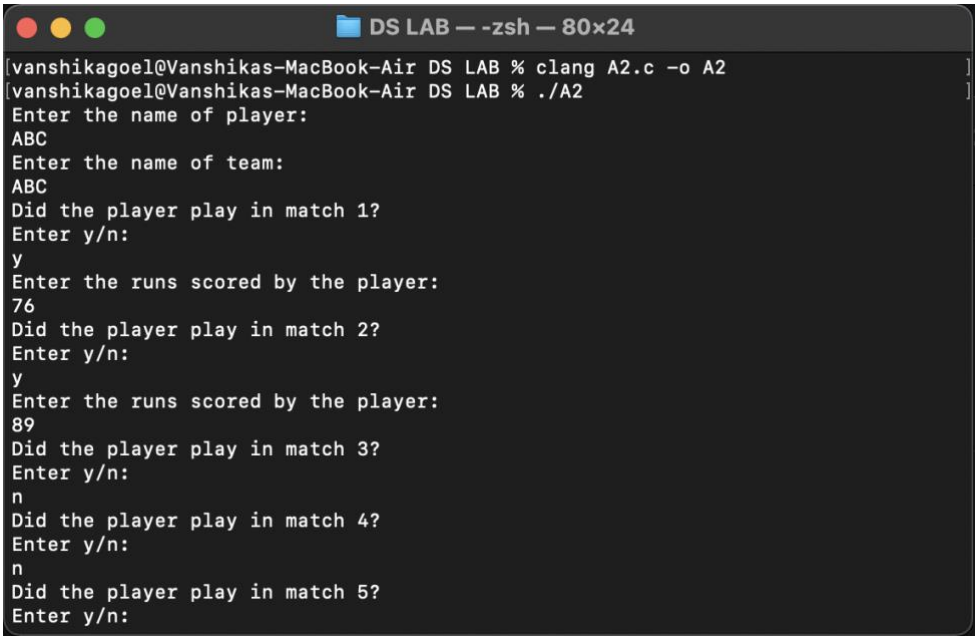
```
#include<string.h>
#include<stdlib.h>
struct match
{
   char played[15];
   int runs[14];
};
typedef struct match MATCH;
struct ipl
{
   char player_name[50];
   char team_name[50];
   MATCH dets;
};
typedef struct ipl IPL;
int main()
{
   int c='y';
   int i=0;
   IPL *s=(IPL*)malloc(sizeof(IPL));
   while(c=='y')
   {
      printf("Enter the name of player: \n");
      scanf("%s",(s+i)->player_name);
      fflush(stdin);
      printf("Enter the name of team: \n");
      scanf("%s",(s+i)->team_name);
```

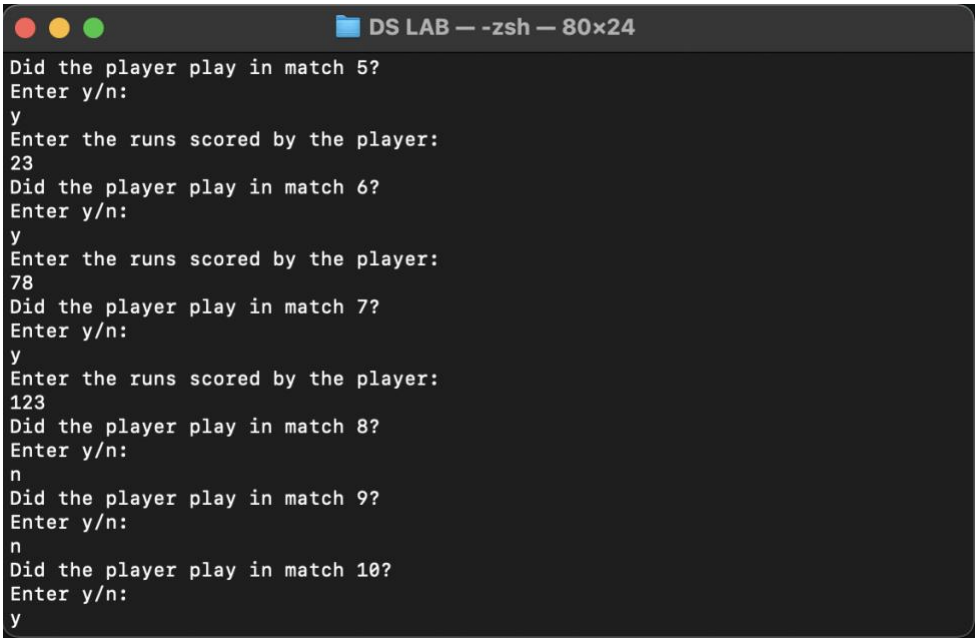
```
    fflush(stdin);
    for(int j=0;j<10;j++)
    {
        printf("Did the player play in match %d? \n",j+1);
        printf("Enter y/n: \n");
        scanf("%c",&((s+i)->dets.played[j]));
        fflush(stdin);
        if((s+i)->dets.played[j]=='y')
        {
            printf("Enter the runs scored by the player: \n");
            scanf("%d",&((s+i)->dets.runs[j]));
            fflush(stdin);
        }
        else
            (s+i)->dets.runs[j]=-1;
    }
    printf("Do you wish to enter more data: \n");
    printf("Enter y/n: \n");
    c=getchar();
    fflush(stdin);
    if(c=='y')
    {
        i++;
        s=(IPL*)realloc(s,sizeof(IPL)*(i+1));
    }
}
int max=-1;
```

