

Introduction of Logic



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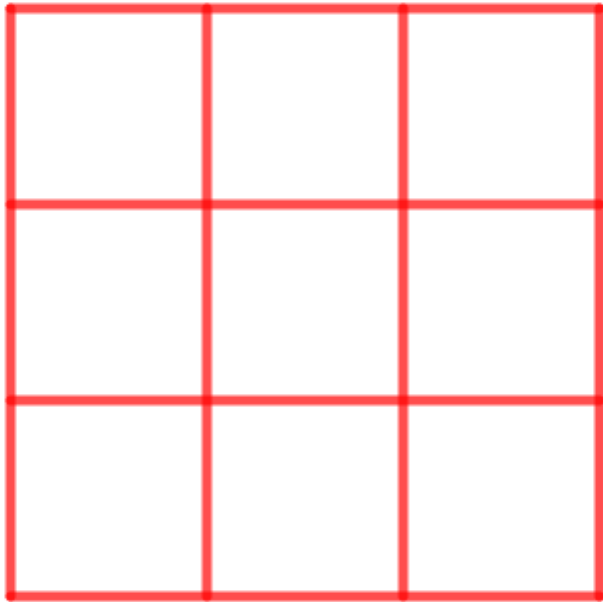
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What does logic mean?

Logic is a particular way of thinking, especially one that is reasonable and based on good judgment:

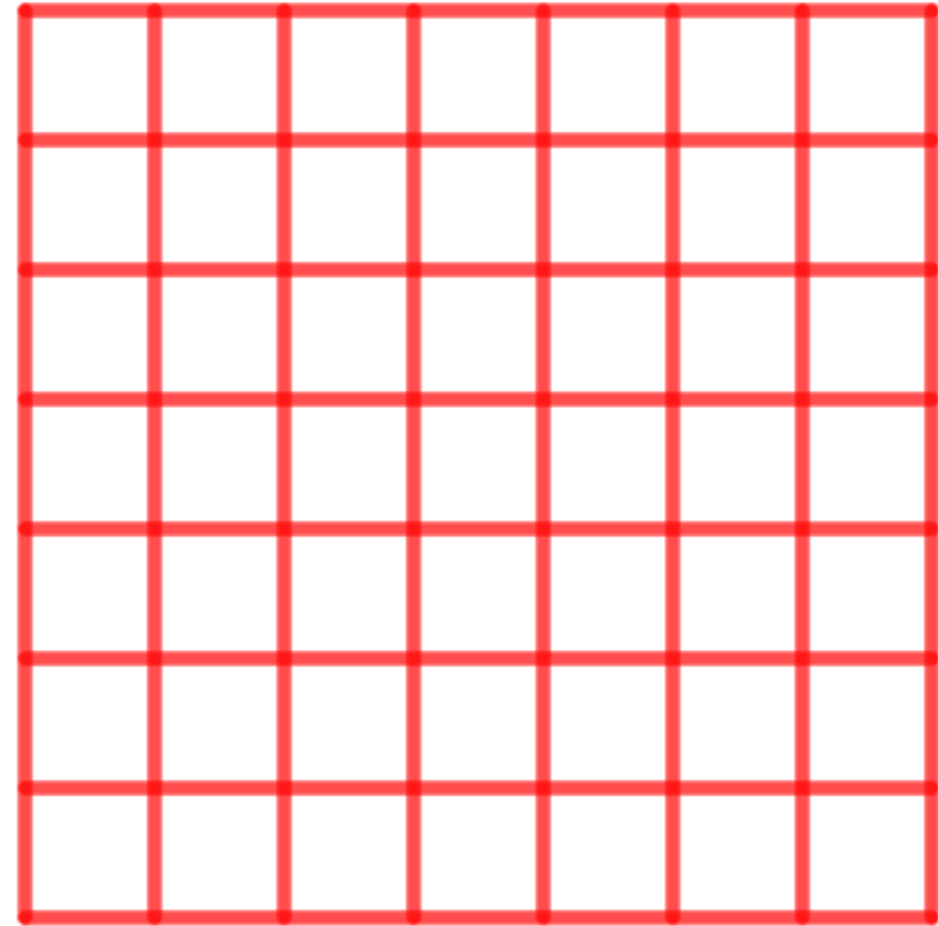
- ❖ *I fail to see the logic behind his argument.*
- ❖ *If prices go up, wages will go up too - that's just logic.*
- ❖ *There's no logic in the decision to reduce staff when orders are the highest they have been for years.*
- ❖ *The **internal** logic of her argument is undeniable.*

How many squares are there in square 3×3 ?



