RAJALAKSHMI ENGINEERING COLLEGE

RAJALAKSHMI NAGAR, THANDALAM – 602 105

RAJALAKSHMI
ENGINEERING COLLEGE

CS23331

DESIGN AND ANALYSIS OF ALGORITHM LAB

Laboratory Observation Notebook

Name : . . . . . .

Year / Branch / Section : . . . . . .

Register No. : . . . . . .

Semester : . . . . . .

Academic Year : . . . . . .

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WEEK 05

DYNAMIC PROGRAMMING

1) 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

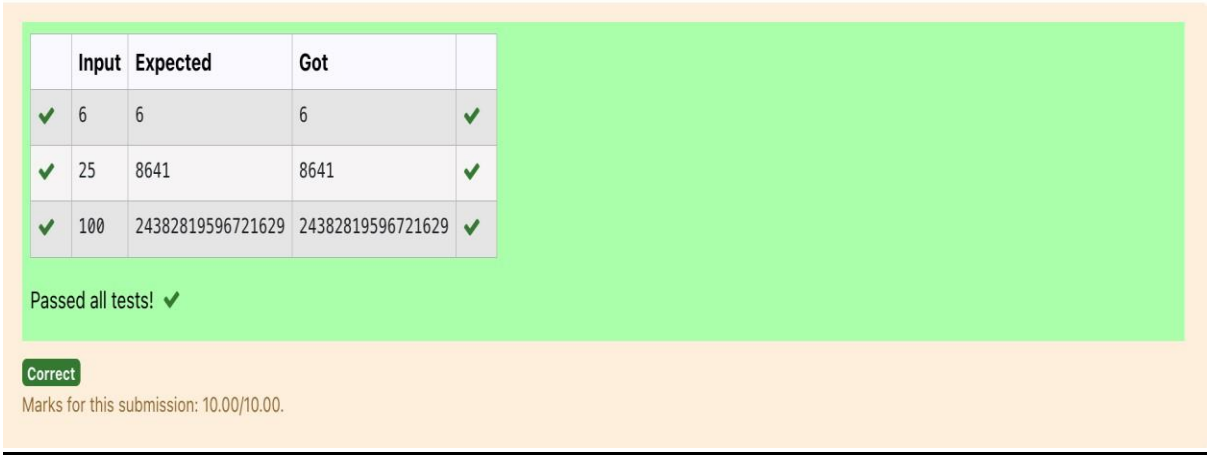
6

CODE:

```
#include <stdio.h> #include
<stdlib.h> long long
countWays(int n) {     if (n <
0) return 0;     if (n == 0)
return 1;
   long long *dp = (long long*)calloc(n + 1, sizeof(long long));
dp[0] = 1;     dp[1] = 1;     dp[2] = 1;
```

```
   for (int i = 3; i <= n; i++) {
dp[i] = dp[i-1] + dp[i-3];
   }
   long long result = dp[n];
free(dp);     return result;
}
int main() {
int n;
   scanf("%d", &n);     long long
ways = countWays(n);
printf("%lld\n", ways);     return 0;
}
```

OUTPUT:



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

Passed all tests! ✔

Correct

Marks for this submission: 10.00/10.00.

2) 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

CODE:

```
#include <stdio.h>
#include <stdlib.h> int
max(int a, int b) {
return (a > b) ? a : b;
}
int findMaxPath(int n, int **board) {     int
**dp = (int **)malloc(n * sizeof(int *));
for (int i = 0; i < n; i++) {         dp[i] = (int
*)malloc(n * sizeof(int));
    }
    dp[0][0] = board[0][0];     for (int j =
1; j < n; j++) {         dp[0][j] = dp[0][j-1]
+ board[0][j];
    }
```

```
   for (int i = 1; i < n; i++) {
dp[i][0] = dp[i-1][0] + board[i][0];
   }
   for (int i = 1; i < n; i++) {
for (int j = 1; j < n; j++) {
          dp[i][j] = max(dp[i-1][j], dp[i][j-1]) + board[i][j];
       }
   }
   int result = dp[n-1][n-1];
   for (int i = 0; i < n; i++) {
free(dp[i]);
   }
   free(dp);
return result;
}
int main() {    int n;
scanf("%d", &n);

   int **board = (int **)malloc(n * sizeof(int *));
for (int i = 0; i < n; i++) {
       board[i] = (int *)malloc(n * sizeof(int));
for (int j = 0; j < n; j++) {            scanf("%d",
&board[i][j]);
       }
   }
```

```
    int maxPath = findMaxPath(n, board);
printf("%d\n", maxPath);

    // Free the board array
for (int i = 0; i < n; i++) {
free(board[i]);
    }
    free(board);
return 0;
}
```

OUTPUT:

