Experiment No. 01

****

Title: A) LCD Display Problem
B) 3n + 1 Problem

Name: Shivlal Arun Yadav
Class: TE CSE **Batch:** T1 **Roll No:** 3011

****

A) LCD Display Problem:

Program:

```
#include <stdio.h>
#include <stdlib.h>
#include <math.h>
#include <string.h>

int nLines;
int nColumns;
char lcdNumber[23][12];
char lcdNumbers[8][23][12];

void setLcdSize(int size) {
    nLines = 2 * size + 3;
    nColumns = size + 2;
}

void clearLcd() {
    int i;
    for (i = 0; i < nLines; i++) {
        int j;
        for (j = 0; j < nColumns; j++) {
            lcdNumber[i][j] = ' ';
        }
    }
}

void drawLine(int lineNumber) {
    int j;
    for (j = 1; j < nColumns - 1; j++) {
        lcdNumber[lineNumber][j] = '-';
    }
}

void drawFirstLine() {
    drawLine(0);
}
```

```
void drawMiddleLine() {
    drawLine(nLines / 2);
}

void drawLastLine() {
    drawLine(nLines - 1);
}

void drawFirstColumn(int columnNumber) {
    int i;
    for (i = 1; i < nLines / 2; i++) {
        lcdNumber[i][columnNumber] = '|';
    }
}

void drawLastColumn(int columnNumber) {
    int i;
    for (i = (nLines / 2) + 1; i < nLines - 1; i++) {
        lcdNumber[i][columnNumber] = '|';
    }
}

void drawFirstLeftColumn() {
    drawFirstColumn(0);
}

void drawLastLeftColumn() {
    drawLastColumn(0);
}

void drawFirstRightColumn() {
    drawFirstColumn(nColumns - 1);
}

void drawLastRightColumn() {
    drawLastColumn(nColumns - 1);
}

void printLcd(int position) {
    int i;
    for (i = 0; i < nLines; i++) {
        int j;
        for (j = 0; j < nColumns; j++) {
            lcdNumbers[position][i][j] = lcdNumber[i][j];
        }
    }
}
```

```
void printZero(int position) {
    clearLcd();
    drawFirstLine();
    drawFirstLeftColumn();
    drawFirstRightColumn();
    drawLastLeftColumn();
    drawLastRightColumn();
    drawLastLine();
    printLcd(position);
}
void printOne(int position) {
    clearLcd();
    drawFirstRightColumn();
    drawLastRightColumn();
    printLcd(position);
}
void printTwo(int position) {
    clearLcd();
    drawFirstLine();
    drawFirstRightColumn();
    drawMiddleLine();
    drawLastLeftColumn();
    drawLastLine();
    printLcd(position);
}
void printThree(int position) {
    clearLcd();
    drawFirstLine();
    drawFirstRightColumn();
    drawMiddleLine();
    drawLastRightColumn();
    drawLastLine();
    printLcd(position);
}
void printFour(int position) {
    clearLcd();
    drawFirstLeftColumn();
    drawFirstRightColumn();
    drawMiddleLine();
    drawLastRightColumn();
    printLcd(position);
}
void printFive(int position) {
    clearLcd();
    drawFirstLine();
    drawFirstLeftColumn();
    drawMiddleLine();
    drawLastRightColumn();
    drawLastLine();
    printLcd(position);
}
void printSix(int position) {
    clearLcd();
    drawFirstLine();
    drawFirstLeftColumn();
    drawMiddleLine();
    drawLastLeftColumn();
    drawLastRightColumn();
    drawLastLine();
    printLcd(position);
}
void printSeven(int position) {
    clearLcd();
    drawFirstLine();
    drawFirstRightColumn();
    drawLastRightColumn();
    printLcd(position);
}
void printEight(int position) {
    clearLcd();
    drawFirstLine();
    drawFirstLeftColumn();
    drawFirstRightColumn();
    drawMiddleLine();
    drawLastLeftColumn();
    drawLastRightColumn();
    drawLastLine();
    printLcd(position);
}
void printNine(int position) {
    clearLcd();
    drawFirstLine();
    drawFirstLeftColumn();
    drawFirstRightColumn();
    drawMiddleLine();
    drawLastRightColumn();
    drawLastLine();
    printLcd(position);
}
void printNumber(int n, int position) {
    void (*functions[10]) (int position) = {
    printZero,
    printOne,
    printTwo,
    printThree,
    printFour,
    printFive,
    printSix,
    printSeven,
    printEight,
    printNine
    };

    functions[n](position);
}
int main() {
    int size = 0;
    char strNumber[9];
    scanf("%d %s", &size, strNumber);

    while (size != 0 || atoi(strNumber) != 0) {
        setLcdSize(size);
        int length = strlen(strNumber);

        int i;
        for (i = 0; i < length; i++) {
            int n = strNumber[i] - '0';
            printNumber(n, i);
        }
       for (i = 0; i < nLines; i++) {
            int n;
            for (n = 0; n < length; n++) {
                int j;
                for (j = 0; j < nColumns; j++) {
                    printf("%c", lcdNumbers[n][i][j]);
                }
                if (n < length - 1) {
                    printf(" "); //column of blanks
                }
            }
            printf("\n");
        }
        printf("\n");

        scanf("%d %s", &size, strNumber);
    }
    return 0;
}
```

Output:

```
2 1234
   --  --
```

```
|  |  || |
|  |  || |
 --  --  --
||    |  |
||    |  |
 --  --
```

B) 3n + 1 Problem

Program:

```
#include <stdio.h>
#include <string.h>
#define max(x, y) ((x) > (y) ? (x) : (y))
#define swap(x, y) {int tmp; tmp = x, x = y, y = tmp;}
#define N 1000000
#define node 1048576
int A[N+1], tree[node<<1];
void setTree(int l, int r, int k) {
    if(l == r)
        tree[k] = A[l];
    if(l < r) {
        int m = (l+r) >> 1;
        setTree(l, m, k<<1);
        setTree(m+1, r, (k<<1)+1);
        tree[k] = max(tree[k<<1], tree[(k<<1)+1]);
    }
}
int getTree(int l, int r, int k, int i, int j) {
    if(l == i && r == j)
        return tree[k];
    if(l < r) {
        int m = (l+r) >> 1;
        if(m >= j)
            return getTree(l, m, k<<1, i, j);
        else if(m < i)
            return getTree(m+1, r, (k<<1)+1, i, j);
        else
            return max(getTree(l, m, k<<1, i, m), getTree(m+1, r, (k<<1)+1,
m+1, j));
    }
}
void build() {
    long long n;
    int i, len;
    memset(A, 0, sizeof(A));
    memset(tree, 0, sizeof(tree));
    A[1] = 1;
    for(i = 2; i <= N; i++) {
        n = i, len = 1;
        while(n != 1) {
            if(n&1) {
                n = n*3 + 1;
            } else {
                n >>= 1;
            }
            if(n < N && A[n] != 0) {
                len += A[n];
                break;
            }
            len ++;
        }
        A[i] = len;
    }
    setTree(1, N, 1);
}
int main() {
    build();
    int i, j;
    while(scanf("%d %d", &i, &j) == 2) {
        printf("%d %d ", i, j);
        if(i > j)
            swap(i, j);
        printf("%d\n", getTree(1, N, 1, i, j));
    }
    return 0;
}
```

Output:

```
1 10
1 10 20
100 200
100 200 125
201 210
201 210 89
900 1000
900 1000 174
```

Experiment No. 02

****

Title: A) The Trip.
B) Australian Voting.

Name: Shivlal Arun Yadav
Class: TE CSE **Batch:** T1 **Roll No:** 3011

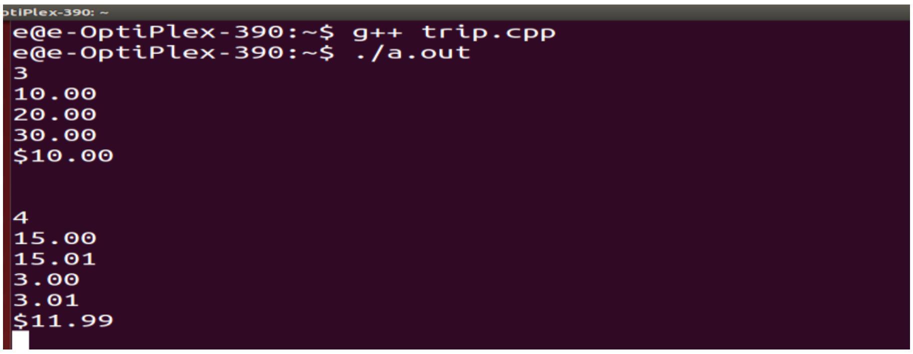
****

A) The Trip.

