SWITCH OR NOT ? THE SIMULATION OF MONTY HALL PROBLEM

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Abstract. *The Monty Hall problem is a brain teaser,The problem was originally posed in a letter by Steve Selvin to the American Statistician in 1975. To find out the principle of this conclusion which given by Marilyn vos Savant, and to find if there is always advantage to the contestants chose to switch their choice .we have make a simulation of this problem.*
Keywords: Monty Hall problem, Simulation

1. **Analysis of the Monty Hall problem.** The hole game complete by three steps: First chose a door in randomly to put a car behind it,Second let the contestants chose a door also in randomly. Third the host open a door with out of car,then calculate the probability to got the car.

The first step is random ,so the contestants have 1/3 probability to got the car.Then the host open one of the doors with out of car.The host's behavior have change the environment of the the game,The host's behavior is controlled by the chose of the contestants,if the contestants have chose the door with a car then the host will open the doors random in the last two doors,but if the contestants have chose the door with out of car,then the host have no choice with out to open the another door with out of car.So the whole process have become a controlled system,to calculate the probability of got the car in randomly is wrong,so the probability is controlled by the contestants's behavior not the host's.

2. **The simulation of the problem. Step 1: Distribute the car randomly to the three doors**

First of all, set a zero matrix containing three variables,then generate a number among 1-3 in randomly, set the corresponding variable's value to 1.

Step 2: Chose the door in randomly

Generate a number among 1-3 in randomly ,then got the corresponding variable's value .if the value is 1 it means the contestants have got the car,On the contrary it means the contestants got the goat.

Step 3: The host open the door with out of car

Use the conclusion of Step 2,if got 1,then chose anyone of the last two doors to open,on the contrary chose the door witch value is 0 to open.

Step 4: Calculate the probability of win for chose to switch

Record the times of the contestants got the car.

Step 5: Repeat step1 to step4

Record the times of repeat and calculate the probability.

The Figure 1,Figure2,Figure7 and Figure4 have show the probability of win when the contestants chose to switch the choice.

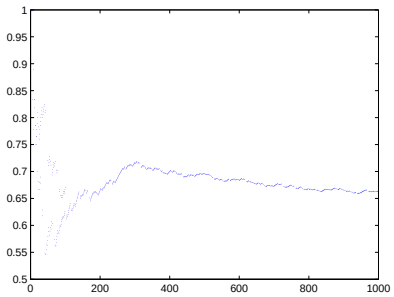

FIGURE 1. The test of 1000 times

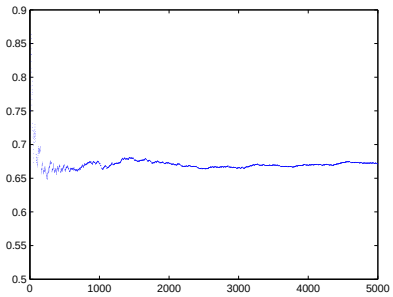

FIGURE 2. The test of 5000 times

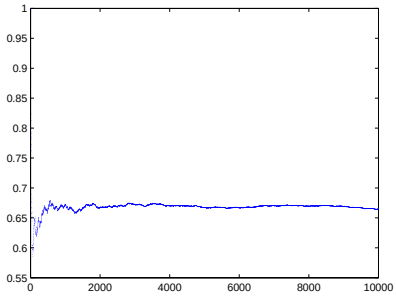

FIGURE 3. The test of 10000 times

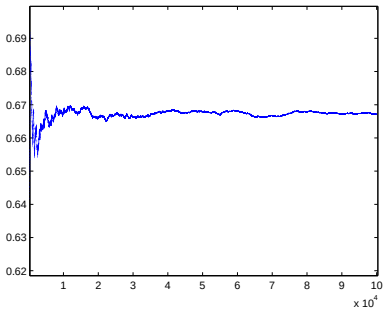

FIGURE 4. The test of 100000 times

TABLE 1. The times of win after a series of experiments

Times of test	Win	Lose	probability
1000000	666883	333117	0.6669
100000	66707	33293	0.6670
10000	6717	3283	0.6717
1000	653	347	0.6530
100	62	38	0.6200
10	7	3	0.7000

We have repeat the test of the problem in 1000 times,5000times,10000 times and 100000 times.