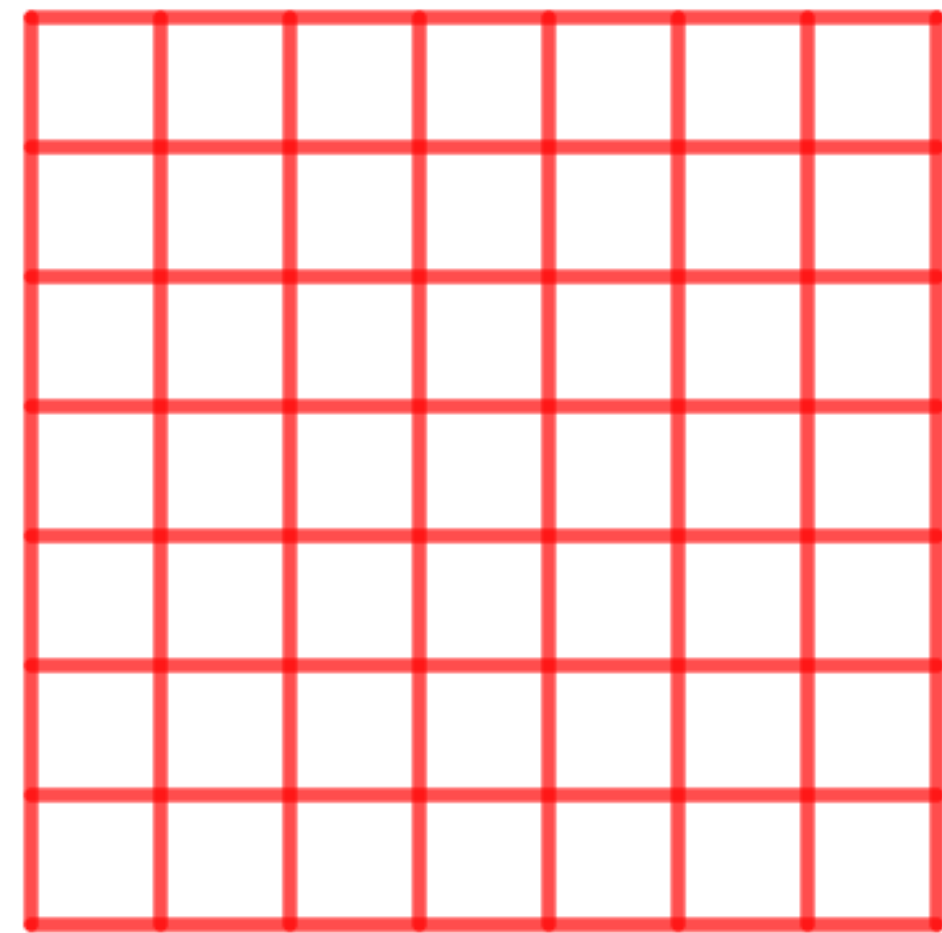
There are 14 squares in square 3×3

How many squares are there in square 7×7 ?