Program:

```
#include <iostream>
#include <iomanip>
#include <cmath>
using namespace std;
int students[1005];
int main()
{
int N;
while (cin>> N, N)
{
int sum = 0;
for (inti = 0; i< N; ++i)
{
int dollar, cent;
char temp;
cin>> dollar >> temp >> cent;
students[i] = dollar * 100 + cent;
sum += students[i];
}
intlowAverage = sum / N;
inthighAverage = lowAverage + ((sum % N) ? 1 : 0);
intsumAbove = 0;
for (inti = 0; i< N; ++i)
{
if (students[i] >highAverage)
sumAbove += students[i] - highAverage;
}
intsumBelow = 0;
for (inti = 0; i< N; ++i)
{
if (students[i] <lowAverage)
sumBelow += lowAverage - students[i];
}
intusedSum = max(sumAbove, sumBelow);
cout<<'$'<< (usedSum / 100) <<'.'<<setw(2) <<setfill('0') << (usedSum % 100)
<<'\n';
}
}
```

Output:



```
e@e-OptiPlex-390:~$ g++ trip.cpp
e@e-OptiPlex-390:~$ ./a.out
3
10.00
20.00
30.00
$10.00


4
15.00
15.01
3.00
3.01
$11.99
```

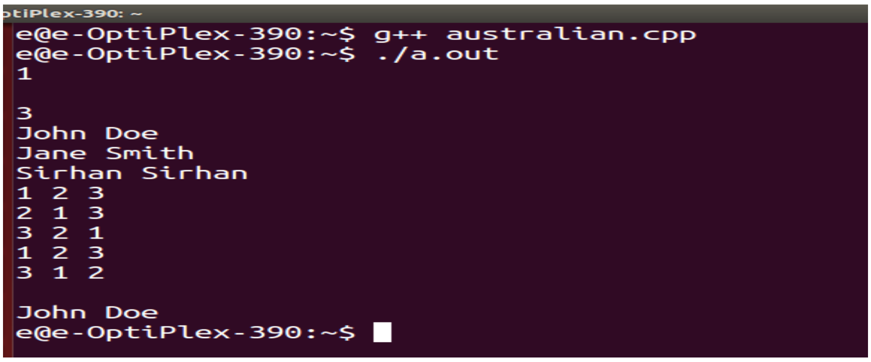
B) **Australian Voting**

Program:

```
#include <iostream>
#include <vector>
#include <sstream>
using namespace std;
int main()
{
int T;
cin>> T;
stringendingSeperator = "";
while (T--)
{
int n;
cin>> n;
vector<string> names(n);
vector<bool> eliminated(n, false);
cin.ignore();
for (inti = 0; i< n; ++i)
getline(cin, names[i]);
string temp;
getline(cin, temp);
vector<vector<int>> ratings;
while (temp != "")
{
stringstreamss;
ss<< temp;
vector<int> order(n);
for (inti = 0; i< n; ++i)
```

```
{
ss>> order[i];
--order[i];
}
ratings.push_back(order);
if (cin.eof())
break;
getline(cin, temp);
}
intnumRatings = ratings.size();
vector<int>posInRatings(numRatings, 0);
int winner = -1;
vector<int> count(n, 0);
for (inti = 0; i<numRatings; ++i)
++count[ratings[i][0]];
while (winner == -1)
{
/*
cout<<"Current eliminated:\n";
for (inti = 0; i<n; ++i)
cout<< eliminated[i] <<"";
cout<<'\n';
*/
for (inti = 0; i<numRatings; ++i)
{
bool changed(false);
while (eliminated[ratings[i][posInRatings[i]]])
{
++posInRatings[i];
changed = true;
}
if (changed)
++count[ratings[i][posInRatings[i]]];
}
/*
cout<<"Current vote count:\n";
for (inti = 0; i< n; ++i)
cout<< count[i] <<"";
cout<<'\n';
cout<<"Current pos in Ratings:\n";
for (inti = 0; i<numRatings; ++i)
cout<<posInRatings[i] <<"";
cout<<'\n';
*/
int highest(0);
int lowest(1000);
for (inti = 0; i< n; ++i)
{
if (eliminated[i])
continue;
if (count[i] > highest)
highest = count[i];
if (count[i] < lowest)
lowest = count[i];
}
if (highest == lowest || highest * 2 >numRatings)
winner = highest;
else
{
for (inti = 0; i< n; ++i)
if (count[i] == lowest)
eliminated[i] = true;
}
}
/*
cout<<"Current vote count:\n";
for (inti = 0; i< n; ++i)
cout<< count[i] <<"";
cout<<'\n';
cout<<"Winner has "<< winner <<" votes. ";
*/
cout<<endingSeperator;
endingSeperator = "\n";
for(inti = 0; i< n; ++i)
if (count[i] == winner && !eliminated[i])
cout<< names[i] <<'\n';
}
        }
```

Output:



```
e@e-OptiPlex-390:~$ g++ australian.cpp
e@e-OptiPlex-390:~$ ./a.out
1

3
John Doe
Jane Smith
Sirhan Sirhan
1 2 3
2 1 3
3 2 1
1 2 3
3 1 2

John Doe
e@e-OptiPlex-390:~$
```

Experiment No. 03

****

Title: A) Crypt Cracker.
B) Jolly Jump.

Name: Shivlal Arun Yadav
Class: TE CSE **Batch:** T1 **Roll No:** 3011

****

A) Crypt Cracker.

Program:

```
#include<stdio.h>
#include<cstring>
#include<set>
#include<algorithm>
using namespace std;
struct data
{
    int id,pal[11],solve[11],tl_pal,sub;
    set<int>s;
};
bool comp(data a,data b)
{
    if(a.s.size()==b.s.size())
    {
        if(a.tl_pal==b.tl_pal)
            return a.id<b.id;
        return (a.tl_pal<b.tl_pal);
    }
    return (a.s.size()>b.s.size());
}
data vec[102];
int main()
{
//freopen ("in.txt", "r", stdin);
    int t,i,j,k,l;
    int id,prb,pal;
    char ver,ar[250];
    scanf("%d\n",&t);
    while(t--)
    {
        for(i=0; i<101; i++)
        {
            memset(vec[i].pal,0,sizeof(vec[i].pal));
            memset(vec[i].solve,0,sizeof(vec[i].solve));
            vec[i].tl_pal=0;
            vec[i].sub=0;
```

```
                vec[i].s.clear();
            }
            while(gets(ar) && ar[0]!='\0')
            {
                sscanf(ar,"%d %d %d %c",&id,&prb,&pal,&ver);
                vec[id].id=id;
                vec[id].sub++;
                if(ver=='C')
                {
                    if(!vec[id].solve[prb])
                    {
                        vec[id].solve[prb]=1;
                        vec[id].tl_pal+=pal+(vec[id].pal[prb]*20);
                        vec[id].s.insert(prb);
                    }
                }
                else if(ver=='I' && vec[id].solve[prb]==0)
                        vec[id].pal[prb]++;
            }
            sort(vec,vec+101,comp);
            for(i=0; i<101; i++)
            {
                if(vec[i].sub>0)
                    printf("%d %d %d\n",vec[i].id,vec[i].s.size(),vec[i].tl_pal);
            }
            if(t>0)
                printf("\n");

        }
        return 0;
}
```

Output:

```
6
and
dick
jane
puff
spot
yertle
bjvg  xsb  hxsn  xsb  qymm  xsb  rqat  xsb  pnetfn
 xxxx  yyy  zzzz  www  yyyy  aaa  bbbb  ccc  dddddd
```

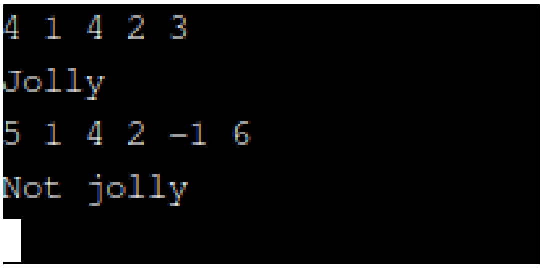
```
Dick  and  jane  and  puff  and  spot  and  yertle
****  ***  ****  ***  ****  ***  ****  ***  ******
```

B) **Jolly Jump**.

Program:

```
#include <cstdio>
#include <cmath>
#include <set>
using namespace std;
int main() {
        int n, m, l;

        while (scanf("%d", &n) != EOF) {
                set<int> checker;
                bool jolly = true;

                scanf("%d", &m);
                for (int i = 0; i < n - 1; i++) {
                        scanf("%d", &l);
                        m = abs(m - l);
                        checker.insert(m);
                        m = l;
                }
                if (checker.size() != n - 1)
                        jolly = false;
                if (checker.count(0) > 0)
                        jolly = false;
                if (checker.upper_bound(n - 1) != checker.end())
                        jolly = false;
                if (jolly)
                        printf("Jolly\n");
                else
                        printf("Not jolly\n");
        }
        return 0;
}
```

Output:



```
4 1 4 2 3
Jolly
5 1 4 2 -1 6
Not jolly
```

Experiment No. 04

****

Title: A) Crypt Cracker.
B) Contest Scoreboard.

