Problem 1. In some population, 30% of the persons smoke and 8% have heart disease. Moreover, 12% of the persons who smoke have the disease.

a. What percentage of the population smoke and have the disease?
b. What percentage of the population with the disease also smoke?
c. Are smoking and the disease independent?

Problem 2. When at the free-throw line for two shots, a basketball player makes at least one free throw 90% of the time. 80% of the time, the player makes the first shot, while 70% of the time both shots succeed.

a. Does it appear that the player’s second shot success is independent of the first?
b. What is the conditional probability that the player makes the second shot given that the first succeeds? What is the conditional probability if the first shot misses?

Problem 3. A study by Bastian et al. [Diagnostic efficiency of home pregnancy test kits, Archives of Family Medicine 7, 465-469 (1998)] investigated home pregnancy tests with the following findings:

When women collected and tested their own samples, the overall sensitivity of the testing kits was 75%. Specificity was also low, in the range from 52% to 75%.

a. Interpret a positive and a negative test result using diagnostic likelihood ratios using both extremes of the specificity.
b. A woman taking a home pregnancy test has a positive test. Draw a graph of the positive predictive value depending on the prior probability (prevalence) that women in the population are pregnant. Assume the specificity is 63.5%
c. Repeat the previous question for a negative test and the negative predictive value.