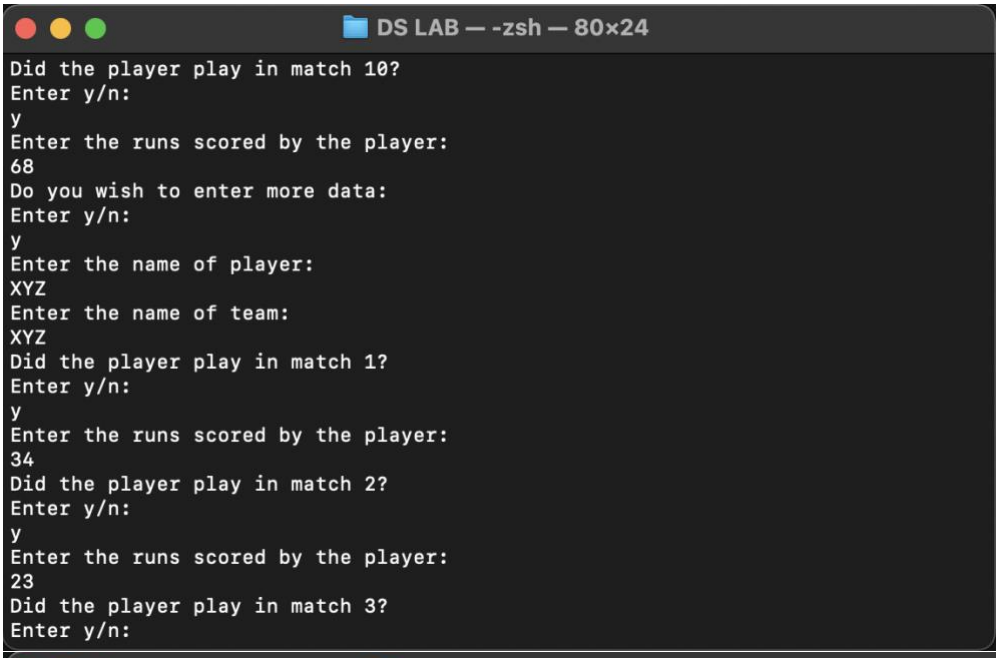
```
   int match_n;
   printf("Enter the match number for calculation of max: \n");
   scanf("%d",&match_n);
   match_n--;
   int index=-1;
   for(int j=0;j<=i;j++)
   {
      if((s+j)->dets.runs[match_n]>max)
      {
         max=(s+j)->dets.runs[match_n];
         index=j;
      }

   }
   if(max==-1)
   {
      printf("No player played that match. \n");
   }
   else
   {
      printf("The player is %s who scored %d in match %d. \n",(s+index)-
>player_name,max,++match_n);
   }
   int count=0;
   for(int j=0;j<=i;j++)
   {
      count=0;
      for(int k=0;k<14;k++)
```

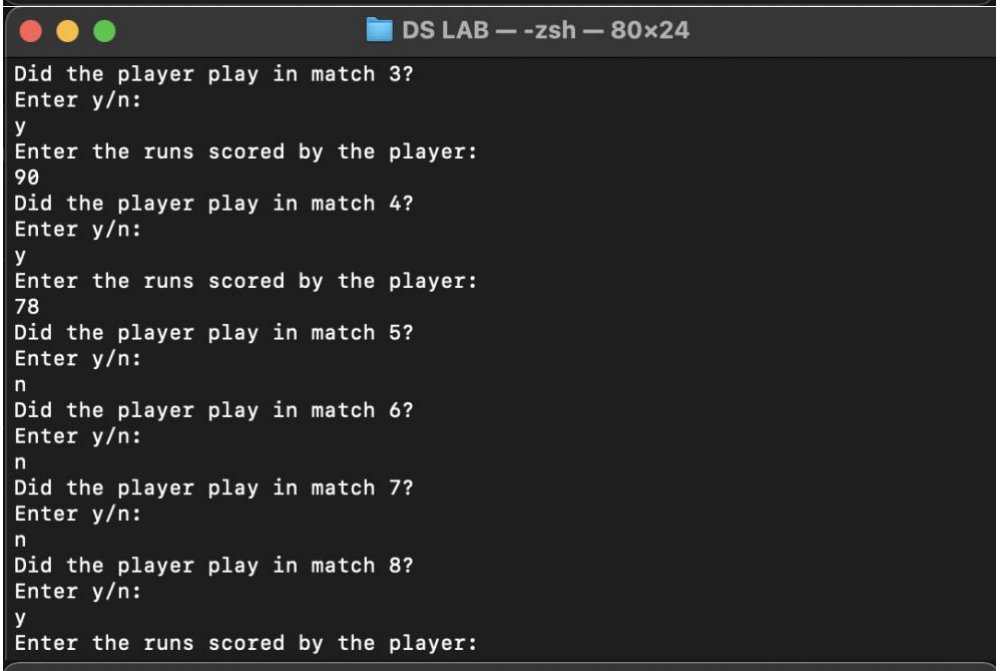
```
    {
        if((s+j)->dets.played[k]=='y')
            count++;
    }
    printf("Player %s played %d matches. \n",(s+j)->player_name,count);
  }
  return 0;
}
```

