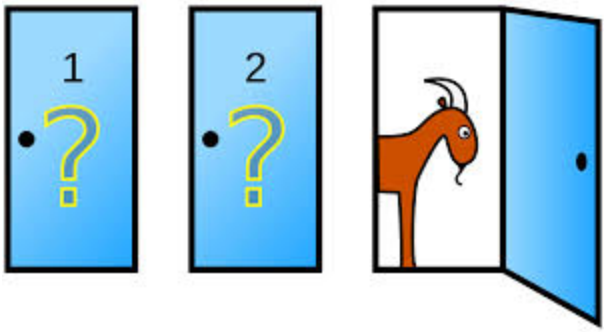
Shiny App Assignment

Description

You are required to write a Shiny App to simulate following game:



Suppose you're on a game show, and you're given the choice of three doors: Behind one door is a car; behind the others, goats--but you have no idea about what is behind the doors. You pick a door, say No. 1, and the host, who **knows** what is behind the doors, opens another door, say No. 3, which has a goat. He then says to you, "Do you want to switch your original pick and go with door No. 2?"

The question is: to win the car, is it to your advantage to switch your choice? Or in other words, does it matter if you switch or not ?

Note: the role of the host is as follows:

1. The host must always open a door that was not picked by you.
2. The host must always open a door to reveal a goat and never the car.
3. The host must always offer you the chance to switch between the originally chosen door and the remaining closed door.

Before you continue, I want you to pause for a while and think about this problem deeply.

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All right, you might be *tricked* to think, if door #3 is eliminated you are just choosing between #1 and #2. Switch or not, it is still a 50/50 chance. So it doesn't matter switching or not. If you think so, you are not alone.

As a matter of fact, the answer is Yes it matters to switch or not: by switching you get a better chance to win the car. Does this answer counter your intuition? Actually this was published in an American magazine in the 1990s and a statistician explained in detail why switching is a better choice. However after her explanation got published she received 10,000 letters from readers around the country who did not agree with her answer, including 1,000 who hold Ph.D. degrees. Here is quote from one of the letter:

> "*You blew it, and you blew it big! Since you seem to have difficulty grasping the basic principle at work here, I'll explain. After the host reveals a goat, you now have a one-in-two chance of being correct. Whether you change your selection or not, the odds are the same. There is enough mathematical illiteracy in this country, and we don't need the world's highest IQ propagating more. Shame!"*

Okay, I will talk about the problem solution in a later class.

For now, you want to figure out the correct answer by writing a simple R program to persuade the 1,000 Ph.D. unbelievers.

Here is what you do. Basically you repeat the game 3,000 times and show how many times you win the car if you choose to switch. If you win roughly 1,000 times, it means the statistician's answer was wrong, switching or not switching has the same chance to win, which is ⅓. If the number is significantly higher than 1,000, let's say if it's 1,500 or even more, then the statistician is right. Try to increase the total number of trials to 30,000 and figure out what is the exact chance of winning by switching.

You are required to simulate the game with two different approaches i.e., you write two different programs to simulate the game:

Approach #1. Each time your program randomly decides which door (1,2, or 3) has the prize; and the contestant will initially randomly pick a door. Then your program will simulate the host's action to open a door: remember the host must follow the rules to open a door, so your program must also follow the same rules to decide which door to open. Sometimes he has freedom to randomly choose which door to open, sometimes he doesn't. You must consider all possible scenarios. Finally you record if switching wins or not.

Approach #2. Each time your program still randomly decides which door (1,2, or 3) has the prize; but the contestant will initially always pick door 1, and then your program will simulate the host's action to open a door. You finally record if switching wins or not.

For each approach you repeat 3,000 times and count the number of "switching and winning" cases. Submit your code with outcome and your guess of chance (in percentage or fraction) to win by switching.

If you are puzzled by the outcome from the simulation, you can print out 10 game results: what is the prize door, what is the initially picked door, and what is the opened and switched door. Then you carefully study the 10 different results to understand the outcome.

You can solve the problem using conditional probability and later using Bayes rule if you learn it. You are encouraged to post your intuitive understanding (that is, without using probability formula) at the discussion board on canvas.

After you submit your simulation you want to make a shiny app to show your parents or friends if they are not convinced for the answer. Make your app elegant and your creativity boosts your grade.

Finally you want to create a Shiny App to demonstrate the game and explain the results graphically.