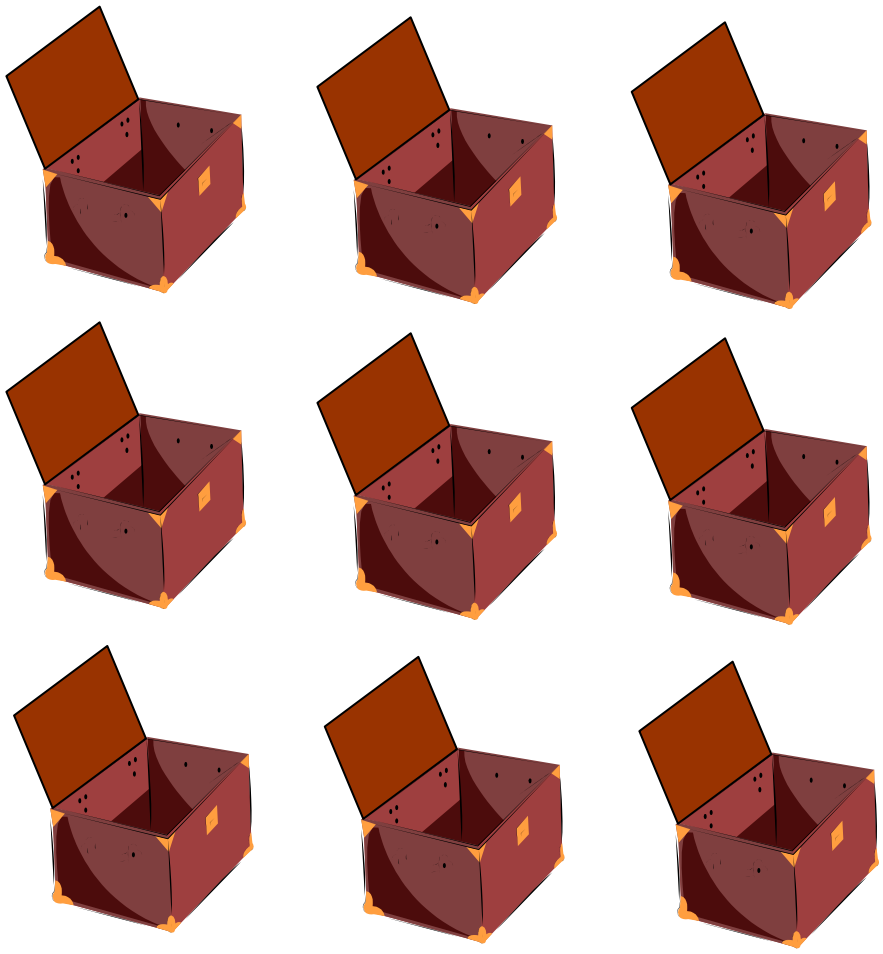
The Princess and the Golden Key

A powerful and rich queen had one son.

