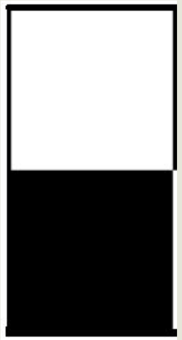
# Board Tiling, Chocolate Breaking with a Hint of Fibonacci

Part III

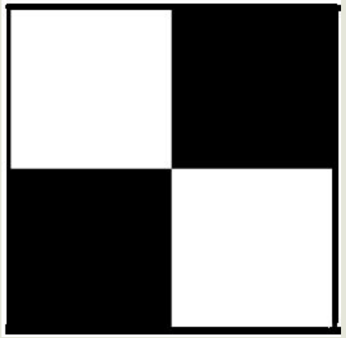
By Harry Main-Luu

## Overarching question for today:

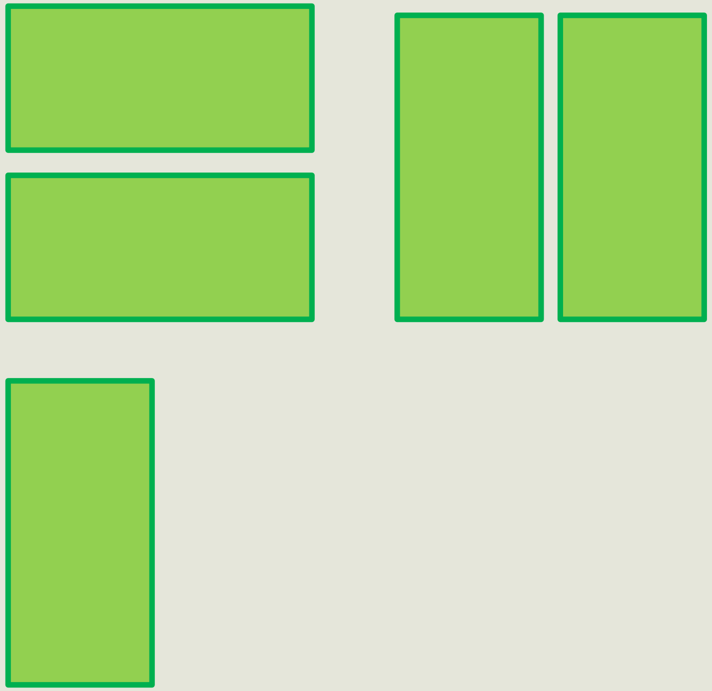
How many ways to break a 2xn chocolate bar into 2x1 pieces to share with n friends?



