

## In-class, Week 9, day 1

**Section 7.2, Problem 30:** Find the probability that a randomly generated bit string of length 10 does not contain a 0 if bits are independent and

- a) a 0 bit and a 1 bit are equally likely.
- b) the probability that a bit is 1 is 0.6.
- c) the probability that the  $i^{\text{th}}$  bit is a 1 is  $\frac{1}{2^i}$  for  $i = 1, 2, 3, \dots, 10$ .

**Section 7.2, Problem 38:** A pair of dice is rolled in a remote location and when you ask an honest observer whether at least one die came up six, this honest observer answers in the affirmative.

- a) What is the probability that the sum of the numbers that came up on the two dice is seven, given the information provided by the honest observer?

**Section 7.3, Problem 8:** Suppose that one person in 10,000 has a rare genetic disease. There is an excellent test for the disease: 99.9% of the people with the disease test positive and only 0.02% who do not have the disease test positive.

- a) What is the probability that someone who tests positive has the disease? (Assume that any person in the population is equally likely to be tested.)
- b) What is the probability that someone who tests negative does not have the disease? (Assume that any person in the population is equally likely to be tested.)

**Section 7.3, Problem 16:** Ramesh can get to work in three different ways: by bicycle, by car, or by bus. Because of commuter traffic, there is a 50% chance that he will be late when he drives his car. When he takes the bus, which uses a special lane reserved for buses, there is a 20% chance he will be late. The probability that he is late when he rides his bicycle is only 5%. Ramesh arrives late one day.

- a) Suppose the boss assumes that there is a  $\frac{1}{3}$  chance that Ramesh takes each of the three ways he can to get to work. What estimate for the probability that Ramesh drove his car does the boss obtain from Bayes' theorem under this assumption?
- b) Suppose the boss knows that Ramesh drives 30% of the time, takes the bus 10% of the time, and rides his bicycle 60% of the time. What estimate for the probability that Ramesh drove his car does the boss obtain from Bayes' theorem under this assumption?