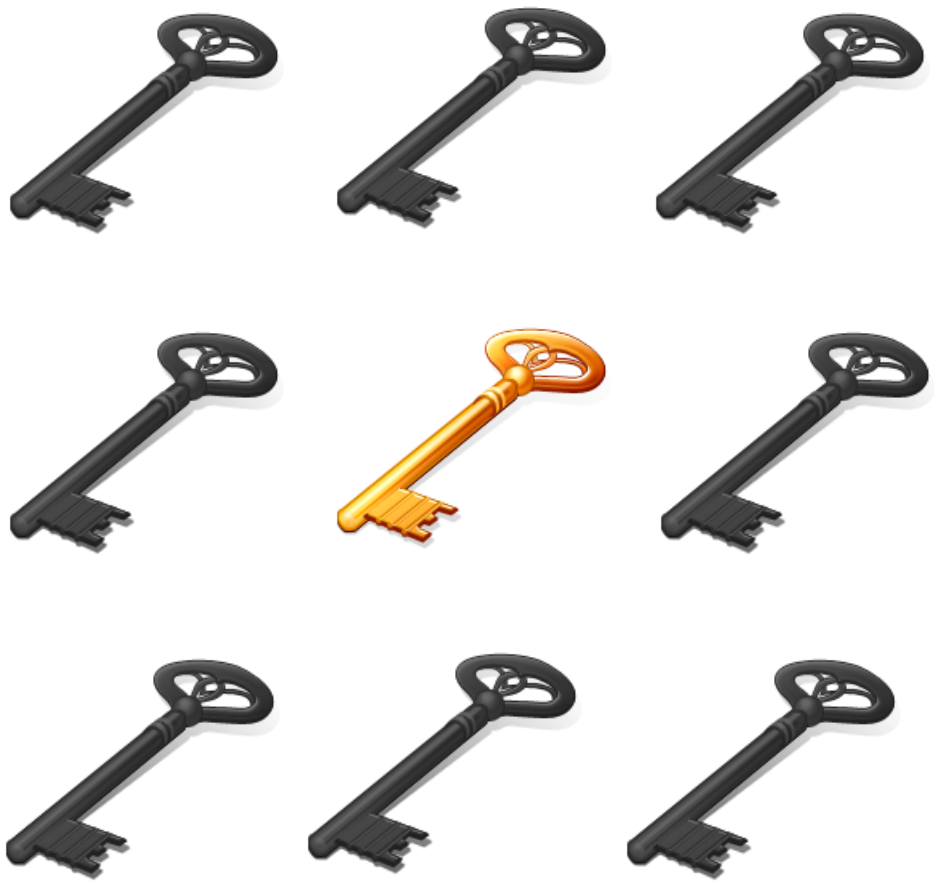
One day he would be king.

Princesses came from far and wide to seek his hand in marriage.

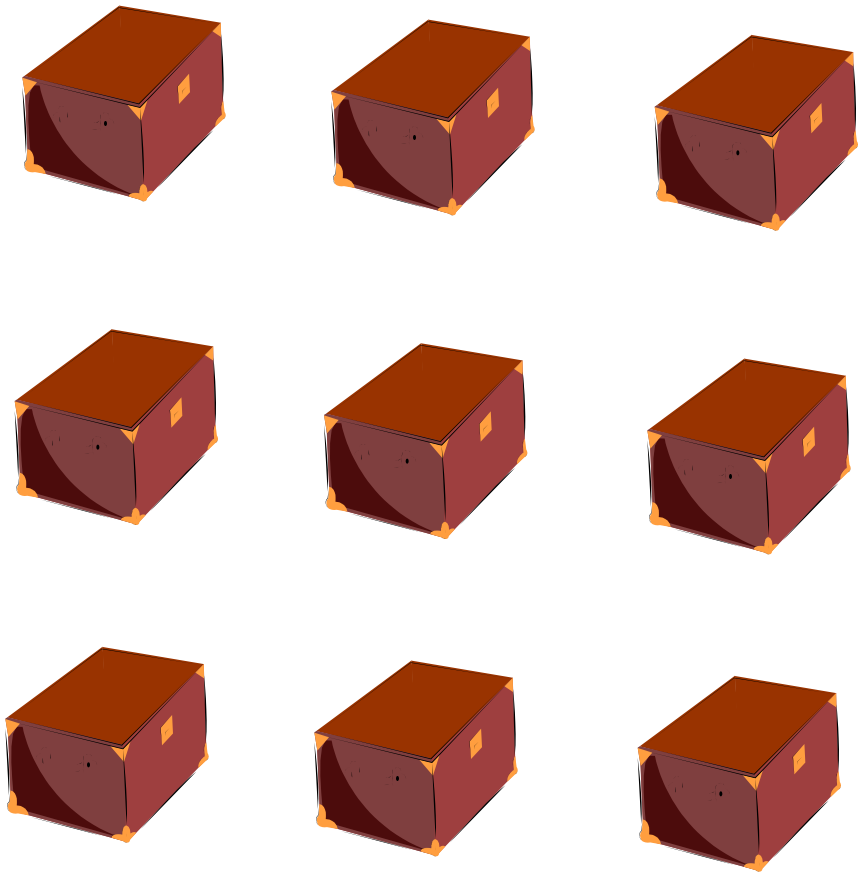
But the queen set a challenge for them.



She took nine small wooden boxes. They were all exactly the same.



…and nine keys. Eight of the keys were made of iron and one of gold.



She locked the keys in the boxes. Then she mixed them up so that even she did not know which one held the golden key.