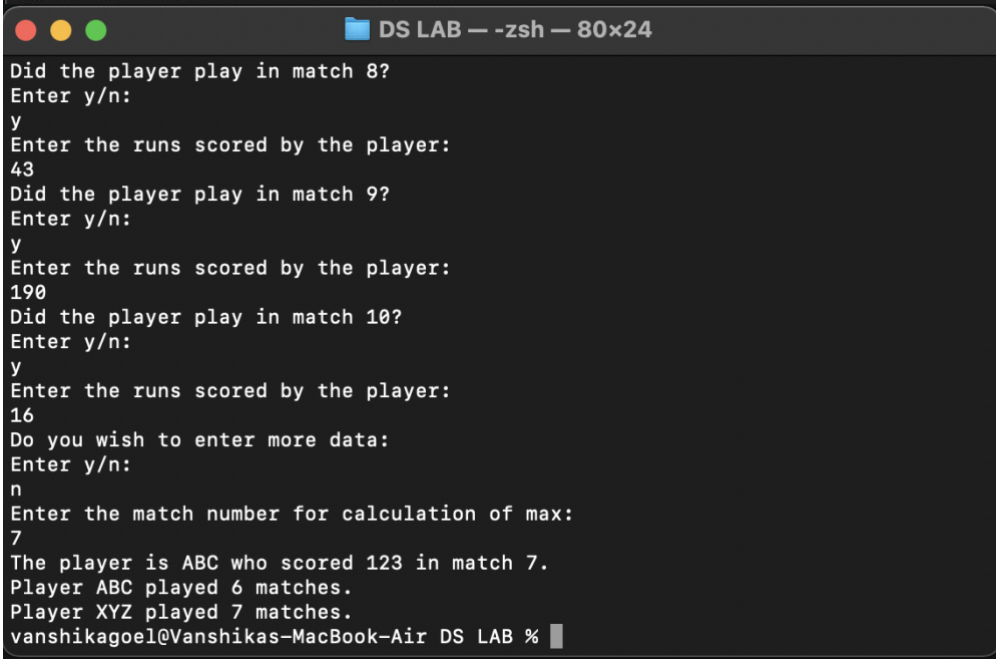
Output:






DS LAB — -zsh — 80×24
Did the player play in match 10?
Enter y/n:
y
Enter the runs scored by the player:
68
Do you wish to enter more data:
Enter y/n:
y
Enter the name of player:
XYZ
Enter the name of team:
XYZ
Did the player play in match 1?
Enter y/n:
y
Enter the runs scored by the player:
34
Did the player play in match 2?
Enter y/n:
y
Enter the runs scored by the player:
23
Did the player play in match 3?
Enter y/n:


DS LAB — -zsh — 80×24
Did the player play in match 3?
Enter y/n:
y
Enter the runs scored by the player:
90
Did the player play in match 4?
Enter y/n:
y
Enter the runs scored by the player:
78
Did the player play in match 5?
Enter y/n:
n
Did the player play in match 6?
Enter y/n:
n
Did the player play in match 7?
Enter y/n:
n
Did the player play in match 8?
Enter y/n:
y
Enter the runs scored by the player:


DS LAB — -zsh — 80×24
Did the player play in match 8?
Enter y/n:
y
Enter the runs scored by the player:
43
Did the player play in match 9?
Enter y/n:
y
Enter the runs scored by the player:
190
Did the player play in match 10?
Enter y/n:
y
Enter the runs scored by the player:
16
Do you wish to enter more data:
Enter y/n:
n
Enter the match number for calculation of max:
7
The player is ABC who scored 123 in match 7.
Player ABC played 6 matches.
Player XYZ played 7 matches.
vanshikagoel@Vanshikas-MacBook-Air DS LAB %