

Find the Fake Coin

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1. Suppose you have 3 coins. One of them is fake and is lighter than the other two. Use the balance scale to find the fake coin. How many trials do you need to use? Can you find the fake coin with just one trial?

2. Now you have 9 coins, and one of them is fake. The fake coin is lighter than the rest.
 - (a) Can you always find the fake coin?

- (b) Can you always find the fake coin with only 2 trials?
3. Now you have 12 coins, and one of them is fake. You know that the fake coin is lighter than the real coins. What is the smallest number of trials you need to use to guarantee you know which one is fake?
4. Suppose you have 3 coins again, and one of them is fake. This time, you know that the fake coin has a different weight than the real coins, but you don't know whether it is lighter or heavier. How many trials do you need to find the fake coin?

5. Now you have 6 coins and two of them are fake. The fake coins are lighter than the real coins. Can you find both fake coins in 3 trials?

6. Suppose you have 16 coins. One of them is fake and has a different weight than the rest, but you don't know if it's heavier or lighter. Can you find the fake coin in 4 trials?

7. Now you have 12 coins. One of them is fake and has a different weight than the rest, but you don't know if it is heavier or lighter.

(a) Can you find the fake coin in 3 trials?

(b) Can you determine if the coin is heavier or lighter than the rest in just three trials?