These were the rules of the challenge.

You may choose one box, and one box only.

Before you choose, you may ask me one question, and if I know, I will answer truthfully.

Then you may borrow anything from anywhere in my palace and use it twice.

But you cannot damage or open any of the boxes. Then you must choose one box.

If it contains the golden key to the palace, you may marry the prince.

If it contains an iron key to the prison, you will spend the rest of your life locked away.

None of the princesses were willing to take the risk.

So they all left in search of princes whose mothers were less demanding.

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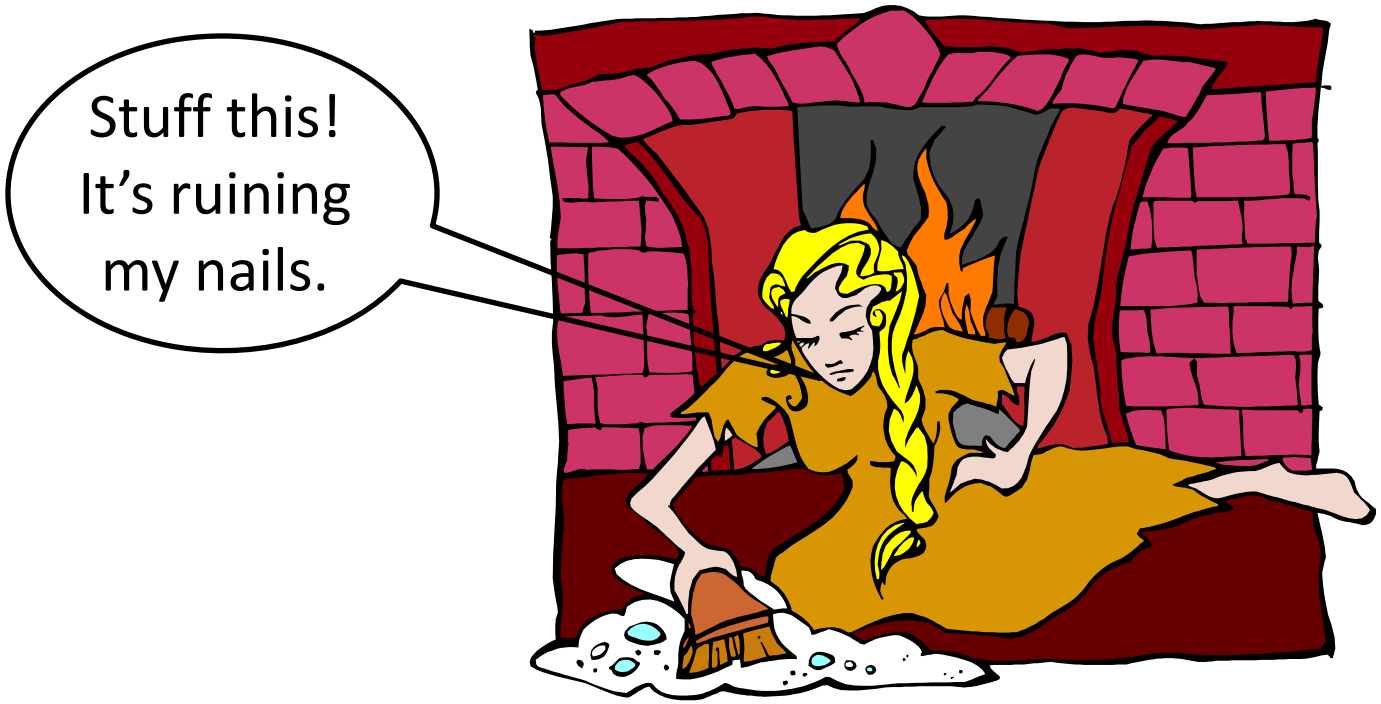
Meanwhile, in the palace kitchens, a princess from a nearby kingdom worked as a maid. Her father had thought it would do her good to do some real work before settling down to royal life. She disagreed. So she decided that she was going to marry the prince.