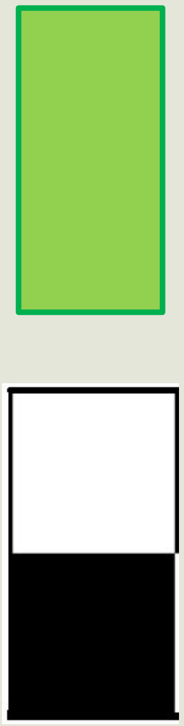
2x1



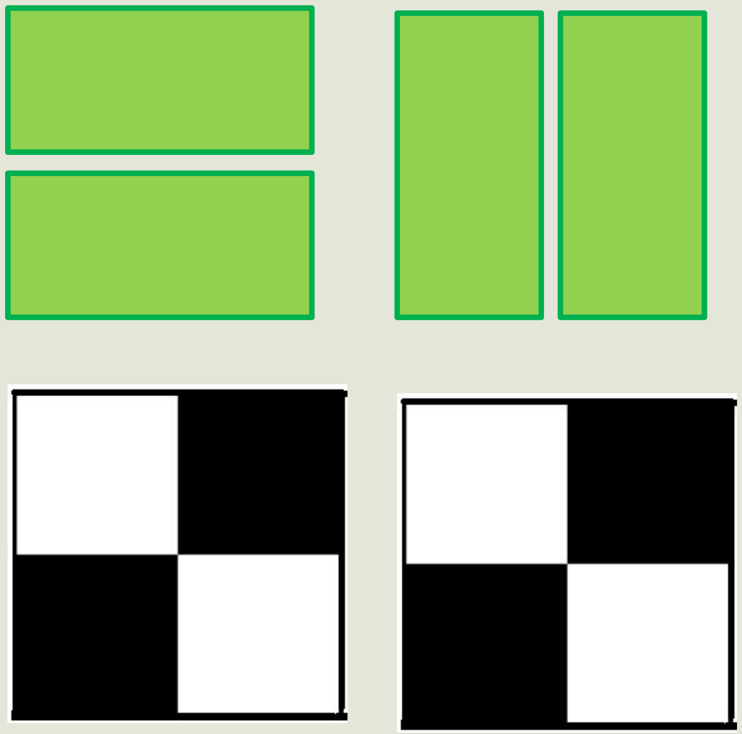
2x2



# Small examples

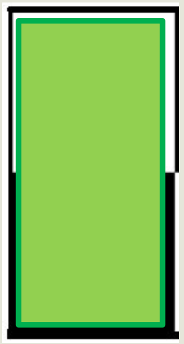


2x1

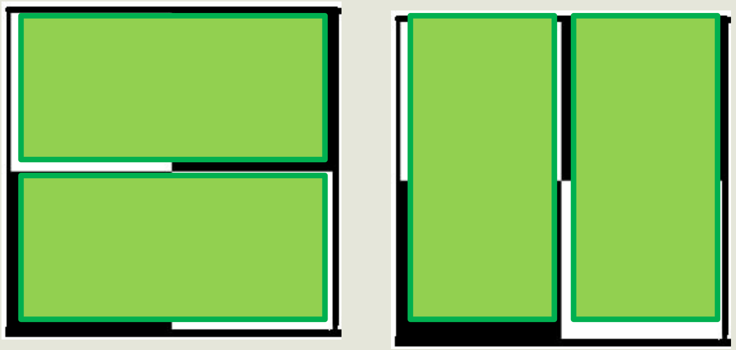


2x2

# Small examples



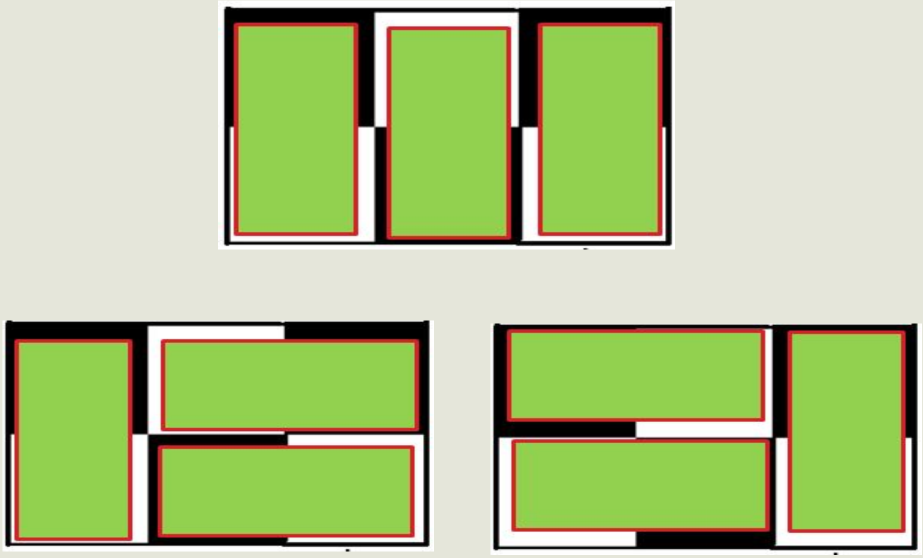
2x1



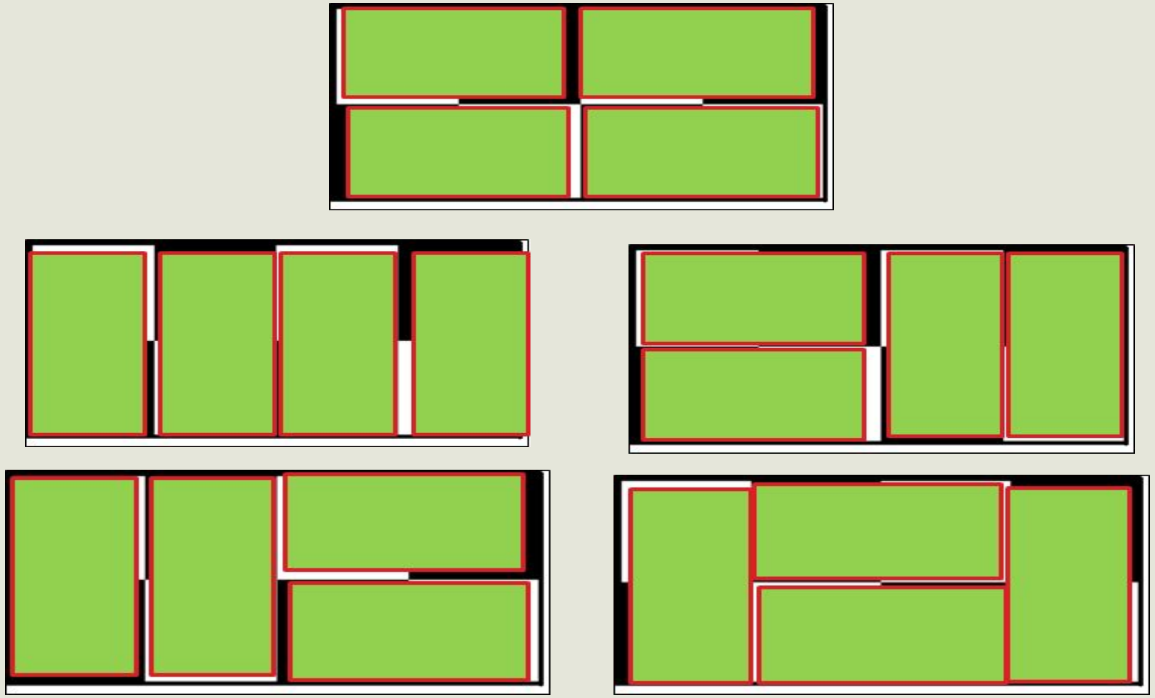
2x2

n=3: 3 ways

n=4: 5 ways



n=3



n=4

# Is there a pattern?

The number of ways to break the chocolate so far looks like:

