

Hints, Advice  
and Info

## Mini-Contests



### 10 Bags of Gold

#### Ten Bags of Gold\*

Gold coin weighs one gram, counterfeit coin weighs 1.1 grams. You have 10 bags full of coins, nine of the bags are full of real gold but one bag is full of the counterfeit coins. Given a perfect scale (a pointer scale, for example) and ONE weighing can you determine which bag has counterfeit coins? If so how?

Z.

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\* This puzzle is a clever modern variation of coin-weighing puzzles...

May 4, 2004

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### Ten Bags of Gold (solution)

We've got solutions of three different types.

Solutions in the first group are "classic." -- **Way 1.**

The only solution from the second group uses the same idea as those from the first group, but it's a little bit tricky -  
- **Way 2.**

Surprisingly, we've received two solutions, which are based on weighing with a balance scale -- **Way 3.**

We show some solutions to illustrate all these ways how to determine which bag has counterfeit coins.

### Way 1 - Solution by Jensen Lai

Place the following on the scale:

- 1 coin from bag 1
- 2 coin from bag 2
- 3 coin from bag 3
- 4 coin from bag 4
- 5 coin from bag 5
- 6 coin from bag 6
- 7 coin from bag 7
- 8 coin from bag 8
- 9 coin from bag 9
- 10 coin from bag 10

If all 55 coins were Gold, this would weigh 55 grams. However, each counterfeit coin will increase the weight by .1 gram. The number of .1 grams over 55 grams this weighs, is the number of the bag with counterfeit coins. For example, if the 55 coins weigh 55.6 grams, there must be 6 counterfeit coins. These will have been from bag number 6.

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### Way 1 - Solution by Mike Kurylo

Take one coin out of the first bag, two out of the second, ... ten out of the tenth bag. Weigh all of them, your remainder will tell you which bag has the counterfeit coins (.1=bag1, .2=bag2, etc). No remainder means the tenth bag.

### Way 1 - Solution by Nicole Takahashi

First label the bags 1 through 10. Then on the scale place 1 coin from bag 1, 2 coins from bag 2, 3 coins from bag 3... and 10 coins from bag 10. Due to the convenience of the numbers, the bag with the counterfeit coins will be revealed by the tenths place of the scale reading: 55.1 means bag 1 is counterfeit, 55.7 means bag 7 is, and 56.0 means bag 10 is.

### Way 2 - Solution by Horst Karaschewski

Bring the bags in order. Take no coins from the first, 1 coin from the second ... 9 coins from the 10th bags and weigh all these coins. The decimals plus 1 give the number of the bag with counterfeit coins.

### Way 3 - Solution by Sheila Hedger

Here is the answer to Ten Bags of Gold puzzles.

Mark each bag with a number one to ten.

Take out all but one coin each from bag one and two, making sure to keep the coins marked and separate.

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Take two coins each from bag three and four, making sure to keep the coins marked and separate.

Take three coins each from bag five and six, making sure to keep the coins marked and separate.

Take four coins each from bag seven and eight, making sure to keep the coins marked and separate.

Take five coins each from bag nine and ten, making sure to keep the coins marked and separate.

Place the bags 1, 3, 5, 7, and 9 on one side of the scale. Place the bags 2, 4, 6, 8, and 10 on the other side of the scale. The counterfeit coins weighs .1 gram more than the real coins. The scale will determine which bag is counterfeit. If all coins were the same weight the scales would be equal. The scale will show which side is heavier and it is that side which has the counterfeit coin(s). The amount of the difference in weight determines which bag is counterfeit. If the scale shows .1 gram heavier, then the bag 1 or 2 that is on the heavier side is the counterfeit bag. If the scale shows .2 grams heavier then the bag 3 or 4 that is on the heavier side is the counterfeit bag. If the scale shows .3 grams heavier then the bag 5 or 6 that is on the heavier side is the counterfeit bag. If the scale shows .4 grams heavier then the bag 7 or 8 that is on the heavier side is the counterfeit bag. If the scale shows .5 grams heavier then the bag 9 or 10 that is on the heavier side is the counterfeit bag.

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### Way 3 - Solution by Jason Meyers

I don't know if this solution counts, as it depends on your definition of "one weighing" but if you take:

10 coins from bag 1

20 coins from bag 2

30 coins from bag 3

40 coins from bag 4 and 50 coins from bag 5 on one side of the scale and 10 coins from bag 6

20 coins from bag 7

30 coins from bag 8

40 coins from bag 9 and 50 coins from bag 10 on the other side.

Now to the side which weighs less (so we know all of those coins are authentic), add as many coins from any bag on that side as is necessary to balance the scale.

When that number of additional coins is multiplied by 10, the bag on the heavier side which had that many coins on the scale is the counterfeit bag. e.g. If the 1-5 side is lighter, and you have to add 4 coins to that side, it's bag 9 (which is heavier by  $40 \times 0.1 = 4$  coins).