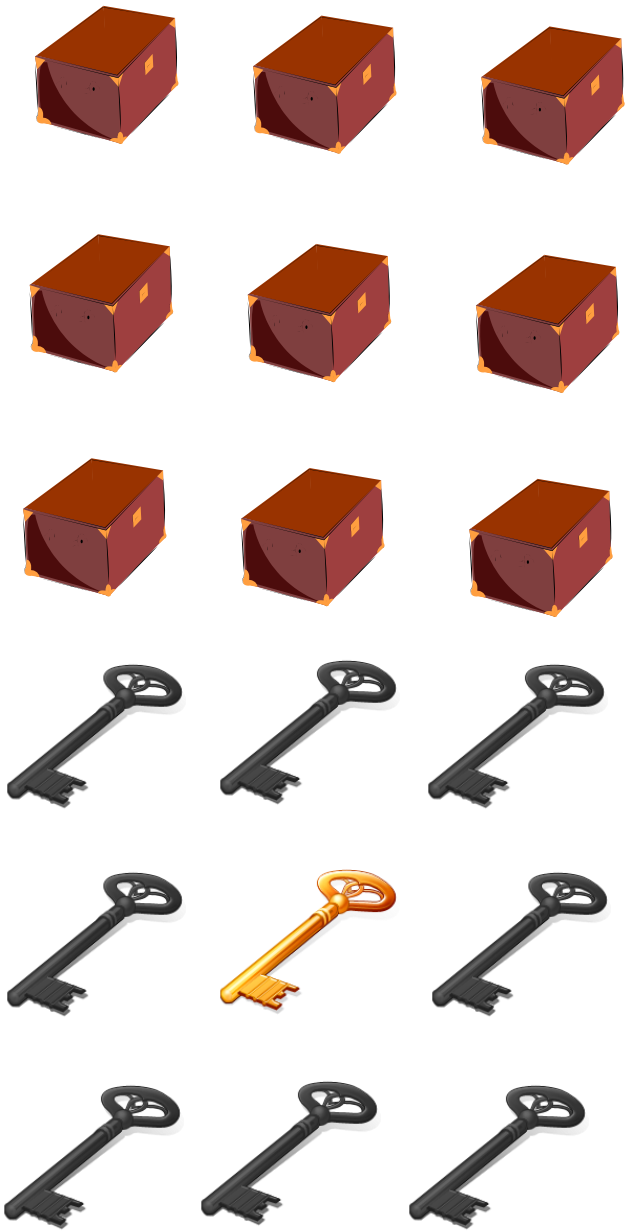
Meanwhile, in the palace kitchens, a princess from a nearby kingdom worked as a maid. Her father had thought it would do her good to do some real work before settling down to royal life. She disagreed. So she decided that she was going to marry the prince.

And she did.

The question is, HOW did she do it?

What question did she ask?
What did she borrow to help her decide?
How did she choose which box to open?

And why was her father right all along?



Nine boxes.
Only one gold key.

Ask one question
(if you need to).

Borrow something
from the palace
and use it twice.

There is a clue on the next slide.

All the boxes look exactly the same. But what will be different about the one with the gold key?

The princess's father was right that it did her some good to do some real work.

What would she have seen in the kitchen that would help her now?

Imagine you have narrowed it down to just three boxes.

What test could you do on two of them that would show you for certain which one held the golden key?

How could you do the same test to narrow it down to three boxes in the first place?

The answer starts on the next slide.

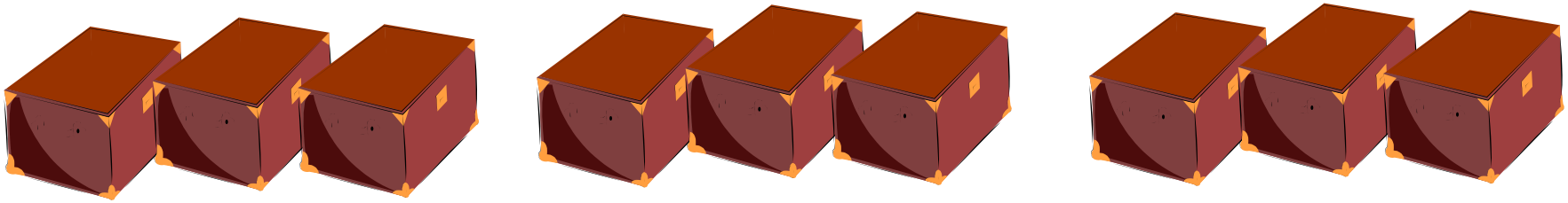
The question you might need to ask is whether the gold key weighs more than the iron ones.