Name: Shivlal Arun Yadav
Class: TE CSE **Batch:** T1 **Roll No:** 3011

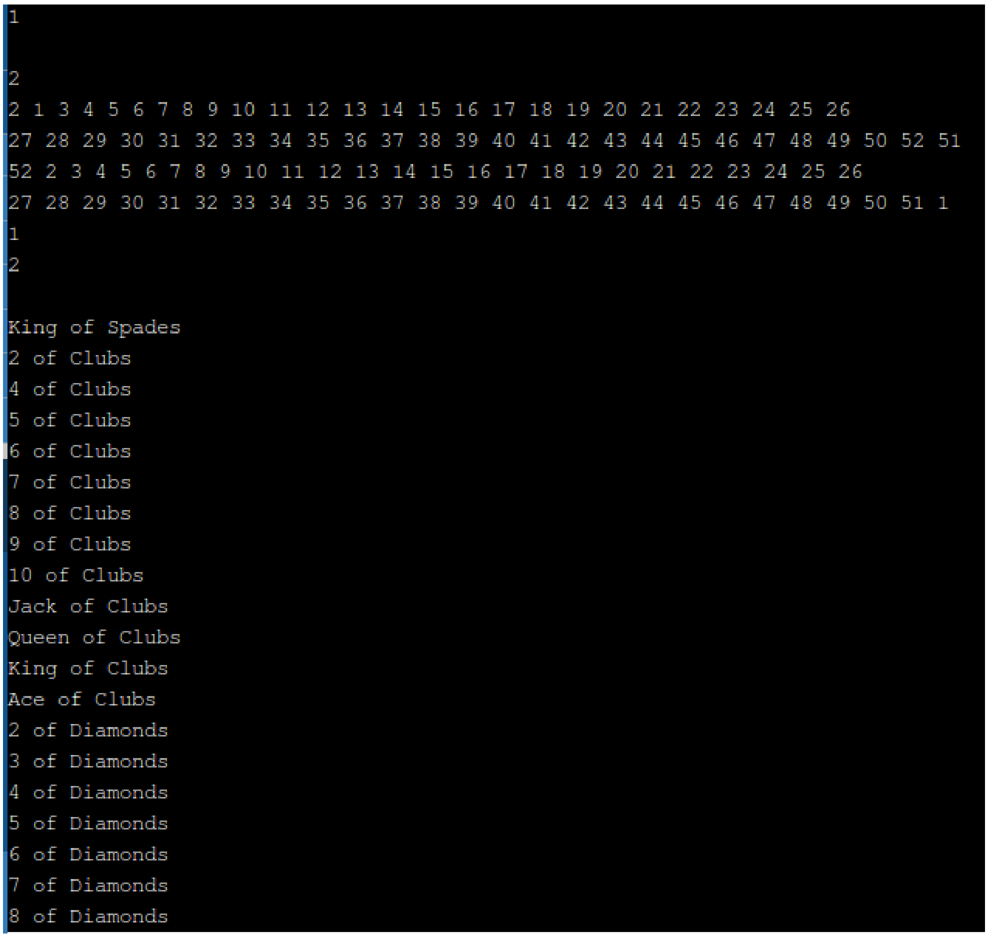
****

A) Stack 'em Up

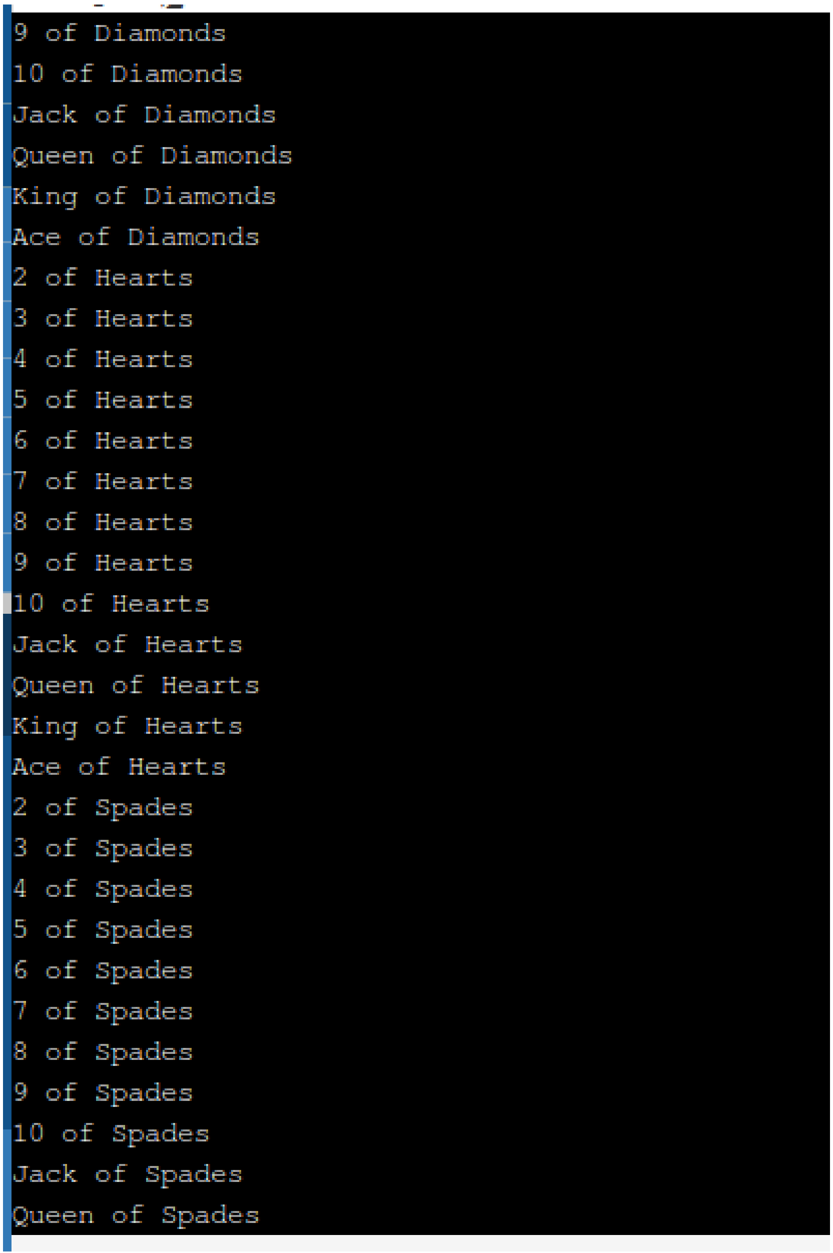
Program:

```
#include <cstdio>
#include <string>
#include <iostream>
#include <algorithm>
using namespace std;
int main()
{
    // Are stored [num % 13][num / 13]
    string cardFirst[] = {"2", "3", "4", "5", "6", "7", "8", "9", "10", "Jack", "Queen", "King",
"Ace" };
    string cardSecond[] = {"Clubs", "Diamonds", "Hearts", "Spades"};
    string temp;
    char separator[2];
    separator[0] = separator[1] = '\0';
    int shuffles[101][52], numShufflesKnown, numShufflesDone, orderOfShuffles[101], T,
pos;
    scanf("%d", &T);
    while (T--)
    {
        printf("%s", separator);
        separator[0] = '\n';
        scanf("%d", &numShufflesKnown);
        for (int i = 0; i < numShufflesKnown; ++i)
        {
            for (int j = 0; j < 52; ++j)
            {
                scanf("%d", &shuffles[i][j]);
                --shuffles[i][j];
            }
        }
        cin.ignore();
        numShufflesDone = 0;
        getline(cin, temp);
        while (temp != "")
        {
            orderOfShuffles[numShufflesDone++] = atoi(temp.c_str()) - 1;
            getline(cin, temp);
        }
        for (int i = 0; i < 52; ++i)
        {
            pos = i;
            for (int c = numShufflesDone - 1; c >= 0; --c)
                pos = shuffles[orderOfShuffles[c]][pos];
            printf("%s of %s\n", cardFirst[pos % 13].c_str(), cardSecond[pos / 13].c_str());
        }
    }
}
```

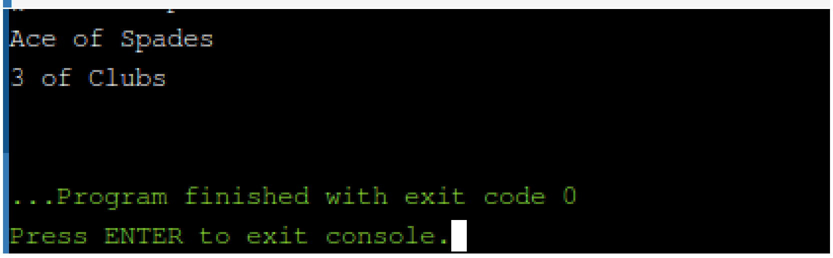
Output:



```
1


2
2 1 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26
27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 52 51
52 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26
27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 1
1
2

King of Spades
2 of Clubs
4 of Clubs
5 of Clubs
6 of Clubs
7 of Clubs
8 of Clubs
9 of Clubs
10 of Clubs
Jack of Clubs
Queen of Clubs
King of Clubs
Ace of Clubs
2 of Diamonds
3 of Diamonds
4 of Diamonds
5 of Diamonds
6 of Diamonds
7 of Diamonds
8 of Diamonds
```



```
9 of Diamonds
10 of Diamonds
Jack of Diamonds
Queen of Diamonds
King of Diamonds
Ace of Diamonds
2 of Hearts
3 of Hearts
4 of Hearts
5 of Hearts
6 of Hearts
7 of Hearts
8 of Hearts
9 of Hearts
10 of Hearts
Jack of Hearts
Queen of Hearts
King of Hearts
Ace of Hearts
2 of Spades
3 of Spades
4 of Spades
5 of Spades
6 of Spades
7 of Spades
8 of Spades
9 of Spades
10 of Spades
Jack of Spades
Queen of Spades
```



```
Ace of Spades
3 of Clubs


...Program finished with exit code 0
Press ENTER to exit console.
```

B) Contest Scoreboard.

