COMP SCI/SFWR ENG 4/6E03 — Assignment 1

1. A program is equally likely to have been written by one of two programmers, A or B. If the program is written by A, it is equally likely to have zero or one bugs. If the program is written by B, it is equally likely to have zero, one, two, three, or four bugs.

   (a) What is the expected number of bugs in a randomly selected program?
   (b) Suppose that there is exactly one bug in a program. What is the probability that this program was written by A?

2. A program is tested using five tests. The results of each of these tests are independent. If there is an error, these tests will discover it with probabilities 0.1, 0.2, 0.3, 0.4, and 0.5, respectively. What is the probability that an error is found by:

   (a) no tests
   (b) at least two tests
   (c) by all five tests

3. The probability that a given component is defective is 0.006. Each component is subjected to a test that correctly identifies a defective component, but with probability 0.02 identifies a good component as defective. Given a randomly chosen component is tested as defective, compute the probability it is actually defective.

4. Suppose that we draw a sequence of cards from a standard 52 card deck. Each time a card is drawn, it is put back in the deck, so a draw is always made from a full deck. Assume that each of the cards is equally likely to be drawn. Draws are made until a heart is revealed.

   (a) What is the probability that we will need at least three draws before we see a heart?
   (b) What is the expected number of draws until we see a heart?

5. A component has a lifetime T that is exponentially distributed with mean one year. (The lifetime is the time until the component fails.)

   (a) Find the lifetime L which a typical component exceeds with probability 0.9.
   (b) If five components are sold to a manufacturer, find the probability that at least one of them will have a lifetime of less than L.
   (c) Suppose that a component is still operating at time L. What is the expected time, starting at L, until it fails?