The same amount of gold is heavier than iron, so the gold key will be heavier.

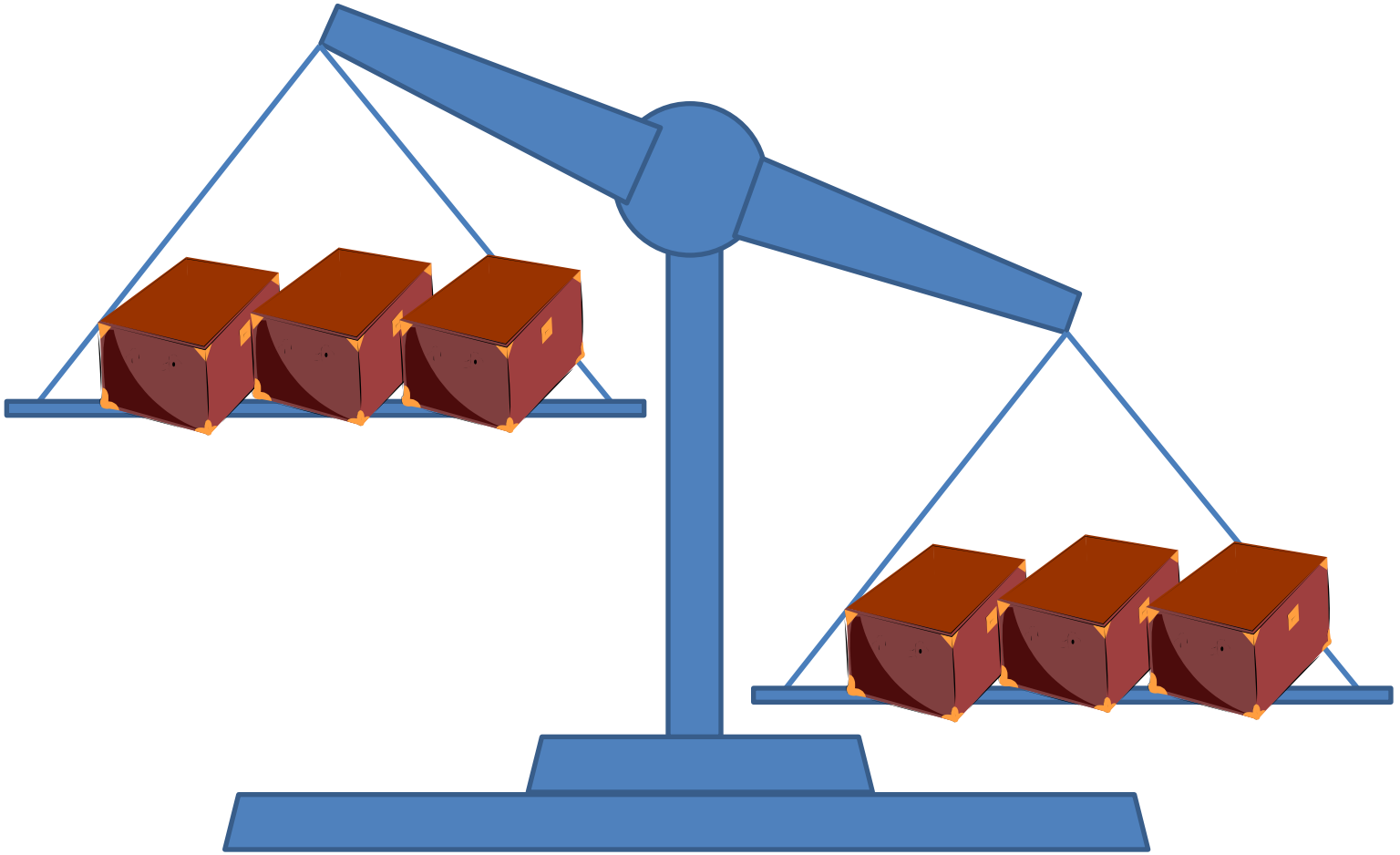
That means the box with the gold key will weigh more.

While working in the kitchen, the princess has seen cooks using the scales, so that is what she asks to borrow.