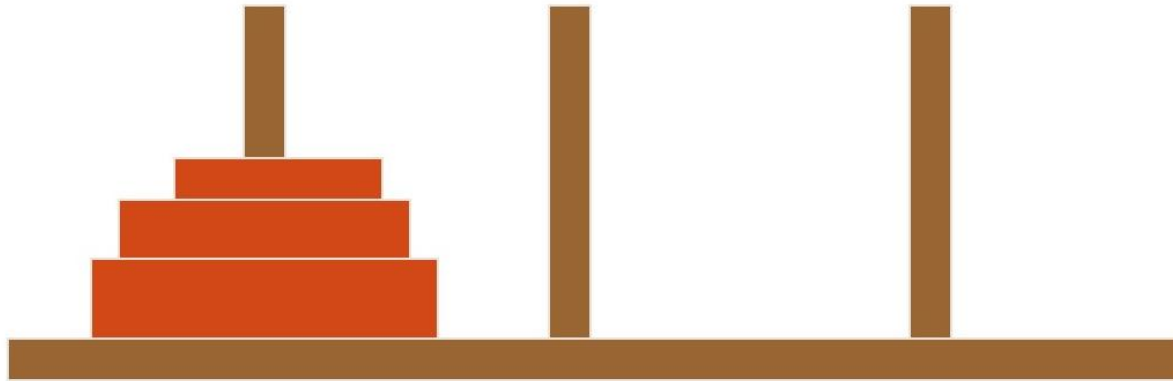
There are 140 squares in square 7×7

How many rectangles are there in square 7×7 ?



There are 784 rectangles in square 7×7

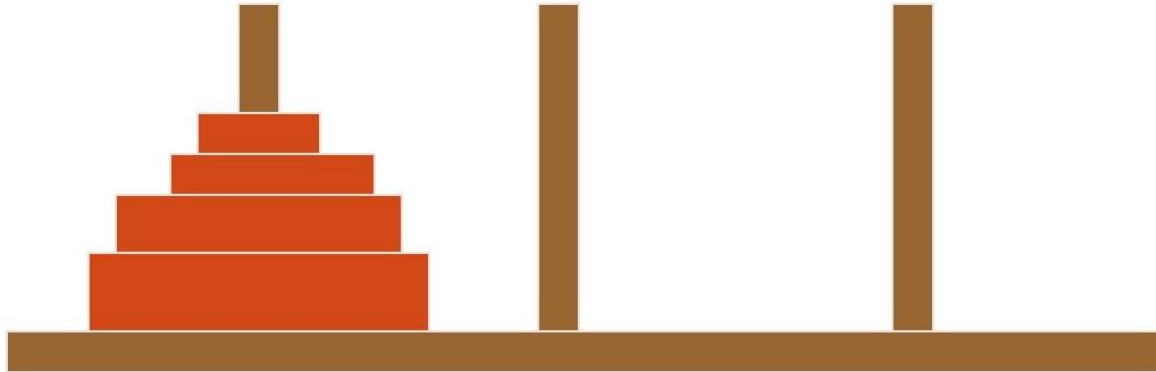
INTRODUCTION TO REAL-WORLD PROBLEM SOLVING

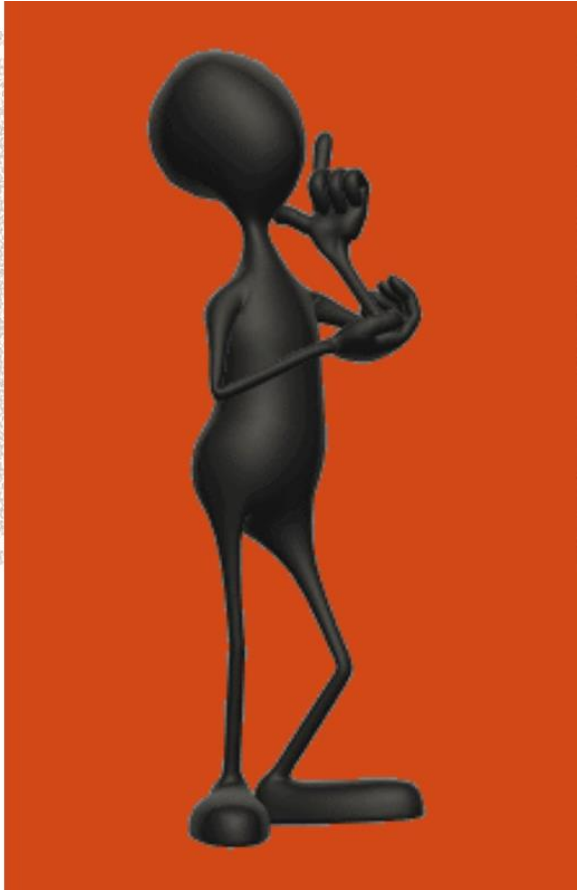


Rule 1 : Move only one disk at a time

Rule 2 : No disk may be placed on top of one smaller than itself

INTRODUCTION TO REAL-WORLD PROBLEM SOLVING





The boy can either jump
one step or two steps.
How many ways can he
climb TWO steps?



