Problem 0: Readings
Read notes 1 and 2 from the course web site.

Problem 1: Independence can be tricky!
Consider flipping a fair coin 3 times.

(a) Draw a tree illustrating the sample space (there should be eight outcomes).

(b) Find three events $A$, $B$, and $C$, such that no two of them are independent, but $P(A \cap B \cap C) = P(A)P(B)P(C)$.

(c) Find three events $A$, $B$, and $C$, such that every two of them are independent (we call them pairwise independent), but the three are not independent, i.e. $P(A \cap B \cap C) \neq P(A)P(B)P(C)$.

Problem 2: Of mice and men
The color of a mouse depends on a pair of genes, each of which is either B or b. If both genes are alike, the mouse is said to be homozygous; otherwise, it is heterozygous. The mouse is brown only if it is homozygous bb. The offspring of a pair of mice have two such genes, one from each parent, and if the parent is heterozygous, the inherited gene is B or b with equal probability. Given a black mouse that results from a mating between two heterozygotes:

(a) What are the probabilities that this mouse is homozygous and heterozygous?

Now suppose that this mouse is mated with a brown mouse, resulting in seven offspring all of which are black.

(b) Use Bayes’ rule to find the probability that the black mouse was homozygous BB.

(c) Recalculate the same by regarding the seven offspring as seven observations made sequentially, treating each posterior after each observation as the prior for the next.