Homework 2

February 19th
Due February 26th

Your assignment may be handwritten or typeset, but in any case it should be neat and readable. Your name and assignment number should be clearly visible (like on this document for example). It is due on Gradescope.

You are encouraged to work in groups for this assignment. However, the redaction should be done on one's own: do not copy some other student's work, or give your assignment to some other student. To consult textbooks or online resources is fair game; on the other hand, to look up the exact exercise and its solution is not. I will be available at my office hours[1] if you need help.

Exercises from the book

Included in this homework are exercises 1.26, 1.27, 1.29, 1.30, 1.34, 1.36, 1.39.

Exercise 1

Your dog has a simple life while you are away. There are five things it can do: watch out the window, nap, play with his toys, eat its food, and... eat the couch.

Your dog does three activities in the day, one after the other (for instance nap, then nap, than play), and forgets all about it once it has changed. Here is its thought process.

- At the beginning of the day, or when it just had a nap, it has an equal chance to watch out the window, nap or play.
- When it just played with his toys, it's tired. It might, with equal probabilities, have a nap, watch out the window, or eat something (not the couch).
- When it just spent some time looking out the window, it is getting bored. Maybe this gives it motivation to play (45%), or maybe it will lose interest and have a nap (45%). Or maybe the frustration will make it eat the couch (10%).
- When it just ate, it is satisfied and will have a nap.
- When it just ate the couch, it becomes impossible to predict its behaviour.

What is the probability that, when you come back, your dog ate the couch?

[1] Monday 2:30-3:30, Thursday 10:30-11:30, or by appointment.

Exercise 2

This is a variation on exercise 1.47 from the book.

An isolated research station sends its tutor government agency two signals each morning. Each of them can be "OK" or "Error", referring to the stability of containment chambers 1 and 2. However, the signal is not perfectly reliable, and there is a 1% chance that a given signal is received as its opposite ("Error" instead of "OK" and vice versa), independently of the other.

1. If the station sends "OK, OK", what is the probability that "OK, OK" is received?
2. There is a minor problem about one day out of five for a given chamber, randomly and independently of the other chamber.
   (a) What is the probability that the station sends "OK, Error" on a given day?
   (b) The agency receives "OK" for containment chamber 1. What is the probability that there is a problem in chamber 1?
   (c) The agency receives "OK, OK". What is the probability that, actually, all is not OK?