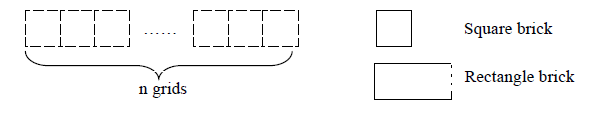
**HW W6-2:**

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1. A worker is tiling a road with n square grids, there are two different kinds of bricks available, one is the square brick and the other is the rectangle brick which covers 2 grids. Please count the total different ways the road can be tiled.



Letdenote the solution for, i.e. the number of tilings forsquare grids. We can directly write a recursive formula foras:

The intuition behind this is:

1. If we already have a valid tiling ofgrids, there is only one way to finish it: use a single square brick.
2. If we already have a valid tiling ofgrids, there are two ways to finish it: we either use two square bricks, or a single rectangle brick. The latter case is included in a) so we do not have to count it here.

Let us first rearrange the formula:

This is a linear homogeneous recurrence relation. The characteristic equation is

Our candidate closed-form formula for becomes:

Let us use the initial conditions to derive the values of these constants:

Plugging this back into our candidate formula, we get:

**The formula above gives us the number of ways a grid of sizecan be tiled.**

1. **How many different ways to color n grids in a line with red, white or blue colors but no two adjacent grids are colored with red?**

Let denote the solution for, i.e. the number of ways to colorgrids in a line with the colors R, B, W s.t. no two adjacent grids are colored R.

Let denote the number of valid colorings forgrids ending with R.

Let denote the number of valid colorings forgrids ending with B or W.

We know that

Given a coloring for a grid of size, we can construct a coloring for a grid of size: if the last square is R, we have two options (B, W); if the last square is B or W, we have three options (R, B, W).

Using these insights, we can construct by partitioning into solutions ending with R and ones ending with B or W:

A solution for n grids ending in R is constructed by getting the solutions for ending in B or W and appending an R:

A solution for n grids ending in B/W is constructed by getting the solutions for and appending a B or W:

Combining the 3 equations above, we get the linear homogeneous recurrence relation

… whose characteristic equation is

Now, we have our new candidate

Using the initial conditions, we can derive the values of the coefficients:

Thus, the closed-form solution for is:

**Using this formula, we can directly calculate the number of valid colorings for a grid of size n.**