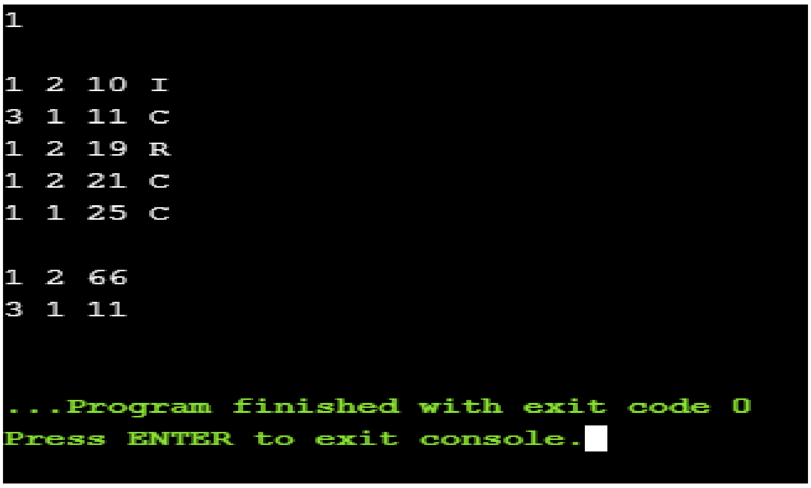
Program:

```
#include<stdio.h>
#include<cstring>
#include<set>
#include<algorithm>
```

```
using namespace std;
struct data
{
   int id,pal[11],solve[11],tl_pal,sub;
   set<int>s;
};
bool comp(data a,data b)
{
   if(a.s.size()==b.s.size())
   {
      if(a.tl_pal==b.tl_pal)
         return a.id<b.id;
      return (a.tl_pal<b.tl_pal);
   }
   return (a.s.size()>b.s.size());
}
data vec[102];
int main()
{
//freopen ("in.txt", "r", stdin);
   int t,i,j,k,l;
   int id,prb,pal;
   char ver,ar[250];
   scanf("%d\n",&t);
   while(t--)
   {
      for(i=0; i<101; i++)
      {
         memset(vec[i].pal,0,sizeof(vec[i].pal));
         memset(vec[i].solve,0,sizeof(vec[i].solve));
         vec[i].tl_pal=0;
         vec[i].sub=0;
         vec[i].s.clear();
      }
      while(gets(ar) && ar[0]!='\0')
      {
         sscanf(ar,"%d %d %d %c",&id,&prb,&pal,&ver);
         vec[id].id=id;
         vec[id].sub++;
         if(ver=='C')
         {
            if(!vec[id].solve[prb])
            {
               vec[id].solve[prb]=1;
               vec[id].tl_pal+=pal+(vec[id].pal[prb]*20);
               vec[id].s.insert(prb);
            }
         }
         else if(ver=='I' && vec[id].solve[prb]==0)
               vec[id].pal[prb]++;
```

```
        }
//         for(i=0;i<9;i++)
//             printf("%d ",vec[1].pal[i]);
//         printf("\n");
        sort(vec,vec+101,comp);
        for(i=0; i<101; i++)
        {
            if(vec[i].sub>0)
                printf("%d %d %d\n",vec[i].id,vec[i].s.size(),vec[i].tl_pal);
        }
        if(t>0)
            printf("\n");

    }
    return 0;
}
```

Output:



```
1

1 2 10 I
3 1 11 C
1 2 19 R
1 2 21 C
1 1 25 C

1 2 66
3 1 11


...Program finished with exit code 0
Press ENTER to exit console.
```

Experiment No. 05

****

Title: A) WERTYU
B) Common Prmutation.

Name: Shivlal Arun Yadav
Class: TE CSE **Batch:** T1 **Roll No:** 3011

****

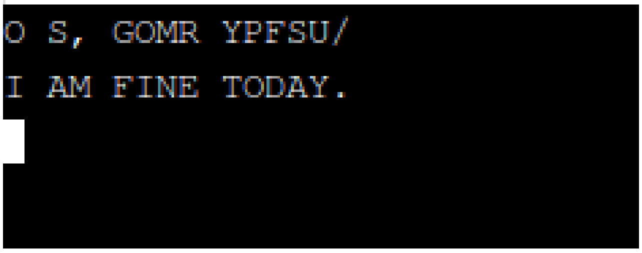
A) WERTYU

Program:

```
#include <cstdio>
using namespace std;
char translate(char c) {
        switch (c) {
        case '1':
                return '`';
        case '2':
                return '1';
        case '3':
                return '2';
        case '4':
                return '3';
        case '5':
                return '4';
        case '6':
                return '5';
        case '7':
                return '6';
        case '8':
                return '7';
        case '9':
                return '8';
        case '0':
                return '9';
        case '-':
                return '0';
        case '=':
                return '-';
        case 'W':
                return 'Q';
        case 'E':
                return 'W';
        case 'R':
                return 'E';
        case 'T':
                return 'R';
        case 'Y':
                return 'T';
```

```
case 'U':
        return 'Y';
case 'I':
        return 'U';
case 'O':
        return 'I';
case 'P':
        return 'O';
case '[':
        return 'P';
case ']':
        return '[';
case '\\':
        return ']';
case 'S':
        return 'A';
case 'D':
        return 'S';
case 'F':
        return 'D';
case 'G':
        return 'F';
case 'H':
        return 'G';
case 'J':
        return 'H';
case 'K':
        return 'J';
case 'L':
        return 'K';
case ';':
        return 'L';
case '\'':
        return ';';
case 'X':
        return 'Z';
case 'C':
        return 'X';
case 'V':
        return 'C';
case 'B':
        return 'V';
case 'N':
        return 'B';
case 'M':
        return 'N';
case ',':
        return 'M';
case '.':
        return ',';
        case '/':
                return '.';
        case ' ':
                return ' ';
        case '\n':
                return '\n';
        }
        return ' ';
}
int main() {
        char c;
        while (scanf("%c", &c) != EOF) {
                printf("%c", translate(c));
        }
        return 0;
}
```

Output:



```
O S, GOMR YPFSU/
I AM FINE TODAY.
```

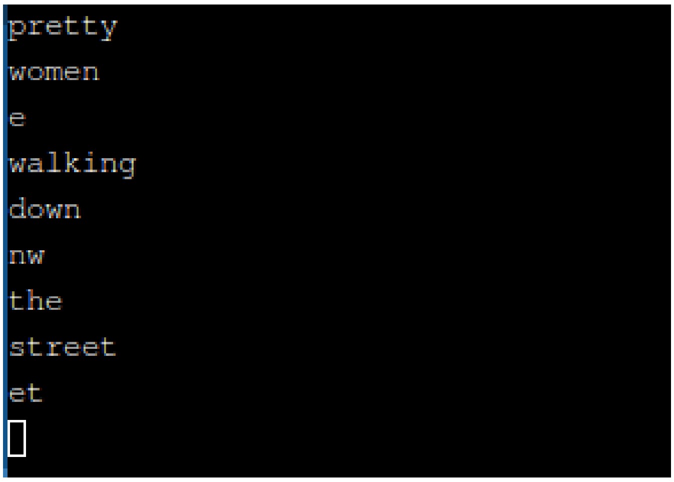
B) Common Prmutation

Program:

```
#include <iostream>
#include <string>
#include <algorithm>
using namespace std;
int main()
{
   string a, b;
   while (getline(cin, a), getline(cin, b))
   {
      int aCounts[128], bCounts[128];
      for (int i = 'a'; i <= 'z'; ++i)
         aCounts[i] = bCounts[i] = 0;
      for (int i = 0; i < a.size(); ++i)
         ++aCounts[a[i]];
      for (int i = 0; i < b.size(); ++i)
         ++bCounts[b[i]];
```

```
        string longest = "";
        for (int i = 'a'; i <= 'z'; ++i)
            while (aCounts[i] > 0 && bCounts[i] > 0)
            {
                longest += (char) i;
                --aCounts[i];
                --bCounts[i];
            }
        cout << longest << '\n';
    }
}
```

Output:



```
pretty
women
e
walking
down
nw
the
street
et
```

Experiment No. 06

****

Title: A) Doublets
B) File Fragmentation.

Name: Shivlal Arun Yadav
Class: TE CSE **Batch:** T1 **Roll No:** 3011

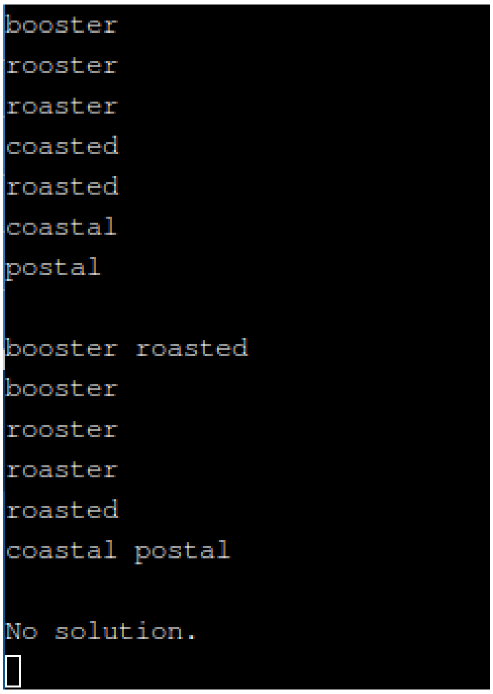
****

A) Doublets

Program:

```
#include <set>
#include <map>
#include <list>
#include <cmath>
#include <ctime>
#include <climits>
#include <queue>
#include <stack>
#include <cctype>
#include <cstdio>
#include <string>
#include <vector>
#include <cassert>
#include <cstdlib>
#include <cstring>
#include <sstream>
#include <iostream>
#include <algorithm>
using namespace std;
#define FOR(i, L, U) for(int i=(int)L; i<=(int)U; i++)
#define FORD(i, U, L) for(int i=(int)U; i>=(int)L; i--)
#define READ(x) freopen(x, "r", stdin)
#define WRITE(x) freopen(x, "w", stdout)
#define PQ priority_queue
#define PB push_back
#define SZ size()
#define ff first
#define ss second
#define EPS 1e-9
#define SQR(x) ((x)*(x))
#define INF 99999999
#define ALL_BITS ((1 << 31) - 1)
#define NEG_BITS(mask) (mask ^= ALL_BITS)
#define TEST_BIT(mask, i) (mask & (1 << i))
#define ON_BIT(mask, i) (mask |= (1 << i))
#define OFF_BIT(mask, i) (mask &= NEG_BITS(1 << i))
typedef long long LL;
typedef vector<char> VC;
typedef vector<vector<char> > VVC;
typedef vector<int> VI;
typedef vector<vector<int> > VVI;
typedef vector<string> VS;
typedef vector<bool> VB;
typedef vector< vector<bool> > VVB;
typedef pair<int, int> PII;
typedef map<int, int> MII;
typedef map<char, int> MCI;
typedef map<string, int> MSI;
typedef map<int, string> MIS;
#define WHITE 0
#define GRAY 1
#define BLACK 2
#define MAX_NODE 25145
string name;
int nodes;
int dist[MAX_NODE];
bool color[MAX_NODE];
int pre[MAX_NODE];
int u,v;
MIS rev;
MSI dic;
void bfs(int src){
    map<int,string> ::iterator revEnd = rev.end();
    string ustr,vstr;
    queue<int> q;
    FOR(i,1,nodes){
        dist[i] = INF;
        color[i] = false;
        pre[i] = i;
        }
    dist[src] = 0;
    color[src] = true;
    q.push(src);
    while(!q.empty()){
        u = q.front();
        ustr = rev[u];
        q.pop();
        FOR(i,0,ustr.length()-1){
            FOR(j,'a','z'){
                if(ustr[i]==j)continue;
                vstr= ustr;
                vstr[i] = j;
                v =  dic[vstr];
                if(color[v]==false&&rev.find(v)!=revEnd){
                    color[v] = true;
                    dist[v] = dist[u] + 1;
                    pre[v] = u;
                    q.push(v);
                }
            }
        }
    }
}
int main()
{
   //READ("input.txt");
    //WRITE("output.txt");
    map<string,int> ::iterator it;
    string str;
    string st,en;
    bool letBlank = false;
    while(getline(cin,name)){
        if(name!=""){
            if(!dic[name]){
                dic[name] = ++nodes;
                rev[nodes] = name;
            }
        }
        else while(cin >> st >> en){
            if(letBlank) printf("\n");
            letBlank = true;
            bfs(dic[st]);
            if(dist[dic[en]]==INF)printf("No solution.\n");
            else {
                VI path;
                int u,v;
                v = dic[en];
                u = dic[st];
                while(v!=u){
                    path.push_back(v);
                    v = pre[v];
                }
                path.push_back(u);
                FORD(i,path.size()-1,0) cout << rev[path[i]] << endl;
            }
        }
    }
  return 0;
}
```

