Etude 10: Four The Same

Minimum = 0 steps, all start the same
Average = 4 steps after 10000 attempts
Max around 10 - 20 but could be infinite, however my program never went on for more than 20 moves.

Solution description:

At the beginning pick the top two boxes and flip them to both be an H. At that point you know for certain two are H. Then they rotate, pick the top left box and bottom right box, then flip both of the coins to tails. Now you know two of the boxes diagonal to each other are tails, and the other boxes has a head and the box diagonal to this box is unknown. It rotates again, pick the top right box and the bottom left box, if atleast one of the coins is heads then you know you have found the unknown coin, so if you flip them both to tails you have all four the same since the other two coins are tails as well.

Evidence:

To prove the solution we made a program that performs our method. From 10000 attempts of the puzzle we found that on average it takes 4 spins, not including when they are all the same before the 3rd spin, since it is only random to get less than 3 spins. If you include < 3 spins the average is 3.

Method:

Step 1: Pick the top two boxes, flip them both to an H. Now you know two of the boxes, two ‘H’s’.

? ? ===> H H

? ? ? ?

Step 2: Then it rotates to these 4 possibilities. Now you want to pick the top left box and the bottom right box, flip them both to a T. Now you know 3 of the boxes, two are ‘T’ and one is an ‘H’.

H H ===> T H

? ? ? T

OR ? H ===> T H

? H ? T

OR ? ? ===> T ?

H H H T

OR H ? ===> T ?

H ? H T

Step 3: Then it rotates again, it will end up with 4 possibilities. Now pick the top right and the bottom left, if one of the coins is an H you know that the other box is the last unknown box so flip them both to T and now four are the same. If they are both T then rotate and repeat this step again.

T H ===> T T Done

? T T T

OR T ? ===> T T Done

H T T T

OR ? T ===> ? T Repeat

T H T H

OR H T ===> H T Repeat

T ? T ?

Finished: Since you know one of the boxes is an H and two of the boxes are T's when you pick two diagonal boxes and find an H you know the other two boxes are T's, so when you flip them both to T you know they are all the same. There is a 50/50 chance of finding an H so it could take an infinite amount of rotations to find the H since each rotation is independent, however it is on average around 4 total steps to make all four the same. We found this from writing a program that performed the method.

T T

T T