# Case Study with Data Applications

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## Exercises

1. **Exactly 2 people with the same birthday - Simulation**. Complete a similar analysis for case where exactly 2 people in a room of 23 people have the same birthday. In this exercise you will use a computational simulation.

a) Create a new R Markdown file.

b) Simulate having 23 people in the class which each day of the year equally likely. Find the cases where exactly 2 people have the same birthday, you will have to alter the code more than changing 18 to 23.

c) Plot the frequency of occurences as a bar chart.

d) Estimate the probability of exactly two people having the same birthday.

2. **Exactly 2 people with the same birthday - Mathematical**. Repeat problem 1 but do it mathematically. As a big hint, you will need to use the `choose()` function. The idea is that will 23 people we need to choose 2 of them to match. We thus need to multiply, the multiplication rule again, by `choose(23,2)`. If you are having trouble, work with 3 people in the room first.

a) Find a formula for the exact probability of exactly 2 people in a room of 23 have the same birthday.

b) Generalize your solution to any number `n` people and create a function.

c) Vectorize the function.

d) Plot the probability of exactly 2 people have the same birthday versus number of people in the room.

e) Comment on the shape of the curve and explain it.

f) `knit` and compile your report.