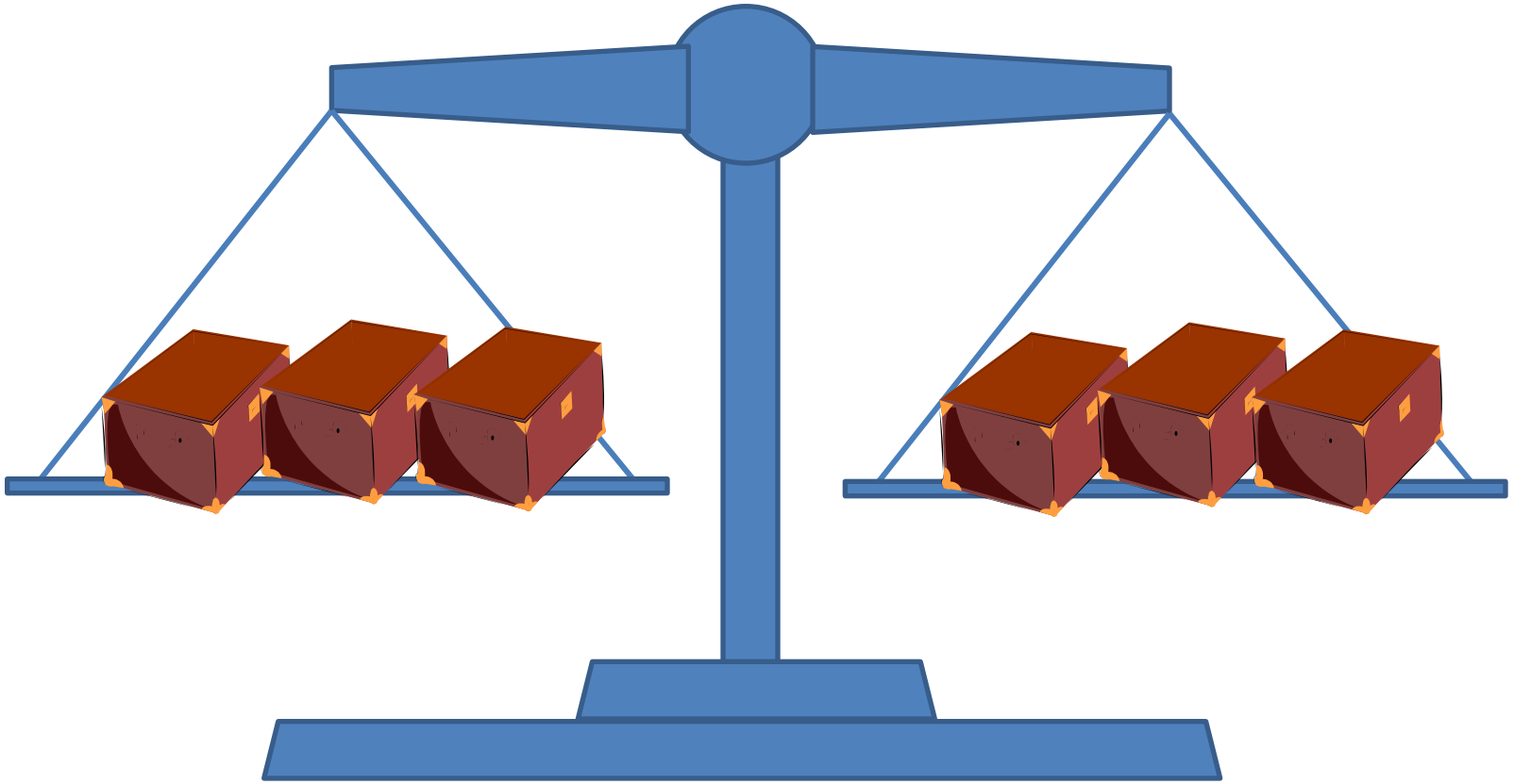
First, split the boxes into three sets of three. It doesn't matter which ones go in which set.



Then choose two sets to weigh against each other. It doesn't matter which sets you weigh.