Output:



```
booster
rooster
roaster
coasted
roasted
coastal
postal

booster roasted
booster
rooster
roaster
roasted
coastal postal

No solution.
```

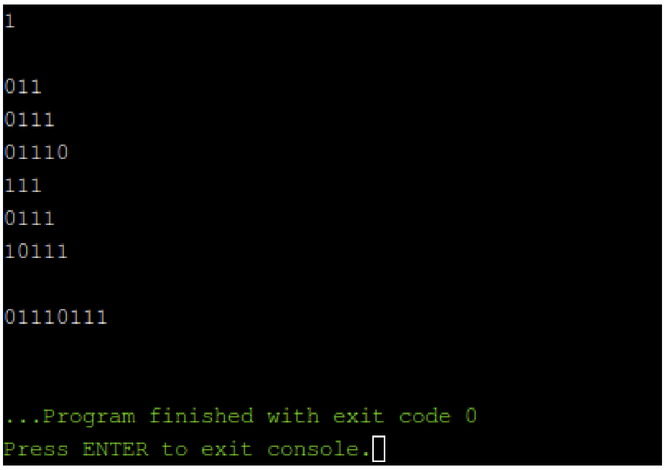
B) File Fragmentation

Program:

```
#include <iostream>
#include <sstream>
#include <map>
#include <string>
#include <vector>
using namespace std;
int main()
{
   string s;
   getline(cin, s);
   size_t T;
   istringstream ss(s);
   ss >> T;
   // Skip the first empty line.
   getline(cin, s);
   while ( T-- )
   {
      vector<string> fragments;
      while (getline(cin, s) && !s.empty())
      {
         ss.clear();
         ss.str(s);
         string fragment;
         ss >> fragment;
         fragments.push_back(fragment);
```

```
        }
        // Consider all concatenations of any two strings.
        map<string, int> memo;
        for (size_t i = 0; i < fragments.size(); ++i)
            for (size_t j = i + 1; j < fragments.size(); ++j)
            {
                ++memo[fragments[i] + fragments[j]];
                ++memo[fragments[j] + fragments[i]];
            }
        // Search for the string of highest count.
        map<string, int>::iterator iter(memo.begin());
        map<string, int>::iterator file(memo.begin());
        for (; iter != memo.end(); ++iter)
        {
            if (iter->second > file->second)
                file = iter;
        }
        cout << file->first << endl;
        if (T)
            cout << endl;
    }
    return 0;
}
```

Output:



```
1

011
0111
01110
111
0111
10111

01110111


...Program finished with exit code 0
Press ENTER to exit console.
```

Experiment No. 07

****

Title: A) Vito’s Family.
B) Shoemaker’s Problem

.

Name: Shivlal Arun Yadav

Class: TE CSE **Batch:** T1 **Roll No:** 3011

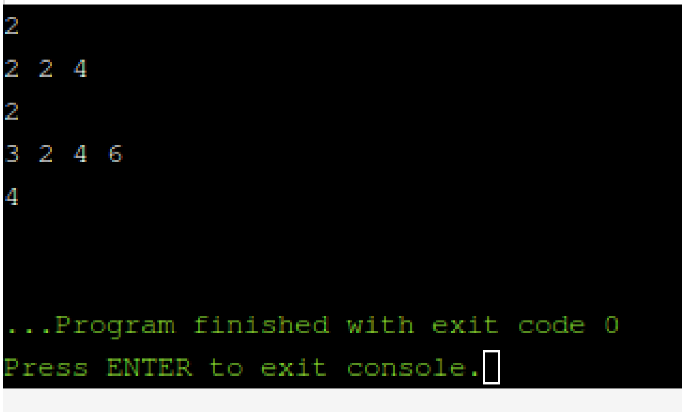
****

A) Vito’s Family

Program:

```
#include <cstdio>
#include <algorithm>
using namespace std;
int main() {
        int tc, r, median, x[505], ans;
        scanf("%d", &tc);
        while (tc--) {
                scanf("%d", &r);

                for (int i = 0; i < r; i++) {
                        scanf("%d", &x[i]);
                }
                sort(x, x + r);
                median = x[r / 2];
                ans = 0;
                for (int i = 0; i < r; i++) {
                        ans += abs(median - x[i]);
                }
                printf("%d\n", ans);
        }
        return 0;
}
```

Output:



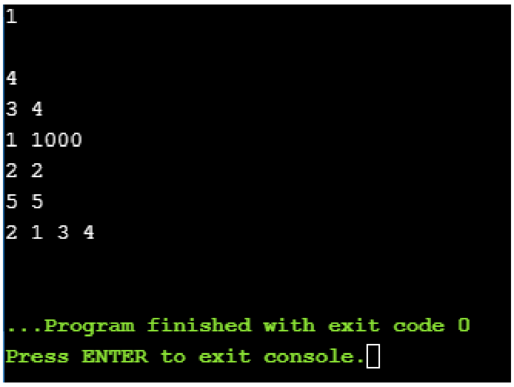
```
2
2 2 4
2
3 2 4 6
4


...Program finished with exit code 0
Press ENTER to exit console.
```

B) Shoemaker’s Problem

Program:

```
#include <iostream>
#include <vector>
#include<string>
#include<algorithm>
#include<queue>
using namespace std;
struct shoe
{
int time, cost, name;
};
int main()
{
int cases, num, x, y, z;
cin>>cases;
vector<shoe> vec;
vector<int> retVec;
for (x=0; x<cases; x++)
{
vec.clear();
retVec.clear();
cin.ignore(255,'\n');
string buff;
getline(cin,buff);
int totalTime=0;
cin>>num;
for (y=0; y<num; y++)
{
shoe s;
cin>>s.time>>s.cost;
s.name=y+1;
totalTime+=s.time;
vec.push_back(s);
}
int worst;
int wNum;
for (y=0; y<vec.size();)
{
worst=-1;
for (z=0; z<vec.size(); z++)
{
if (vec[z].cost*(totalTime-vec[z].time)>worst)
{
worst=vec[z].cost*(totalTime-vec[z].time);
wNum=z;
}
}
retVec.push_back(vec[wNum].name);
totalTime-=vec[wNum].time;
vec.erase(vec.begin()+wNum);
}
for (y=0; y<retVec.size(); y++)
{
cout<<retVec[y];
if (y!=retVec.size()-1)
cout<<" ";
}
cout<<endl;
if (x!=cases-1)
cout<<endl;
}
return 0;
}
```

Output:



```
1


4
3 4
1 1000
2 2
5 5
2 1 3 4



...Program finished with exit code 0
Press ENTER to exit console.
```

Experiment No. 08

****

Title: A) Shell Sort
B) Football

.

Name: Shivlal Arun Yadav

Class: TE CSE **Batch:** T1 **Roll No:** 3011

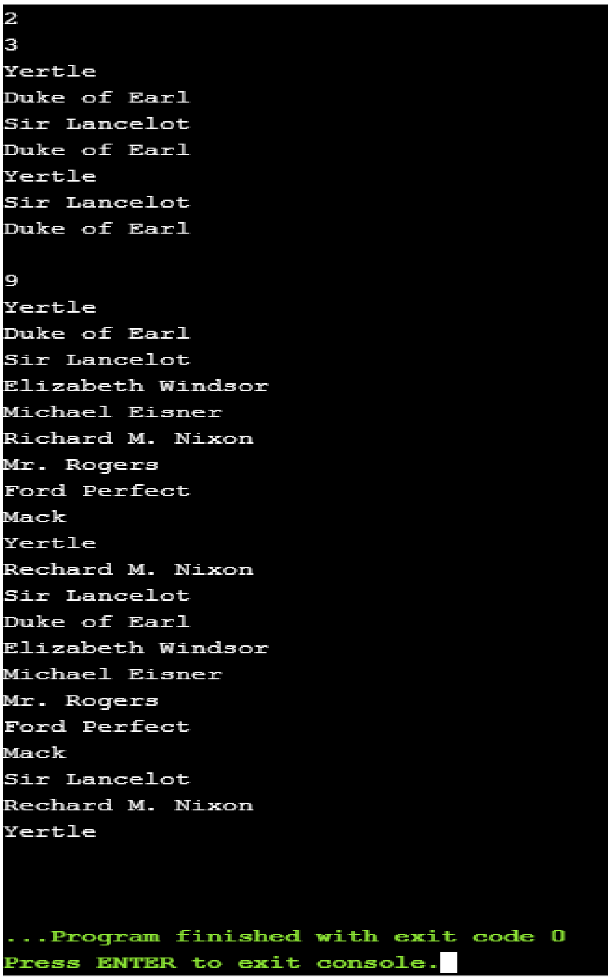
****

A) Shell Sort

Program:

```
#include <stdio.h>
#include <string.h>
int main() {
    int t, n, i, j;
    char org[210][88], des[210][88];
    scanf("%d", &t);
    while(t--) {
        scanf("%d", &n);
        getchar();
        for(i = 0; i < n; i++)
            gets(org[i]);
        for(i = 0; i < n; i++)
            gets(des[i]);
        for(i = n-1, j = n-1; i >= 0; i--)
            if(!strcmp(org[i], des[j]))
                j--;
        for(; j >= 0; j--)
            puts(des[j]);
        puts("");
    }
    return 0;
}
```