n=1: 1 way

n=2: 2 ways

n=3: 3 ways

n=4: 5 ways

n=5: 8 ways

.

.

.

# Is there a pattern?

The number of ways to break the chocolate so far looks like:

n=1: 1 way
n=2: 2 ways
n=3: 3 ways
n=4: 5 ways
n=5: 8 ways
.
.
.

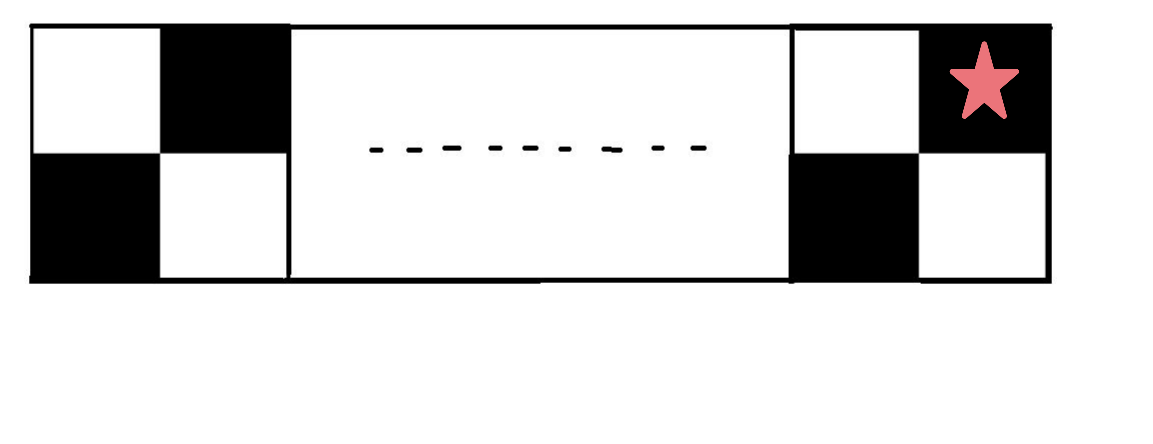
**Hmm…**
**Sounds familiar?**

**But why?**

# Hmm… where did the pattern come from?

Let $a_n$ be the number of ways to break a 2xn bar:

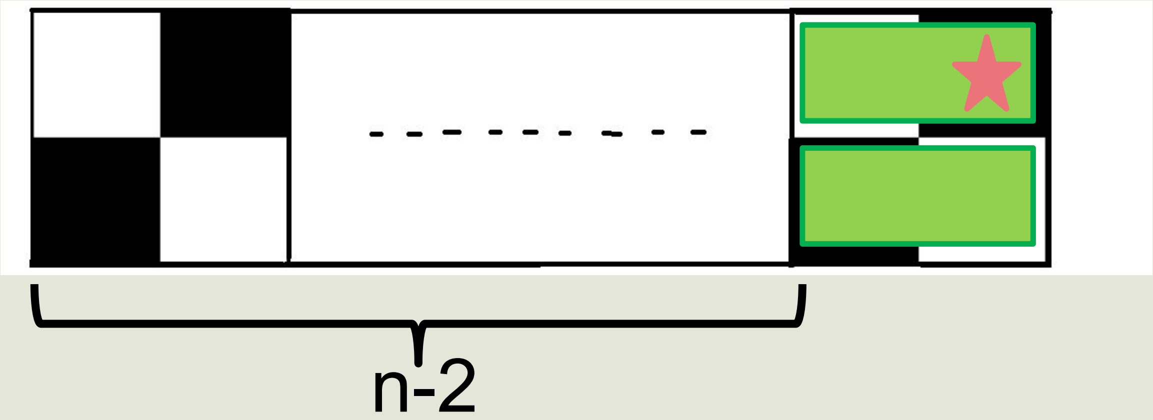
How many ways can we break the special corner?



2xn bar

# Hmm… where did the pattern come from?

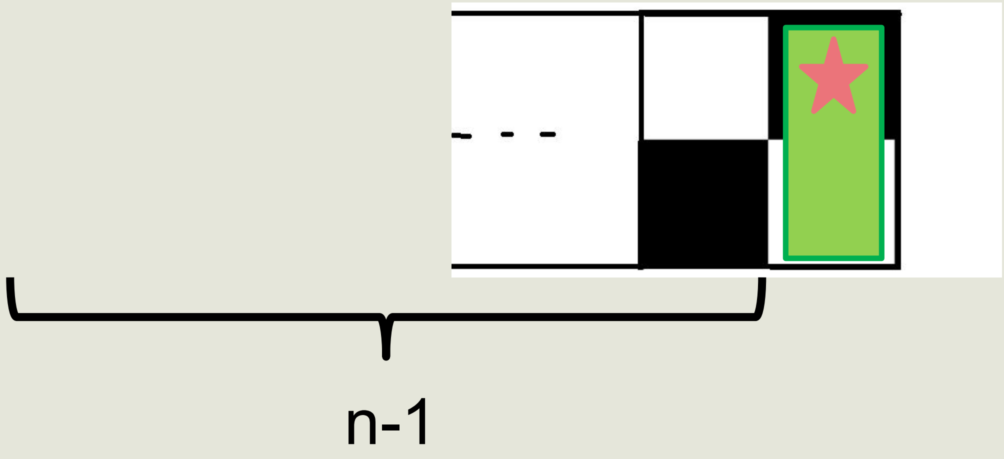
First way:




Then, we have $a_{n-2}$ ways to break the rest.

# Hmm… where did the pattern come from?

Second way:




Then, we have $a_{n-1}$ ways to break the rest.

# That is, total we have:

$$a_n = a_{n-1} + a_{n-2}$$

ways to break the chocolate bar! And there is our Fibonacci Sequence.

But does that answer how many ways we can break a giant chocolate bar, say 2x50?

# Turn to your handout! We will do some serious maths!

To most (if not all) of you, the technical details in the handout will feel overwhelming and intimidating. I'd recommend taking small steps and solving one small calculation at a time.

The hope is that the second or third time you see this derivation, it will become clearer and easier to chew.

Learning and understanding mathematics is a long and enjoyable process. I still find new perspectives and interesting things every time I derive this formula, even though I have done it by hand numerous times.

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I hope you enjoyed some (most) of these sessions. See you next time! ♥