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

Example:

s1: ggtabe

s2: tgatasb

s1		**a**	**g**	**g**	**t**	**a**	**b**
s2	**g**	**x**	**t**	**x**	**a**	**y**	**b**

The length is 4

Solving it using Dynamic Programming For example:

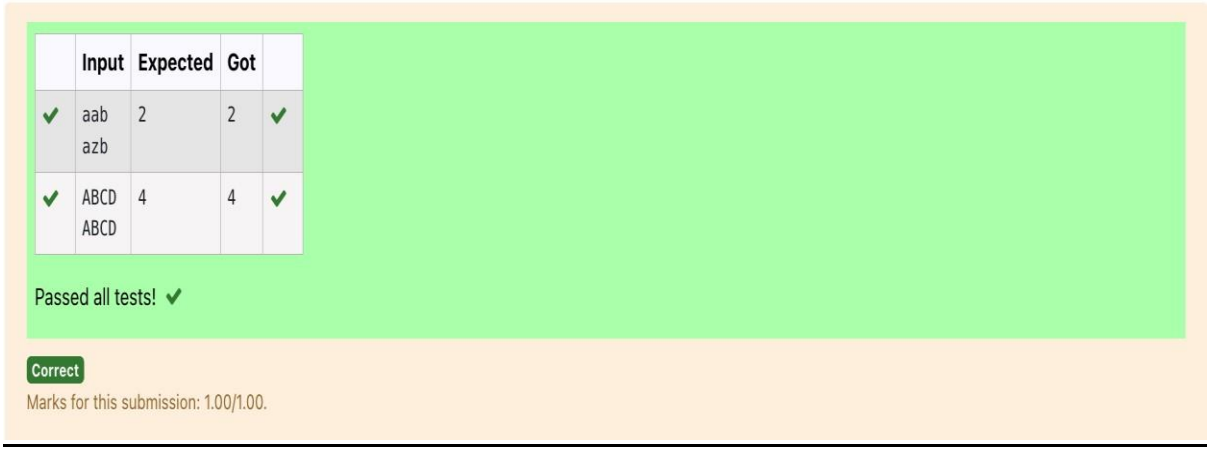
Input	Result
aab azb	2

CODE:

```
#include <stdio.h>
#include <string.h> int
lcs(char *s1, 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;  // LCS of any string with an empty string is 0
         }
         else if (s1[i-1] == s2[j-1]) {
            dp[i][j] = dp[i-1][j-1] + 1;  // Characters match
         }
else {
            dp[i][j] = (dp[i-1][j] > dp[i][j-1]) ? dp[i-1][j] : dp[i][j-1
         }
      }
   }
     return dp[m][n];
}
int main() {     char
s1[100], s2[100];
scanf("%s %s", s1, s2);
```

```
int result = lcs(s1, s2);
printf("%d\n", result);
return 0;
}
```

OUTPUT:



	Input	Expected	Got	
✔	aab azb	2	2	✔
✔	ABCD ABCD	4	4	✔

Passed all tests! ✔

Correct

Marks for this submission: 1.00/1.00.

4) 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]

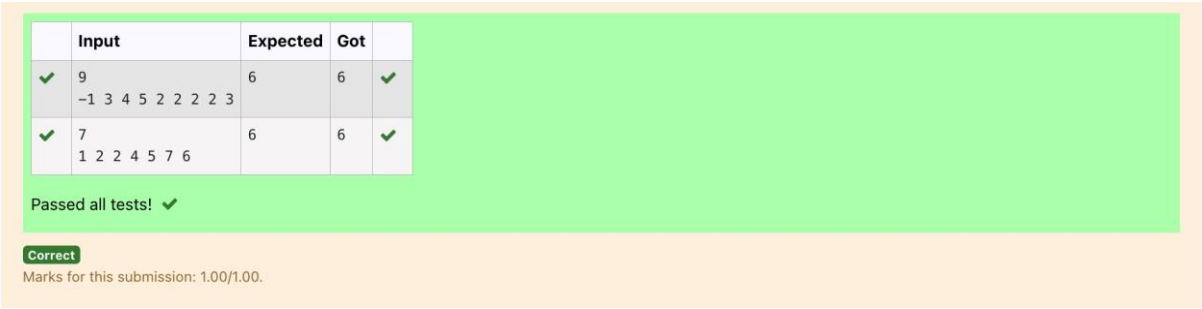
Output:6

CODE:

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

```
for (i = 1; i < n; i++) {
for (j = 0; j < i; j++) {
if (a[j] <= a[i]) {
            b[i] = b[i] > (b[j] + 1) ? b[i] : (b[j] + 1);
        }
      }
      if(b[i]>max)
max=b[i];
   }
   printf("%d",max);
}
```

OUTPUT:



	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.