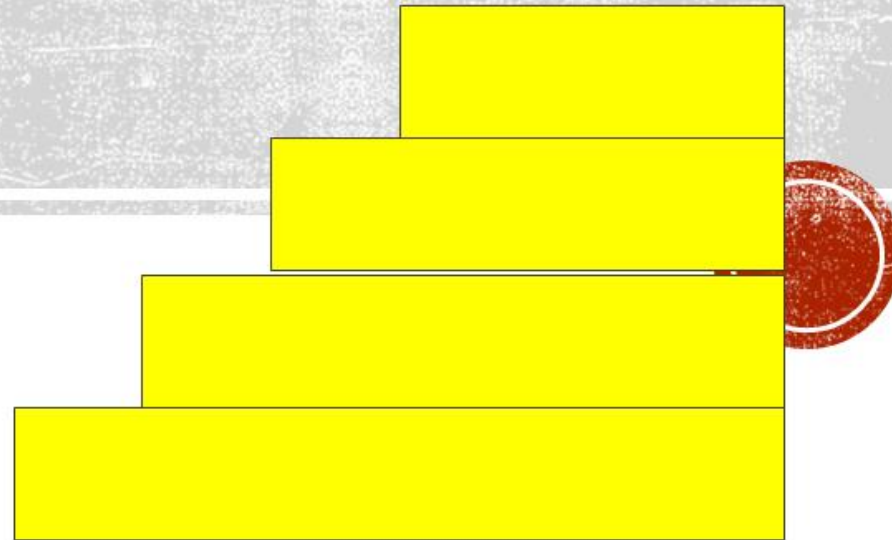


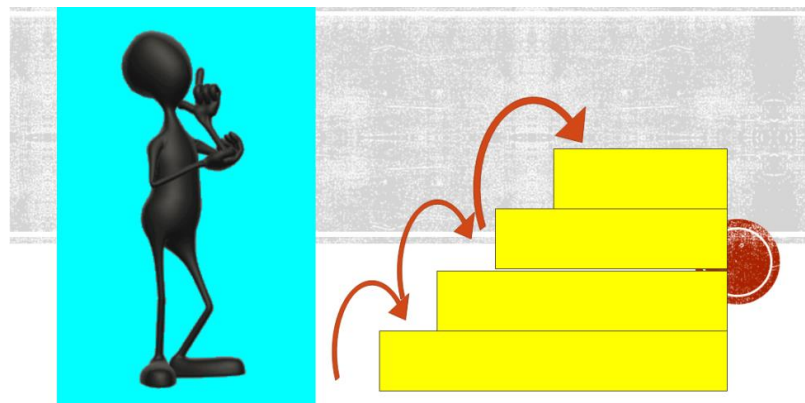
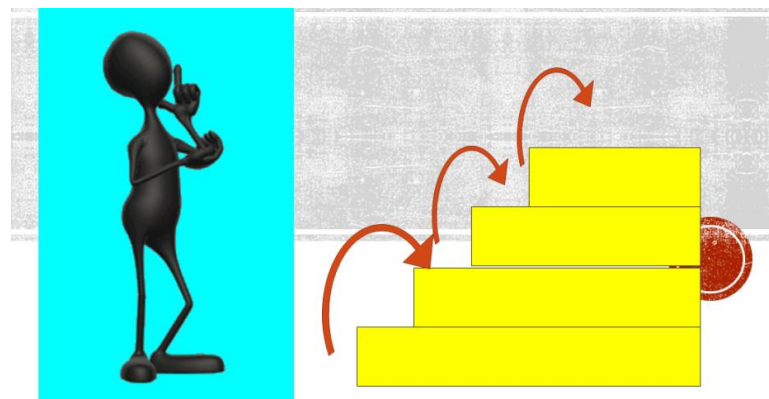
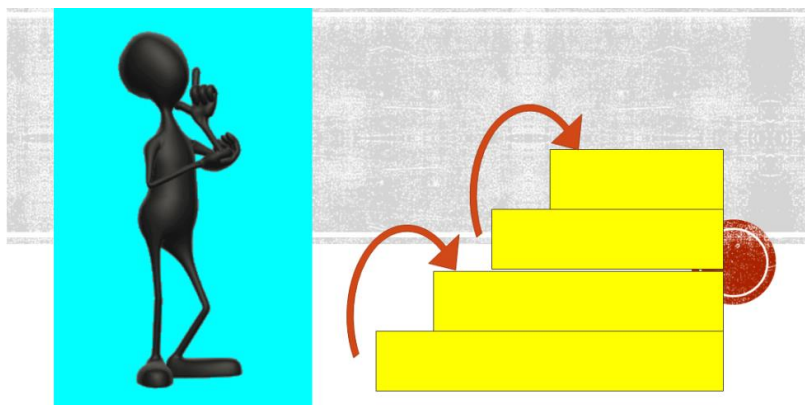
