

# The Counterfeit Coin Puzzle

Original video: <https://www.youtube.com/watch?v=tE2dZLDJSjA>

## My solution

(Carl Smith December 2020)

*This solution is different to the one in the above video — I think mine is more straightforward ;)*

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Number the coins from 1–12.

**First** weigh 1–4 against 5–8. Two outcomes are possible:

1. If they balance, we know the fake is in 9–12 (4 coins remain):
  - **2nd** weighing: weigh 9 against 10:
    - If they balance, fake is in 11–12.
      - **3rd** weighing: weigh 11 against 9 (or any other coin):
        - If they match, fake is 12, or if they don't balance, fake is 11.
      - If they don't balance, fake is one of 9 or 10.
        - **3rd** weighing: weigh 9 against 11 (or any other coin), and follow the same logic as 3rd weighing above.
  - 2. If they don't balance, then counterfeit is obviously in 1–8. Take note of the *direction* the scales tipped in this first weighing.

Put 7 & 8 aside, then swap some around so your **2nd** weighing is 1, 2, 5 against 3, 4, 6.

- If they balance, then the counterfeit is either 7 or 8, and you can just use the earlier logic to determine which one it is in the final weighing.
- If they don't balance, then take note of which *direction* the scales tilt. If they tilt the same way as the first weighing, then you know the fake is one of the coins that didn't get moved — i.e. 1, 2 or 6. If they tilt the other way, then the fake is one of the coins that *was* moved — i.e. 3, 4 or 5.

Take the group of three you've narrowed it down to. For the rest of this explanation, we'll assume the fake is in 1, 2 or 6, and that the scale was heaviest on the left, but the exact same logic can be applied to any of the other scenarios.

So, for 1, 2 and 6, we know that if the fake is either 1 or 2, then the fake coin must be *heavier*, but if it's 6, then it is *lighter* (based on the the way the scales tilted in

the first weighings: left side down)

So now, for the **3rd** weighing, weigh 1 against 2. Since we know that the fake is heavier if it's 1 or 2, then if they don't balance, whichever one goes down is the fake. And if they balance, then coin 6 is the fake.

Done! :)