B.NIKITHA
230701211
CSE -'D'
III SEM

Dynamic Programming

1-DP-Playing with Numbers

Playing with Numbers:

Ram and Sita are playing with numbers by giving puzzles to each other. Now it was Ram term, so he gave Sita a positive integer 'n' and two numbers 1 and 3. He asked her to find the possible ways by which the number n can be represented using 1 and 3.Write any efficient algorithm to find the possible ways.

Example 1:

Input: 6
Output:6
Explanation: There are 6 ways to 6 represent number with 1 and 3

```
        1+1+1+1+1+1
        3+3
        1+1+1+3
        1+1+3+1
        1+3+1+1
        3+1+1+1
```

Input Format
First Line contains the number n

Output Format

Print: The number of possible ways 'n' can be represented using 1 and 3

Sample Input

6

Sample Output

6

Answer:(penalty regime: 0 %)

```
#include<stdio.h>
int main(){
    int n;
    scanf("%d",&n);
    long long a[n+1];
    a[0]=1;
    a[1]=1;
    for(int i=2;i<n+1;i++){
        a[i]=0;
        if(i-1>=0){
            a[i]+=a[i-1];
        }
        if(i-3>=0){
            a[i]+=a[i-3];
        }
    }
    printf("%lld",a[n]);

}
```

Feedback

```
Input            Expected          Got
6                6                 6
25                8641             8641
100                24382819596721629   24382819596721629
```

Passed all tests!

2-DP-Playing with chessboard
Playing with Chessboard:

Ram is given with an n*n chessboard with each cell with a monetary value. Ram stands at the (0,0), that the position of the top left white rook. He is been given a task to reach the bottom right black rook position (n-1, n-1) constrained that he needs to reach the position by traveling the maximum monetary path under the condition that he can only travel one step right or one step down the board. Help ram to achieve it by providing an efficient DP algorithm.

Example:
Input
3
1 2 4
2 3 4
8 7 1
Output:
19

Explanation:
Totally there will be 6 paths among that the optimal is
 Optimal path value:1+2+8+7+1=19

Input Format
First Line contains the integer n
The next n lines contain the n*n chessboard values

Output Format

Print Maximum monetary value of the path

Answer:(penalty regime: 0 %)

```
#include<stdio.h>
int main(){
    int n;
    scanf("%d",&n);
    int c[n][n];
    for(int i=0;i<n;i++){
        for(int j=0;j<n;j++){
            scanf("%d",&c[i][j]);
        }
    }
    int max(int a,int b){
        if(a>b)
        return a;
        else
        return b;
    }
    int dp[n][n];
    dp[0][0]=c[0][0];
    for(int j=1;j<n;j++){
        dp[j][0]=dp[j-1][0]+c[j][0];
    }
    for(int i=1;i<n;i++){
        dp[0][i]=dp[0][i-1]+c[0][i];
    }
    for(int i=1;i<n;i++){
        for(int j=1;j<n;j++){
            dp[i][j]=c[i][j]+max(dp[i-1][j],dp[i][j-1]);}
    }
    printf("%d",dp[n-1][n-1]);


}
```

Feedback

Input	Expected	Got

3
1 2 4
2 3 4
8 7 1
	19	19

3
1 3 1
1 5 1
4 2 1
	12	12

4
1 1 3 4
1 5 7 8
2 3 4 6
1 6 9 0
	28	28

Passed all tests!

Correct

Marks for this submission: 10.00/10.00.

3-DP-Longest Common Subsequence

Given two strings find the length of the common longest subsequence(need not be contiguous) between the two.

Example:

s1: ggtabe

s2: tgatasb

The length is 4

Solveing it using Dynamic Programming

For example:

Input	Result
aab azb	2

Answer:(penalty regime: 0 %)

```
#include<stdio.h>
#include <string.h>
#include <stdlib.h>
int max(int x, int y);
int lcs(const char *S1, const char *S2) {
    int m = strlen(S1);
    int n = strlen(S2);
    int dp[m + 1][n + 1];
    for (int i = 0; i <= m; i++) {
        for (int j = 0; j <= n; j++) {
            if (i == 0 || j == 0)
                dp[i][j] = 0;
            else if (S1[i - 1] == S2[j - 1])
                dp[i][j] = dp[i - 1][j - 1] + 1;
            else
                dp[i][j] = max(dp[i - 1][j], dp[i][j - 1]);
        }
    }

    return dp[m][n];
}

int max(int x, int y) {
    return (x > y) ? x : y;
}

int main() {
    char S1[20];
    char S2[20];
    scanf("%s",S1);
    scanf("%s",S2);
    int m=lcs(S1,S2);
    printf("%d",m);

    return 0;
}
```

Feedback

```
Input Expected Got
aab     2               2
azb
ABCD    4               4
ABCD
Passed all tests!
```

4-DP-Longest non-decreasing Subsequence

Problem statement:

Find the length of the Longest Non-decreasing Subsequence in a given Sequence.

Eg:

Input:9

Sequence:[-1,3,4,5,2,2,2,2,3]

the subsequence is [-1,2,2,2,2,3]

Output:6

Answer:(penalty regime: 0 %)

```
#include<stdio.h>
int main(){
int n,maxLength;
scanf("%d",&n);
int arr[n];
for(int i=0;i<n;i++){
    scanf("%d",&arr[i]);
}
int dp[n];
for(int i=0;i<n;i++){
dp[i]=1;
}
for(int i=1;i<n;i++){
    for(int j=0;j<i;j++){
        if(arr[j]<=arr[i] && dp[i] ){
            dp[i]=dp[j]+1;
}
}
}
for(int i=0;i<n;i++){
    if(dp[i]>maxLength){
maxLength=dp[i];
}
}
printf("%d",maxLength);
}
```

Feedback

```
Input                  Expected Got
9
-1 3 4 5 2 2 2 2 3      6               6
7
1 2 2 4 5 7 6           6               6
```

Passed all tests!

Correct
Marks for this submission: 1.00/1.00.