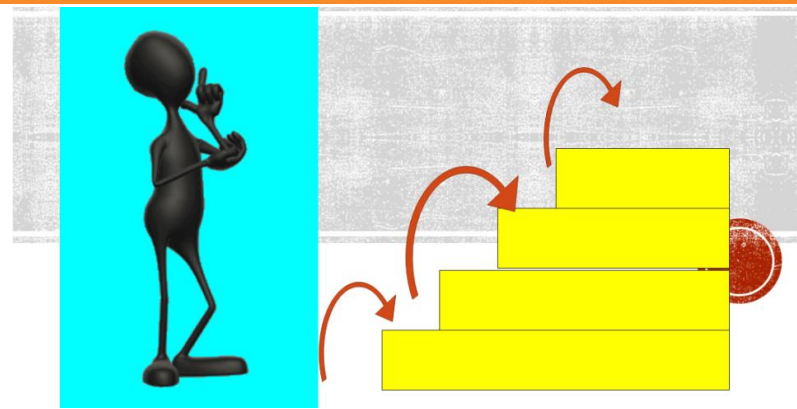
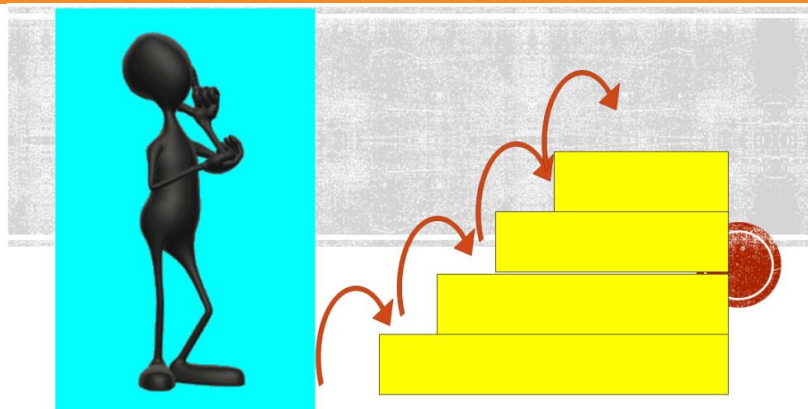
The boy can either jump **one step or two steps**. How many ways can he climb **THREE** steps?