Output:



```
2
3
Yertle
Duke of Earl
Sir Lancelot
Duke of Earl
Yertle
Sir Lancelot
Duke of Earl

9
Yertle
Duke of Earl
Sir Lancelot
Elizabeth Windsor
Michael Eisner
Richard M. Nixon
Mr. Rogers
Ford Perfect
Mack
Yertle
Rechard M. Nixon
Sir Lancelot
Duke of Earl
Elizabeth Windsor
Michael Eisner
Mr. Rogers
Ford Perfect
Mack
Sir Lancelot
Rechard M. Nixon
Yertle



...Program finished with exit code 0
Press ENTER to exit console.
```

B) Football

Program:

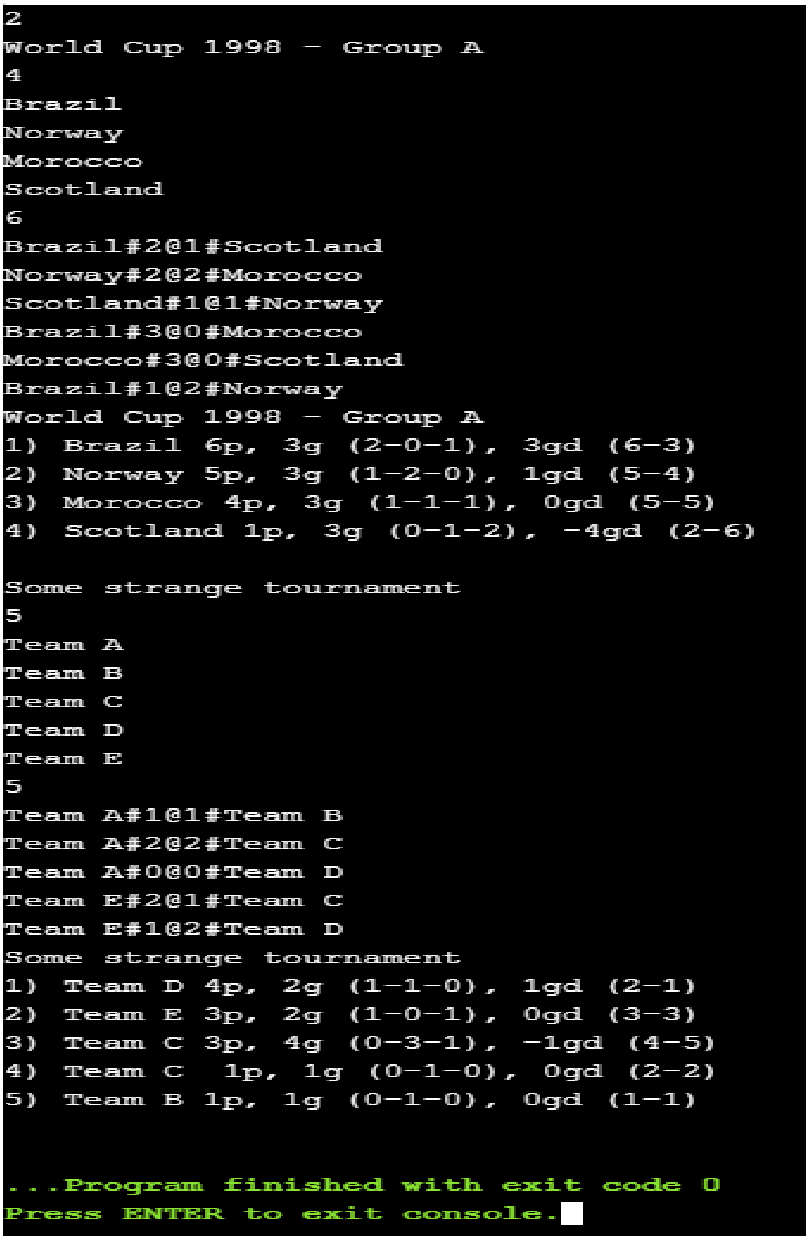
```
#include<bits/stdc++.h>
        #define CLR(a,b) memset(a, b, sizeof(a))
        using namespace std;
        map<string , int> teams;
map<string , int> :: iterator it;
int team_goal_dise[100], team_goal_khaise[100], total_khelse[100];
int winner[100], point[100], looser[100], draw[100];
struct data{
string teamname;
int point, goaldise, goal_diff, khelse, jitse;
};
        bool cmp(data one, data two)
        {
        char bread[105], butter[105];
        if(one.point==two.point)
        {
         if(one.jitse==two.jitse)
```

```
            {
             if(one.goal_diff==two.goal_diff)
            {
              if(one.goaldise == two.goaldise)
              {
                if(one.khelse==two.khelse)
            {
               int szbread = one.teamname.size();
               int szbutter = two.teamname.size();
               for(int i=0; i<szbread; i++)
                bread[i] = tolower(one.teamname[i]);
                 for(int i=0; i<szbutter; i++)
                 butter[i] = tolower(two.teamname[i]);
                 return strcmp(bread, butter)<0;
               }
               else return one.khelse<two.khelse;
               }
               else return one.goaldise>two.goaldise
              }
              else return one.goal_diff>two.goal_diff;
              }
  else return one.jitse>two.jitse;
              }
  else return one.point>two.point;
              }
int main()
            {
  int test, n, m, goalone, goaltwo;
  string name, score, adi1, adi2, tourn_name;
              scanf("%d", &test);
              getchar();
              while(test--)
                {
                    getline(cin,tourn_name);
                    //getchar();
                    teams.clear();
                    CLR(team_goal_dise, 0); CLR(team_goal_khaise, 0); CLR(looser,0);
                    CLR(total_khelse, 0); CLR(winner, 0); CLR(point, 0); CLR(draw, 0);
                    scanf("%d", &n);
                    getchar();
                    for(int i=0; i<n; i++)
                    {
                        getline(cin,name);
                       // cout<<name<<endl;
                        teams[name] = i;
                    }
                    scanf("%d",&m);
                    getchar();
                    for(int i=0; i<m; i++)
                    {
```

```
              getline(cin,score);
              //cout<<score<<endl;
              int sz = score.size(), j;
              goalone = 0; adi1 = "";
              bool hashfound = false;
              for(j=0; score[j]!='@'; j++)
              {
                  if(score[j]=='#') { hashfound = true; continue; }
                  if(!hashfound)
                  {
                      adi1 = adi1 + score[j];
                  }
                  else if(isdigit(score[j]))
                  {
                      goalone = goalone*10 + (score[j]-'0');
                  }
              }
              adi2 ="";goaltwo = 0; hashfound = false;
              for(int l=j+1; score[l]!='\0'; l++)
              {
                  if(score[l]=='#') {hashfound = true; continue; }
                  if(hashfound)
                  {
                      adi2 = adi2 + score[l];
                  }
                  else if(isdigit(score[l]))
                  {
                      goaltwo = goaltwo*10 + (score[l]-'0');
                  }
              }
          //cout<<goalone<<' '<<adi1<<' '<<goaltwo<<' '<<adi2<<endl;
        team_goal_dise[teams[adi1]] = team_goal_dise[teams[adi1]] + goalone;
        team_goal_dise[teams[adi2]] = team_goal_dise[teams[adi2]] + goaltwo;
        team_goal_khaise[teams[adi1]] = team_goal_khaise[teams[adi1]] + goaltwo;
team_goal_khaise[teams[adi2]] = team_goal_khaise[teams[adi2]] + goalone;
              total_khelse[teams[adi1]]++;
              total_khelse[teams[adi2]]++;
              if(goalone>goaltwo)
              {
                  winner[teams[adi1]]++;
                  looser[teams[adi2]]++;
                  point[teams[adi1]] = point[teams[adi1]] + 3;
              }
              else if(goalone<goaltwo)
              {
                  winner[teams[adi2]]++;
                  looser[teams[adi1]]++;
                  point[teams[adi2]] = point[teams[adi2]] + 3;
              }
              else
```

```
                    {
                       draw[teams[adi1]]++;
                       draw[teams[adi2]]++;
                       point[teams[adi1]] = point[teams[adi1]] + 1;
                       point[teams[adi2]] = point[teams[adi2]] + 1;
                    }
                }
                /*for(it=teams.begin(); it!=teams.end(); ++it)
                {
     cout<<it->first<<' '<<point[teams[it->first]]<<' ';
     cout<<total_khelse[teams[it->first]]<<' '<<winner[teams[it->first]]<<' ';
     cout<<draw[teams[it->first]]<<' '<<looser[teams[it->first]]<<' ';
     cout<<team_goal_dise[teams[it->first]]<<'
'<<team_goal_khaise[teams[it->first]]<<endl;
                }*/
                data total_teams[100];
                for(it=teams.begin(); it!=teams.end(); ++it)
                {
      total_teams[it->second].point = point[it->second];
      total_teams[it->second].jitse = winner[it→second];
total_teams[it→second].goal_diff = team_goal_dise[it→second] -
team_goal_khaise[it→                    total_teams[it->second].goal_diff =
team_goal_dise[it->second] - team_goal_khaise[it->second];
                    total_teams[it->second].goaldise = team_goal_dise[it->second];
                    total_teams[it->second].khelse = total_khelse[it->second];
                    total_teams[it->second].teamname = it->first;
                }
                sort(total_teams, total_teams+n, cmp);
                cout<<tourn_name<<endl;
                for(int i=0; i<n; i++)
                {
                    cout<<i+1<<')'<<' '<<total_teams[i].teamname<<'
'<<total_teams[i].point<<"p, "<<total_teams[i].khelse<<"g
("<<winner[teams[total_teams[i].teamname]]<<'-';
cout<<draw[teams[total_teams[i].teamname]]<<'-
'<<looser[teams[total_teams[i].teamname]]<<"), "<<total_teams[i].goal_diff<<"gd (";
                    cout<<team_goal_dise[teams[total_teams[i].teamname]]<<'-
'<<team_goal_khaise[teams[total_teams[i].teamname]]<<')'<<endl;
                }
                if(test)
                    printf("\n");
                //CLR(total_teams,0);
             }
             return 0;
          }
```