The result have proof that the Marilyon vos Savant's answer is right, see the detail at Table 1 ,but this phenomenon only happened in three doors condition, when we use more than three doors to test, the result will change. We have test when the door's counts have rise to 4,5,10,12,15 and 20.We have find that the when the doors among 10 to 15,switch the choice almost no use to increase the probability to got the car.We also have test when the doors counts have rise to 100,1000and10000,the result is in random distribution.See the detail in the fellow Figures.

3. **Conclusion.** The conclusion of our simulation have show that when use more than 15 doors in this game,no matter the contestants chose to switch or not,the probability of win will approach to the random-probability.So when the door's counts is less than 15 chose to switch,else switch or not is insignificant.

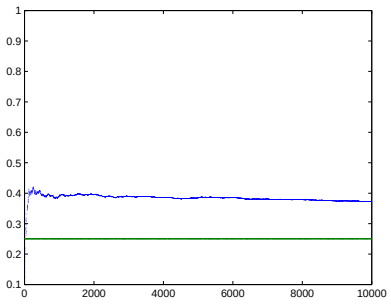

FIGURE 5. The probability of test 10000 times with 4 doors

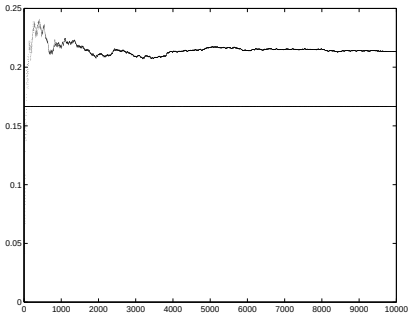

FIGURE 6. The probability of test 10000 times with 5 doors

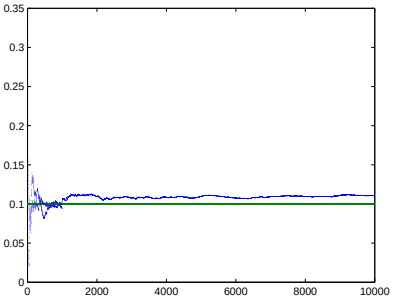

FIGURE 7. The probability of test 10000 times with 10 doors

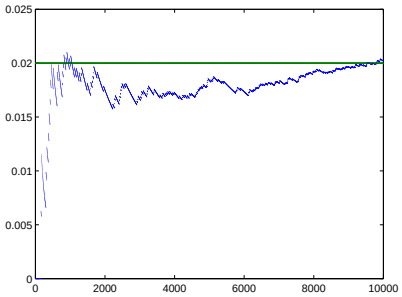

FIGURE 8. The probability of test 10000 times with 20 doors

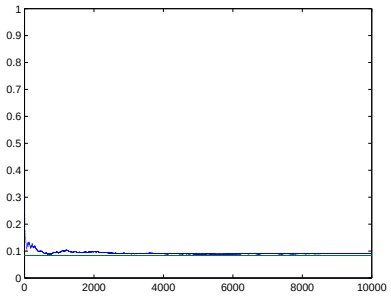

FIGURE 9. The probability of test 10000 times with 12 doors

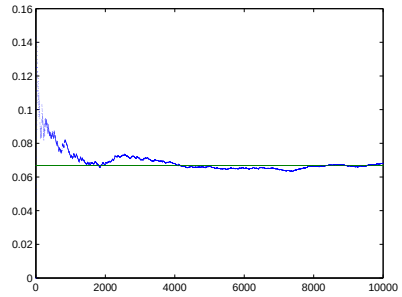

FIGURE 10. The probability of test 10000 times with 15 doors

TABLE 2. Different counts of doors to test

Counts of door	Times of tests	probability
4	10000	0.3745
5	10000	0.2713
10	10000	0.1147
100	10000	0.0112
1000	10000	0.0013
10000	10000	0.0002