

Bag o' Pebbles

Solution

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Put one white pebble alone in one bag. Put the other 99 pebbles in the other bag.

You have a $1/2$ chance of keeping the bag with the single white pebble, in which case you win for sure. Otherwise you draw from a bag containing 49 white and 50 black pebbles. Therefore

$$\Pr(\text{win}) = \frac{1}{2} + \frac{1}{2} \frac{49}{99} = \frac{74}{99} \approx 0.747475.$$

This is about a 74.75% chance, not exactly 75%.

Why this is best

Both bags must be nonempty. Call the smaller bag's size k , so $1 \leq k \leq 50$, and let w of its pebbles be white. Then the winning probability is

$$\frac{1}{2} \left(\frac{w}{k} + \frac{50 - w}{100 - k} \right).$$

For a fixed bag size k , moving a white pebble into the smaller bag and a black pebble out increases, or at $k = 50$ leaves unchanged, the chance of winning. A white pebble helps more when it is one of fewer pebbles in a bag. So the best choice for that size is to make the smaller bag all white: $w = k$.

The probability then becomes

$$\frac{1}{2} \left(1 + \frac{50 - k}{100 - k} \right).$$

Making this all-white bag larger does not improve its own success rate: that rate is already 1. It only removes useful white pebbles from the other bag, decreasing the other bag's white fraction. Therefore choose the smallest possible size, $k = 1$.

The bags are selected with equal probability, regardless of their sizes. If instead a pebble were chosen uniformly from all 100 pebbles before selecting its bag, this trick would not change the probability from $1/2$.

History and sources: [companion history PDF](#).