Output:



```
2
World Cup 1998 - Group A
4
Brazil
Norway
Morocco
Scotland
6
Brazil#2@1#Scotland
Norway#2@2#Morocco
Scotland#1@1#Norway
Brazil#3@0#Morocco
Morocco#3@0#Scotland
Brazil#1@2#Norway
World Cup 1998 - Group A
1) Brazil 6p, 3g (2-0-1), 3gd (6-3)
2) Norway 5p, 3g (1-2-0), 1gd (5-4)
3) Morocco 4p, 3g (1-1-1), 0gd (5-5)
4) Scotland 1p, 3g (0-1-2), -4gd (2-6)

Some strange tournament
5
Team A
Team B
Team C
Team D
Team E
5
Team A#1@1#Team B
Team A#2@2#Team C
Team A#0@0#Team D
Team E#2@1#Team C
Team E#1@2#Team D
Some strange tournament
1) Team D 4p, 2g (1-1-0), 1gd (2-1)
2) Team E 3p, 2g (1-0-1), 0gd (3-3)
3) Team C 3p, 4g (0-3-1), -1gd (4-5)
4) Team C  1p, 1g (0-1-0), 0gd (2-2)
5) Team B 1p, 1g (0-1-0), 0gd (1-1)


...Program finished with exit code 0
Press ENTER to exit console.
```

Experiment No. 09

****

Title: A) Primary Arithmetic
B) Reverse and Add

Name: Shivlal Arun Yadav
Class: TE CSE **Batch:** T1 **Roll No:** 3011

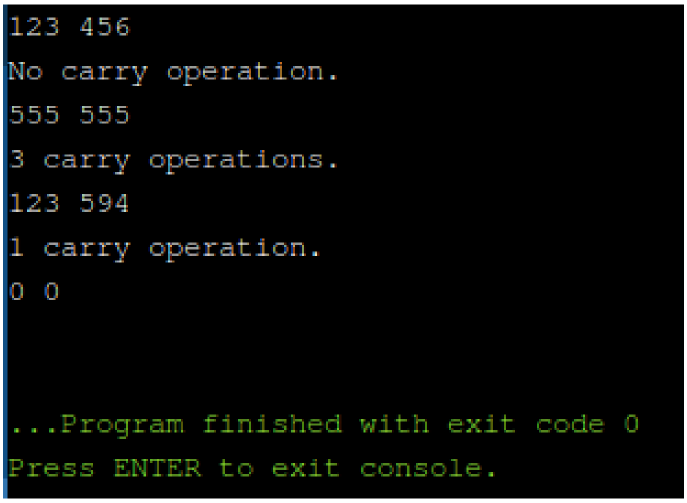
****

A) Primary Arithmetic

Program:

```
#include<bits/stdc++.h>
using namespace std;

int main(){
        long long a, b, c , _a, _b, result, carry;


        while (scanf("%lld %lld",&a,&b)){
                if ( !a && !b) break;
                carry = c = 0;
                while (a || b){
                        _a=a%10;
                        a/=10;
                        _b=b% 10;
                        b/=10;

                        result = _a + _b + c;
                        if (result>9){
                                c=1;
                                carry++;
                        }
                        else
                                c=0;
                }
                if (!carry){
                        printf("No carry operation.\n");
                }
                else if (carry == 1){
                        printf("1 carry operation.\n");
                }
                else
                        printf("%lld carry operations.\n",carry);
        }

return 0;
}
```

Output:



```
123 456
No carry operation.
555 555
3 carry operations.
123 594
1 carry operation.
0 0


...Program finished with exit code 0
Press ENTER to exit console.
```

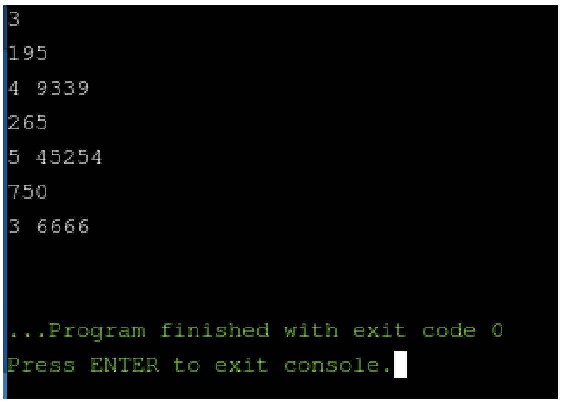
B) Reverse and Add

Program:

```
#include <iostream>
using namespace std;
long Reverse(long x)
{
        long newX(0);
        while (x)
        {
                newX *= 10;
                newX += x % 10;
                x /= 10;
        }
        return newX;
}
int main()
{
        int numberOfCases;
        cin >> numberOfCases;
        for (int i = 0; i < numberOfCases; ++i)
        {
                long number;
                cin >> number;
                long reverseNumber = Reverse(number);
                int count(0);
                while (reverseNumber != number)
                {
                        number += reverseNumber;
```

```
            reverseNumber = Reverse(number);
            ++count;
        }
        cout << count << " " << number << endl;
    }
}
```

Output:



```
3
195
4 9339
265
5 45254
750
3 6666


...Program finished with exit code 0
Press ENTER to exit console.
```

Experiment No. 10

****

Title: A) A multiplication game.
B) Polynomial coefficients.

Name: Shivlal Arun Yadav
Class: TE CSE **Batch:** T1 **Roll No:** 3011

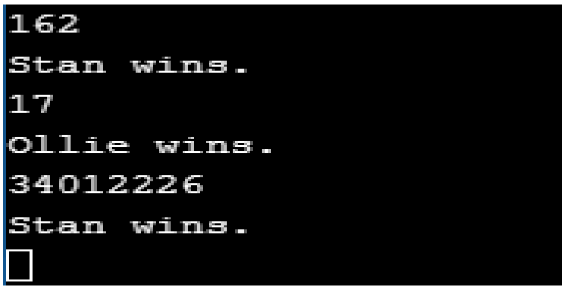
****

A) A multiplication game.

Program Code:

```
#include<iostream>
using namespace std;
int main(){
    long long n;
    int cont;
    while(cin>>n){
       if(n==1){
  cout<<"Stan wins."<<endl;
            continue;
        }
        cont=0;
        while(n>1){
            cont++;
            if(cont%2==1) n=(n+8)/9;
            else n=(n+1)/2;
        }
        if(cont%2==1) cout<<"Stan wins."<<endl;
        else cout<<"Ollie wins."<<endl;
    }
    return 0;
}
```

Output:



```
162
Stan wins.
17
Ollie wins.
34012226
Stan wins.
```

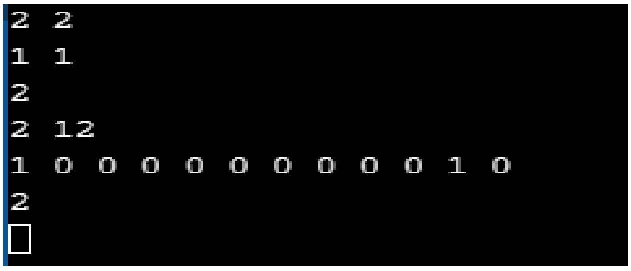
B) Polynomial coefficients.

Program Code:

```
#include <iostream>
```

```
using namespace std;
int main()
{
    int fac[13];
    fac[0] = 1;
    for (int i = 1; i < 13; ++i)
        fac[i] = i * fac[i - 1];
    int n, k;
    while (cin >> n >> k)
    {
        // Coefficient = n!/(n1! n2! n3!...)
        int product = 1;
        for (int i = 1; i <= k; ++i)
        {
            int n_i;
            cin >> n_i;
            product *= fac[n_i];
        }
        cout << fac[n] / product << endl;
    }
    return 0;
}
```

Output:



```
2 2
1 1
2
2 12
1 0 0 0 0 0 0 0 0 0 1 0
2
```

Experiment No. 11

****

Title: A) How many fibs?
B) How many pieces of land?

Name: Shivlal Arun Yadav
Class: TE CSE **Batch:** T1 **Roll No:** 3011

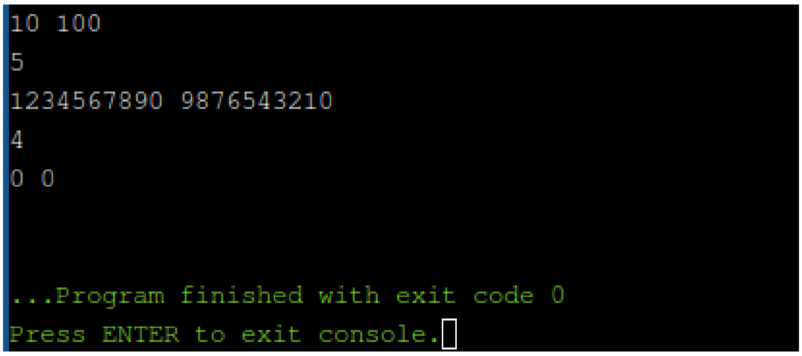
****

A) How many fibs?

