Count number of ways to fill a “n x 4″ grid using “1 x 4″ tiles

Given a number n, count number of ways to fill a n x 4 grid using 1 x 4 tiles.

Examples:

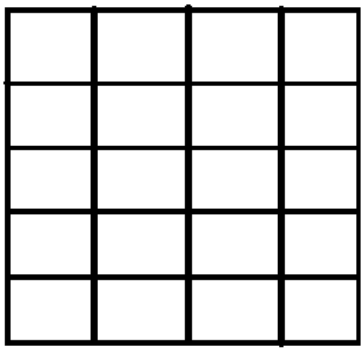
```
Input : n = 1
Output : 1

Input : n = 2
Output : 1
We can only place both tiles horizontally

Input : n = 3
Output : 1
We can only place all tiles horizontally.

Input : n = 4
Output : 2
The two ways are :
  1) Place all tiles horizontally
  2) Place all tiles vertically.

Input : n = 5
Output : 3
We can fill a 5 x 4 grid in following ways :
  1) Place all 5 tiles horizontally
  2) Place first 4 vertically and 1 horizontally.
  3) Place first 1 horizontally and 4 horizontally.
```

We strongly recommend that you click here and practice it, before moving on to the solution.

This problem is mainly an extension of this tiling problem

Let **“count(n)” be the count of ways to place tiles on a “n x 4″ grid**, following two cases arise when we place the first tile.

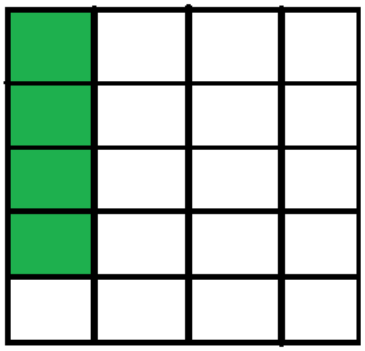
1. **Place the first tile horizontally** : If we place first tile horizontally, the problem reduces to “count(n-1)”
2. **Place the first tile vertically** : If we place first tile vertically, then we must place 3 more tiles vertically. So the problem reduces to “count(n-4)”



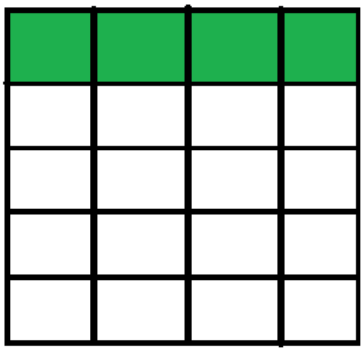
Grid

Tile

Two cases arise after placing first tile



Place first tile horizontally



Place first tile vertically

Therefore, count(n) can be written as below.

```
count(n) = 1 if n = 1 or n = 2 or n = 3
count(n) = 2 if n = 4
count(n) = count(n-1) + count(n-4)
```

This recurrence is similar to Fibonacci Numbers and can be solved using Dynamic programming.

C/C++

```
// C++ program to count of ways to place 1 x 4 tiles
// on n x 4 grid.
#include<iostream>
using namespace std;

// Returns count of count of ways to place 1 x 4 tiles
// on n x 4 grid.
int count(int n)
{
    // Create a table to store results of subproblems
    // dp[i] stores count of ways for i x 4 grid.
    int dp[n+1];
    dp[0] = 0;
```

```
    // Fill the table from d[1] to dp[n]
    for (int i=1; i<=n; i++)
    {
        // Base cases
        if (i >= 1 && i <= 3)
            dp[i] = 1;
        else if (i==4)
            dp[i] = 2 ;

        else
            // dp(i-1) : Place first tile horizontally
            // dp(n-4) : Place first tile vertically
            //           which means 3 more tiles have
            //           to be placed vertically.
            dp[i] = dp[i-1] + dp[i-4];
    }

    return dp[n];
}

// Driver program to test above
int main()
{
    int n = 5;
    cout << "Count of ways is " << count(n);
    return 0;
}
```

Run on IDE

Python

```
# Python program to count of ways to place 1 x 4 tiles
# on n x 4 grid.

# Returns count of count of ways to place 1 x 4 tiles
# on n x 4 grid.
def count(n):

    # Create a table to store results of subproblems
    # dp[i] stores count of ways for i x 4 grid.
    dp = [0 for _ in range(n+1)]

    # Fill the table from d[1] to dp[n]
    for i in range(1,n+1):

        # Base cases
        if i <= 3:
            dp[i] = 1
        elif i == 4:
            dp[i] = 2
        else:
            # dp(i-1) : Place first tile horizontally
            # dp(n-4) : Place first tile vertically
            #           which means 3 more tiles have
            #           to be placed vertically.
            dp[i] = dp[i-1] + dp[i-4]

    return dp[n]

# Driver code to test above
n = 5
print ("Count of ways is"),
print (count(n))
```

Run on IDE