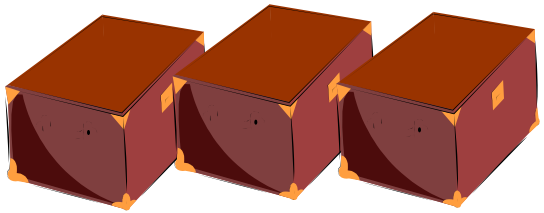


If one set is heavier, you know the gold key is somewhere in that set.

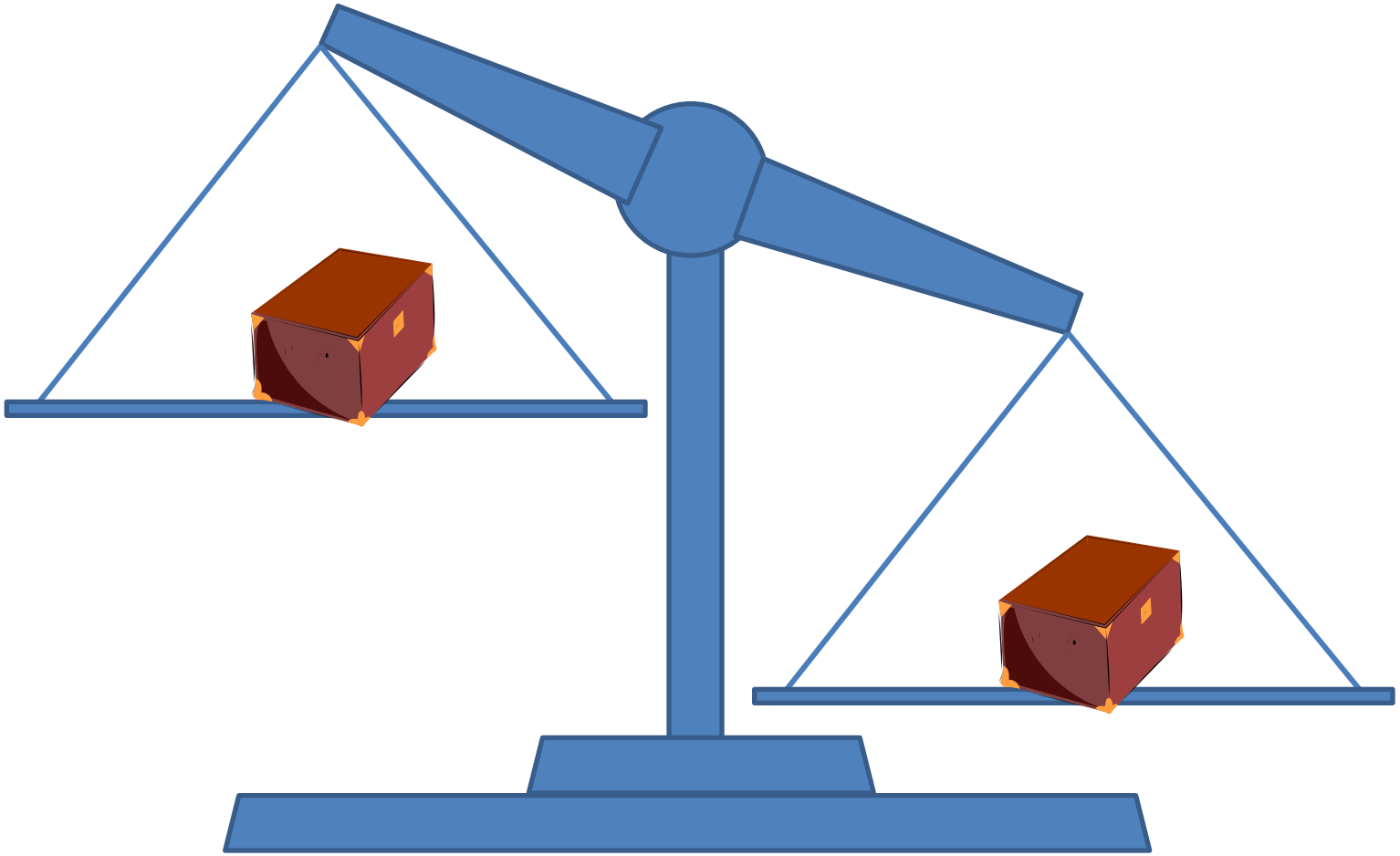


If they weigh the same, all the keys they contain must be iron, so the gold key is in the set you haven’t weighed.