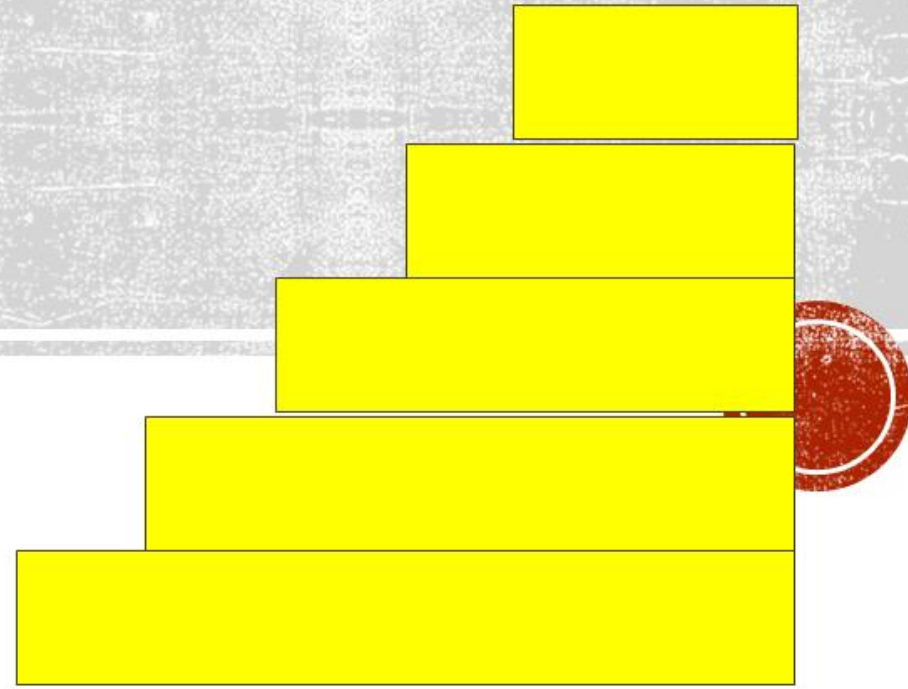
The boy can either jump **one step** or **two steps**. How many ways can he climb FOUR steps?







What about FIVE steps?



Solve the equation $\sum_{i=1}^n i = \frac{n(n+1)}{2}$

Let n be a natural number ($n \in \mathbb{N}$)

So we denoted $S = \sum_{i=1}^n i$ or $S = \sum_{i=1}^n (n-i+1)$

now we have

$$2S = \sum_{i=1}^n i + \sum_{i=1}^n (n-i+1)$$

$$2S = \sum_{i=1}^n (i + n - i + 1)$$

$$2S = \sum_{i=1}^n (n+1) = n(n+1)$$

$$S = \frac{n(n+1)}{2}$$

Which is greater, the number of drops of water in the world's oceans, or the number of ways to seat 30 students in a classroom with 30 desks?

(Work with someone to solve this. You'll need a calculator, but use of the internet is forbidden. You may need to know that the radius of the earth is approximately 6380 km; also, there are about 20 drops in 1 cm³ of water.)

A solution

The number of ways to seat 30 students in a classroom with 30 desks is

$$30! = 2.65 \cdot 10^{32}$$

How many drops of water in the world's oceans?

❖ Assume the earth is covered with water to a uniform depth of 10 km. The volume of this water is

$$\frac{4}{3}\pi(6390)^3 - \frac{4}{3}\pi(6380)^3 \approx 5.12 \cdot 10^9 km^3 = 5.12 \cdot 10^{24} cm^3$$

❖ At 20 drops per ml, this means there are no more than $1.02 \cdot 10^{26}$ drops in the world's oceans.

(According to a Google search, my estimate is high by a factor of about 4.)

Let's play a game of Russian Roulette. You are tied to a chair. Here's a gun, six chambers, all empty. Now watch me as I put two bullets in the gun into adjacent chambers. I close the cylinder and spin it. I put the gun to your head and pull the trigger. Click. You're still alive. Lucky you! Now, before we discuss your résumé, I'm going to pull the trigger one more time. Which would you prefer, that I spin the cylinder first or that I just pull the trigger?"



1. Re-Spin the cylinder then pull the trigger

As soon as the gangster spins the cylinder you will get a fresh set of possibilities where every chamber has equal chances of appearing for the next short.

Out of 6 chambers, 4 are safe

Chances of survival (in next short)

$$= \frac{4}{6} = 66.7\%$$

2. Pull the trigger right away (no spin)



So... 3 out of 4 chambers are safe

(from the perspective of next shot)

Chances of survival (in next short)

$$= \frac{3}{4} = 75\%$$

