

# Probabilities: Exercises

## Exercise

### Birthday problem

What is the probability of two people in this room sharing a birthday?

Find the probability of the event  $B_n$ , that two people out of  $n$  share a birthday?

Assume that birthdays are independent, equally likely to happen throughout the year, and the year having 365 days.

### Monty Hall problem

In a game show the contestant is presented with three doors. Behind one door is a car and behind the two others are goats. The goal is to win the car by choosing the door with the car.

The contestant chooses a door (but the door remains closed for now). The host (who knows behind which door the car is) then opens one of the two other doors and reveals a goat. The contestant can now choose whether to stick with their original choice of door or switch their choice to the other remaining closed door.

What is the best strategy here? What is the probability of winning the car when sticking with their original choice? What is the probability if they were to change their choice?

Find the probabilities  $\Pr(C_1|H_3)$  and  $\Pr(C_2|H_3)$  of the car being behind door 1 or 2, given that the host has opened door 3.

- Simulate the game to find these probabilities
- Find the probabilities by using the expression for conditional probabilities and Bayes' theorem

You are free to start with either task.