

# Day 1 - The goat is more likely to be behind the other door

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## 1 Motivation

### Learning Objective 1

Apply basic rules of probability. Determine when random variables are independent or dependent. Interpret distribution plots.

### 1.1 Conditional probability

1. Suppose you have a dataset from a flow cytometry test for diagnosing a bacterial infection in a clinical setting. The test is designed to identify the presence of the bacterial pathogen "Bacillus bacterium X" in patient blood samples. The dataset includes 1000 test results. True Positives (correctly identified infected patients): 450 True Negatives (correctly identified healthy patients): 475 False Positives (healthy patients incorrectly identified as infected): 20 False Negatives (infected patients incorrectly identified as healthy): 55

Calculate the following metrics based on the dataset:

- (a) What is the probability that a randomly selected patient has the bacterial infection?
- (b) What is the probability that a randomly selected patient has the bacterial infection given that the test result is positive?
- (c) What is the probability that a randomly selected patient has the bacterial infection given that the test result is negative?
- (d) What is the probability that a randomly selected patient has the bacterial infection given that the test result is positive?
- (e) What is the probability that a randomly selected patient has the bacterial infection given that the test result is negative?