Program:

```
#include<stdio.h>
#include<string.h>
#define MAX(x,y) ( (x) >= (y) ? (x) : (y) )
char str1[10000],str2[10000],str3[10000];
char a[10000],b[10000];
bool bigger(char t1[],char t2[]){
        int len1=strlen(t1);
        int len2=strlen(t2);
        if(len1>len2)
                return true;
        else if(len1<len2)
                return false;
        else{
                for(int i=0;i<len1;i++)
                        if(t1[i]>t2[i])
                                return true;
                        else if(t1[i]<t2[i])
                                return false;
                return true;
        }
}
bool contain(char str[]){
        if(bigger(str,a)&&bigger(b,str))
                return true;
        else
                return false;
}
void plus(char str1[],char str2[],char str3[]){
        int len1=strlen(str1);
        int len2=strlen(str2);
        int len3=MAX(len1,len2)+1;
        int i,j,k,temp,carry;
        str3[len3]='\0';
        for(i=len1-1,j=len2-1,k=len3-1,carry=0;i>=0||j>=0;){
                if(i>=0&&j>=0)
                        temp=str1[i--]-'0'+str2[j--]-'0'+carry;
                else if(i>=0)
                        temp=str1[i--]-'0'+carry;
                else
                        temp=str2[j--]-'0'+carry;
                carry=temp/10;
                temp%=10;
                str3[k--]='0'+temp;
        }
        str3[k]='0'+carry;
        if(str3[0]=='0')
                memmove(str3,str3+1,sizeof(char)*len3);
}
int main(){
        while(scanf("%s%s",a,b)==2){
                if(a[0]=='0'&&b[0]=='0')
                        break;
                str1[0]='1',str1[1]='\0';
                str2[0]='2',str2[1]='\0';
                int count=0;
                if(contain(str1))
                        count++;
                if(contain(str2))
                        count++;
                while(!bigger(str2,b)){
                        plus(str1,str2,str3);
                        if(contain(str3))
                                count++;
                        memmove(str1,str2,sizeof(str1));
                        memmove(str2,str3,sizeof(str2));
                }
                printf("%d\n",count);
        }
        return 0;
}
```

Output:



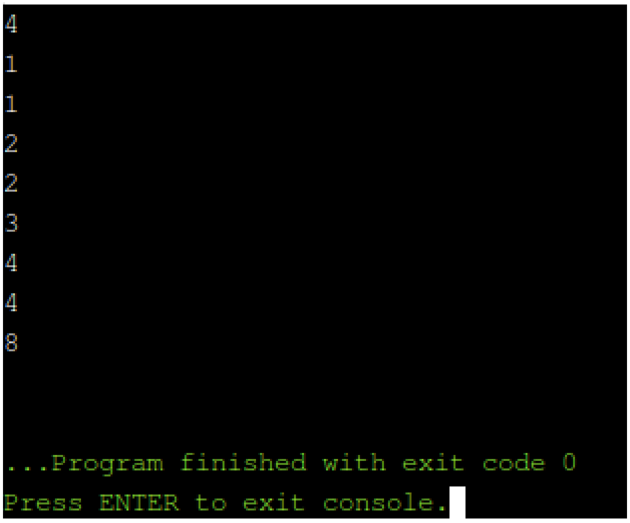
```
10 100
5
1234567890 9876543210
4
0 0


...Program finished with exit code 0
Press ENTER to exit console.
```

B) How many pieces of land?

Program:

```
import java.io.*;
import java.math.BigDecimal;
import java.math.BigInteger;
import java.util.*;
public class Main
{
     public static void main(String args[])
    {
        BigDecimal a = new BigDecimal("0");
        BigDecimal b = new BigDecimal("0");
        BigDecimal c = new BigDecimal("0");
         Scanner s = new Scanner(System.in);
         long n;
         n = s.nextInt();
         for (int i=0; i<n; i++)
         {
             a = s.nextBigDecimal();
             b = a.multiply( a.subtract(BigDecimal.valueOf(1)));
             b = b.multiply(a.subtract(BigDecimal.valueOf(2)));
             b =  b.multiply(a.subtract(BigDecimal.valueOf(3)));
             b = b.divide(BigDecimal.valueOf(24));
             c = a.multiply(a.subtract(BigDecimal.valueOf(1)));
             c = c.divide(BigDecimal.valueOf(2));
             b = b.add(c);
             b = b.add(BigDecimal.valueOf(1));
             System.out.printf("%s\n", b.toString());
         }
    }
}
```

Output:



```
4
1
1
2
2
3
4
4
8


...Program finished with exit code 0
Press ENTER to exit console.
```

Experiment No. 12

****

Title: A) Complete Tree Labeling
B) Steps

Name: Shivlal Arun Yadav
Class: TE CSE **Batch:** T1 **Roll No:** 3011

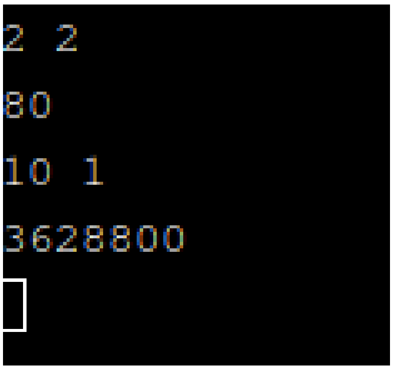
****

A) Complete Tree Labeling

Program:

```
import java.util.Scanner;
import java.util.HashMap;
import java.math.BigInteger;
class Main {
  static int numberOfNodes(int k, int d) {
    // number of nodes for a k-ary tree of depth d
    return ((int)Math.pow((double)k, (double)d + 1.0) - 1) / (k - 1);
  }
  static BigInteger factorial(int n) {
    BigInteger f = BigInteger.ONE;
    for (int i = 1; i <= n; i++)
      f = f.multiply(BigInteger.valueOf(i));
    return f;
  }
  static HashMap<Long, BigInteger> combinationCache =
    new HashMap<Long, BigInteger>();
  static BigInteger combination(int n, int k) {
    if (k == 0 || n == k)
      return BigInteger.ONE;
    else {
      long nk = (long)n << 32 | k;
      BigInteger c = combinationCache.get(nk);
      if (c != null)
        return c;
      c = factorial(n).divide(factorial(n - k).multiply(factorial(k)));
      combinationCache.put(nk, c);
      return c;
    }
  }
  static HashMap<Long, BigInteger> cache = new HashMap<Long, BigInteger>();
  static BigInteger completeTreeLabeling(
    int k /* branching factor */, int d /* depth */) {
    if (k == 1)
      return BigInteger.ONE;
    long kd = (long)k << 32 | d;
    BigInteger nrLabeling = cache.get(kd);
    if (nrLabeling != null)
      return nrLabeling;
  nrLabeling = factorial(k);
  if (d > 1) {
   // number of nodes for a k-ary tree of depth d
   int nrNodes = numberOfNodes(k, d);
   // number of descendants of the root node for a k-ary tree of depth (d - 1)
   int nrDescendants = numberOfNodes(k, d - 1) - 1;
   // number of labeling for a k-ary tree of depth (d - 1)
   BigInteger nrDescendantsLabeling = completeTreeLabeling(k, d - 1);
   for (int i = nrNodes - 2; i >= nrDescendants; i -= nrDescendants + 1) {
    BigInteger c = combination(i, nrDescendants);
    nrLabeling = nrLabeling.multiply(c).multiply(nrDescendantsLabeling);
   }
  }
  cache.put(kd, nrLabeling);
  return nrLabeling;
 }
 public static void main(String[] args) {
  Scanner sc = new Scanner(System.in);
  while (sc.hasNextInt()) {
   int k = sc.nextInt();
   if (sc.hasNextInt()) {
    int d = sc.nextInt();
    System.out.println(completeTreeLabeling(k, d));
   }
  }
 }
}
```

Output:



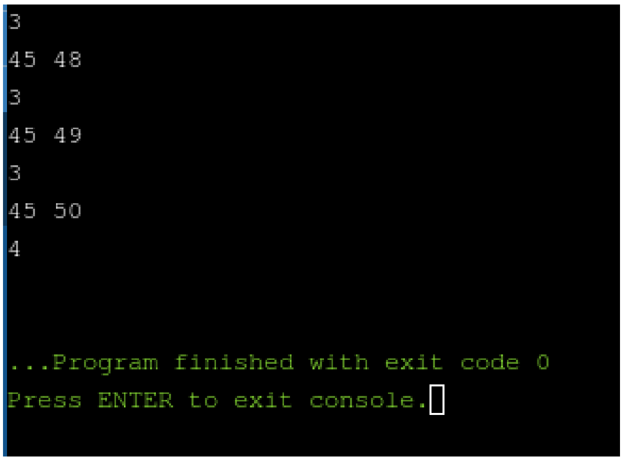
```
2 2
80
10 1
3628800
```

B) Steps

Program:

```
#include <stdio.h>
#include <math.h>
int main() {
        int t, x, y, L;
        scanf("%d", &t);
        while(t--) {
                scanf("%d %d", &x, &y);
                L = y-x;
                int steps = 0, n = (int)sqrt(L);
                steps = n;
                L -= n*(n+1)/2;
                while(L > 0) {
                        while(n*(n+1)/2 > L)
                                n--;
                        if(n*(n+1)/2 == L)
                                L = 0, steps += n;
                        else
                                L -= n, steps ++;
                }
                printf("%d\n", steps);
        }
    return 0;
}
```

Output:



```
3
45 48
3
45 49
3
45 50
4


...Program finished with exit code 0
Press ENTER to exit console.
```