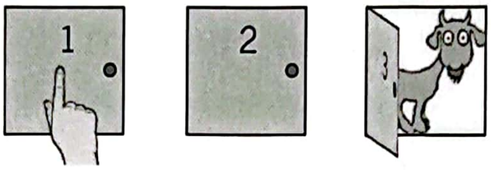
# CS2402- Tutorial 6

## Task 1. Monty Hall problem

The "Monty Hall Problem" (or game show problem) was loosely based on a real TV game show called "Let's Make a Deal", which was hosted by Monty Hall.

There are three doors. A car (the prize) is placed randomly behind one door. Goats (the fake prizes) are placed behind the other doors. The game proceeds as follows:

1. The player picks a door.
2. The host will open one of the other two doors to reveal a goat. If both doors have goats, then the host randomly picks one door to open.
3. The host offers the player a choice to *stick* with their original door, or *switch* doors.
4. The player wins the prize behind the final door that is picked.




In this tutorial, you will analyze the Monty Hall problem and then do an experiment to verify your analysis. In the 2nd task, you will look at a variation of the game.

First we will consider the original problem.

A. Using the table below, fill in the different configurations of 1 car and 2 goats. Assuming that Door 1 is picked, fill in the result when *sticking* or *switching*.

| Door 1 (picked) | Door 2 | Door 3 | Result when Sticking | Result when Switching |
|---|---|---|---|---|
|  |  |  | win | lose |
|  |  |  | lose | win |
|  |  |  | lose | win |

B. Forgetful Monty

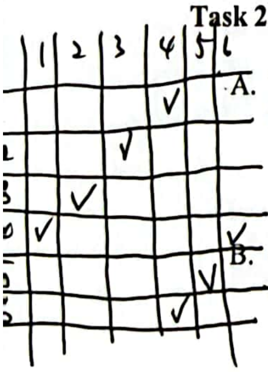
Now we will look at a variation of the game. Suppose the host forgets which door the player had picked, and decides to randomly open a door with a goat. In this case, it's possible that the host opens the same door that the player had picked. The player then has a choice to switch to another door or stick with the original door.

Using the table below, fill in the different configurations of the prizes as well as the door that is opened (there are 6 combinations). Assuming that Door 1 is picked, fill in the result when *switching*. Note: in the case when the host opens Door 1, the player will need to randomly pick between two closed doors.

r = reveal 50%. 50%.

| Probability of this configuration | Door 1 (picked) | Door 2 | Door 3 | Result when Switching |
|---|---|---|---|---|
| $\frac{1}{6}$ | C | G (r) | G | LOSE: 100% |
| $\frac{1}{6}$ | C | G | G (r) | LOSE: 100% |
| $\frac{1}{6}$ | G (r) | C | G | LOSE: 50% |
| $\frac{1}{6}$ | G | C | G (r) | WIN: 100% |
| $\frac{1}{6}$ | G (r) | G | C | LOSE: 50% |
| $\frac{1}{6}$ | G | G (r) | C | WIN: 100% |

## Task 2. Conditional Probability



A. Two dice are rolled. What's the conditional probability that both dice are (5,5) if it's known that the sum of points is divisible by 5?

$P = \frac{1}{7}$

$P(A|B) = \frac{P(AB)}{P(B)} = \frac{\frac{1}{36}}{\frac{7}{36}} = \frac{1}{7}$

B. One card is taken from a pile of 52 cards. Let event A occur when an ace is taken out, event B when a card of spades is taken out. Compute P(A|B) and P(B|A).

$P(A) = \frac{4}{52}$ $P(B) = \cancel{\frac{4}{52}}\ \frac{13}{52}$

$P(AB) = \frac{1}{52}$

$P(A|B) = \frac{P(AB)}{P(B)} = \cancel{\frac{1}{4}}\ \frac{1}{13}$

$P(B|A) = \frac{P(AB)}{P(A)} = \frac{1}{4}$

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