ADS2 – Conditional probabilities

ADS2 (based on MI Stefan)

Semester 2, 2023/24

Work through this guide alone or in groups. Facilitators are here to help, and interested in what you're doing - do not be shy to ask them questions, or discuss your results with them.

The time it takes to complete this practical can vary between individuals - this is OK. Do not worry if you do not finish within the session.

Learning Objectives

- Recall how to compute conditional probabilities
- State and apply Bayes' theorem
- Describe and use Markov chains

Lie detector problem

In a big store, around 10% of employees are stealing. Everybody has to take a lie detector test that is correct in 80% of cases (and mistakes are equally likely in either direction). Everybody says that they are not a thief.

If the lie detector says that 50 people are lying, how many of them are probably thieves?

Work out the answer in two ways:

1. By setting up and running a simulation
2. By using Bayes' theorem

Coin toss

Somebody tosses a fair coin repeatedly, and records the sequence of outcomes (e.g. "H-T-T-T-T-H-H-T-. . ."). How long would it take until the sequence "H-T-T-H" first appears?

1. Complete the Markov chain diagram we started in the lecture
2. Using the Markov chain, create a simulation and run it many times to answer your question

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