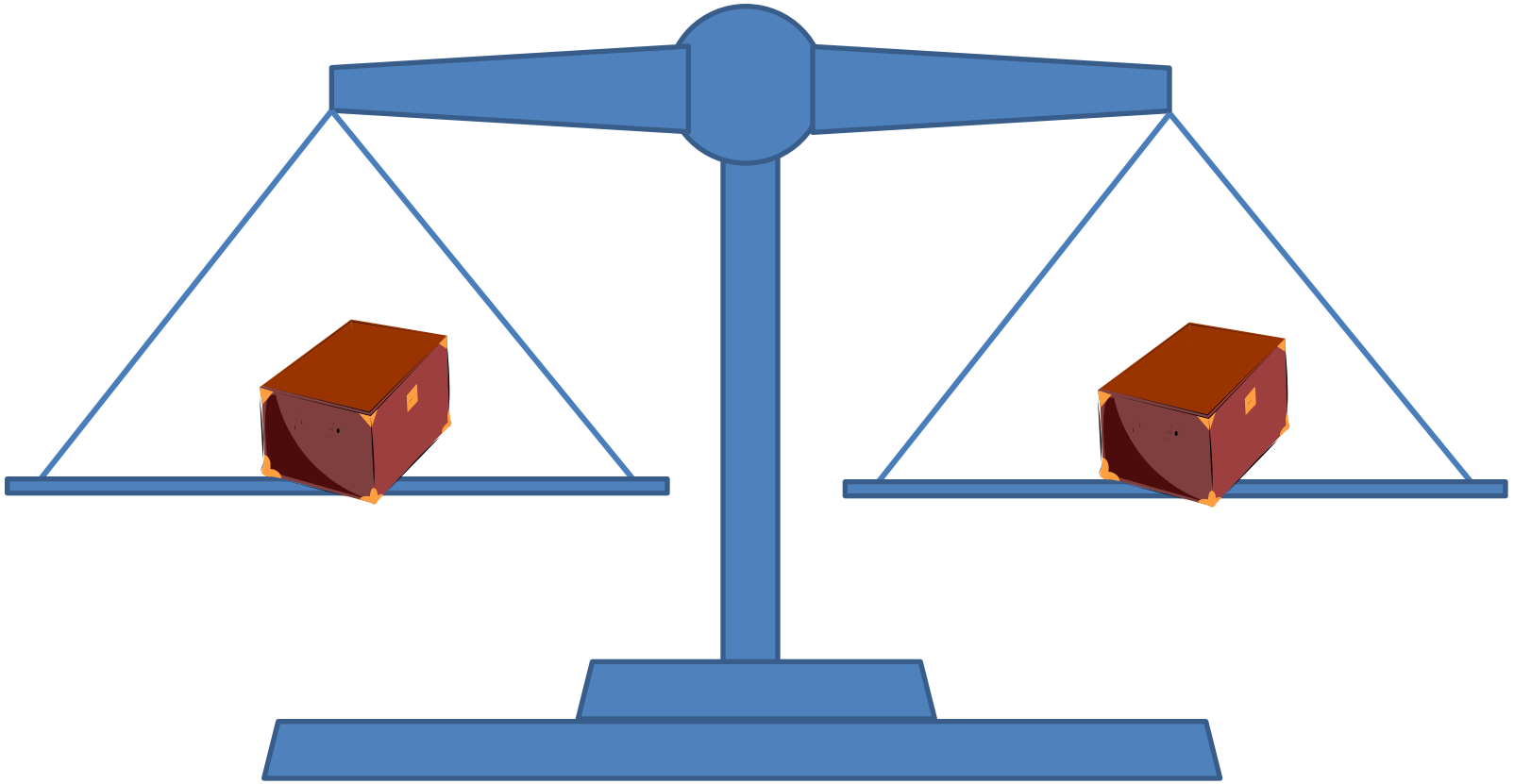
Now you have a shortlist of three boxes.



You choose any two boxes to weigh against each other. Again, it doesn’t matter which you choose.



If one box is heavier, it’s the one with the golden key.



If they weigh the same, the gold key is in the box you haven’t weighed.

So the princess married the prince...

and they lived fairly happily for quite a while.

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