There are a few problems from the book, and two additional problems called A and B.

Exercise 2.33 (about complements being independent)
Exercise 2.36 (about two dice)
Exercise 2.37 (about double sixes)

Recall from class that, under appropriate assumptions,

$$P(A \text{ before } B) = \frac{P(A)}{P(A) + P(B)}.$$

We completed two proofs, and we started a third proof, based on an idea of LT (if I remember correctly).

A. Write out the third proof completely. Be careful and explicit, because I am particularly interested in how you handle the intersections and unions involved.

In class we discussed a one-word Bayesian junk e-mail filter based on the equation

$$P(J|W) = \frac{P(W|J)P(J)}{P(W|J)P(J) + P(W|J^c)P(J^c)}.$$

Now let's design a two-word filter. Let W be the event that a message contains one suspicious word (say, "Rolex") and V the event that it contains a different suspicious word ("libido"). To streamline the problem, we make two assumptions of *conditional independence*:

$$P(WV|J) = P(W|J)P(V|J), \quad P(WV|J^c) = P(W|J^c)P(V|J^c).$$

In the jargon of spam filtering, these assumptions make our filter "naive". It's not state-of-the-art. That's okay.

B. Show that $P(J|WV) = \frac{x}{x+y}$, where

$$x = P(W|J)P(V|J)P(J), \quad y = P(W|J^c)P(V|J^c)P(J^c).$$