1. An urn contains 4 white and 3 red marbles.
   a) If two marbles are selected without replacement from this urn, what is the probability that the two marbles selected are white? (2/7)
   b) If two marbles are selected with replacement from this urn, what is the probability that the two marbles selected are white? (16/49)

2. An urn contains 3 white and 7 yellow balls. Two balls are drawn at random from the urn. Determine the probability for each of the following:
   a) two white balls without replacement. (1/15)
   b) one of each color without replacement. (7/15)
   c) two yellow balls with replacement. (.49)

3. An urn contains 4 red and 6 green balls. Two balls are drawn at random without replacement. What is the probability that the two selected are of different colors? (8/15)

4. Urn A contains 4 white and 3 red marbles, urn B contains 2 white and 5 red marbles, and urn C contains 2 white and 6 red marbles. A marble is to be selected from each one of the three urns. What is the probability that the three selected are of the same color? (53/196)

5. If you have an urn with 3 white and 12 black balls, what is the probability of selecting two black balls in random sampling without replacement? (22/35)

6. Two vacancies exist at the junior executive level of a certain company. Ten people, seven men and three women, are eligible and equally qualified. The company has decided to draw two names at random from the list of those eligible. What is the probability that:
   a) both positions will be filled by a woman? (1/15)
   b) at least one of the positions will be filled by a woman? (8/15)
   c) neither of the positions will be filled by a woman? (7/15)

7. A bin of machine parts contains 10 percent defectives. A random sample of three is drawn from the bin with replacement. What is the probability of at least one defective in the sample? (.271)

8. What is the probability of tossing at least one head in three tosses of a fair coin? (.875)

9. If a product is 5% defective,
   a) what is the probability that a sample of 5 will contain no defective items? (.7738)
   b) what is the probability that the sample will contain at least one defective item?

10. If you have a product with a 5% defective rate and pick three at random from the process,
    a) what is the probability of all three of them being nondefective?
    b) what is the probability of at least one of them being defective? (.1426)

11. In a study involving a manufacturing process, 10% of all parts tested were defective, and 30% of all parts were produced on machine A. Given that a part was produced on machine A, there is a 15% probability that it is defective.
    a) What is the probability that a part tested is both defective and produced by machine A? (.045)
    b) If a part is found to be defective, what is the probability that it came from machine A? (.45)
    c) What is the probability of the part being either defective or produced by machine A? (.355)
    d) Are the events “a defective part” and “produced by machine A” dependent or independent? Why or why not?
12. In a certain country, 30% of the population are males and 60% have low intelligence. In addition, 75% of the males have low intelligence. If a person is selected at random, what is the probability that he or she
   a) is a male of low intelligence? (.225)
   b) is a male or has low intelligence? (.675)
   c) If the student selected is of low intelligence, what is the probability that he or she is a male? (.375)
   d) According to the above results, are gender and intelligence dependent or independent? Why or why not?

13. In a large company it is known that 40% of the employees are college graduates and that 55% of the employees are women. Furthermore, 70% of the college graduates are women. If an employee is selected at random:
   a) what is the probability that the employee is both a college graduate and a woman? (.28)
   b) If a woman is selected, what is the probability that she is a college graduate? (.509)
   c) what is the probability of selecting either a college graduate or a woman? (.67)
   d) According to the above results, are the events “college graduate” and “woman” dependent or independent? Why or why not?

14. You are the marketing manager of a grocery company and you have found that 40% of all your male customers are bikers (that is, motorcyclists. Bicycle riders are called cyclists. No one knows why this is.) In addition, 30% of your male customers purchase Old Spice after shave lotion. You also know that 80% of the men who purchase Old Spice are bikers (motorcyclists). If you select a male customer at random, what is the probability that he:
   a) is a biker who purchases Old Spice? (.24)
   b) is either a biker or purchases Old Spice? (.46)
   c) If you can tell that he’s a biker, what is the probability he will purchase Old Spice? (.60)
   d) Are the events “biker” and “purchaser of Old Spice” dependent or independent? Why or why not?

15. Suppose that a firm is considering instituting a drug testing program for its employees. The test consists of an analysis of a urine sample and is not perfectly accurate. Let us suppose that it is 90% accurate for users, meaning that if a person is a user the probability of a positive result (a positive result indicates that the person is a user) is 90%. Assume also that for non-users the probability of a negative result is 95%. Let us further suppose that 15% of the population being tested are drug users. Adopting the following notation:
   \[ D = \text{“the person is a drug user”} \]
   \[ T = \text{“positive result on the drug test”} \]
   a) What is the marginal probability of a positive result on any given test?
   b) Given that a test result is positive, what is the probability that the person is actually a drug user? (.7606)

16. A recently instituted test procedure is supposed to tell if a particular product is defective or not. However, the test is not 100% accurate. If an item is defective, the test will indicate that it is defective 97% of the time. On the other hand, if the item is not defective, the test will yield a nondefective reading 88% of the time. Assume that 4% of the items are defective. Adopting the following notation:
   \[ T = \text{“the test indicates a defective item”} \]
   \[ D = \text{“defective item”} \]
   a) What is the marginal probability of a test result indicating a defective item? (.154)
   b) If a test result indicates that an item is defective, what is the probability that it is actually defective? (.2519)
17. As reported in the Financial Times of January 9, 2004:

A test for ovarian cancer correctly identifies ovarian cancer 80% of the time, so that if a woman has ovarian cancer, the test will yield a positive result 80% of the time. Also, the test will correctly indicate when she does not have cancer 90% of the time. Assume that 1% of the population who are given the test have ovarian cancer. Adopting the following notation:

\[ C = \text{"subject has ovarian cancer"} \]
\[ T = \text{"positive result on the test"} \]

a) What is the probability of a positive result on the test?
b) If a woman tests positive on the test, what is the probability she actually has cancer? (.07477)

18. Assume that a polygraph (lie detector) correctly identifies liars 95% of the time. Assume also that it correctly identifies truth tellers 95% if the time. (These probabilities come from a polygraph advocate, but in actuality they’re much too high. They’re also very unlikely to be equal to each to other.) Assume you’re using the polygraph to identify spies among FBI agents. You will be asking each agent tested if he or she is a spy. Assuming a reasonable percentage of spies in the FBI and using the following notation:

\[ L = \text{“the agent is lying (and therefore a spy)”} \]
\[ T = \text{“positive result on the test, indicating the agent is lying and therefore a spy”} \]

a) What is the probability of a positive result on the test?
b) If a test result is positive, what is the probability the agent being tested is actually a spy? (.1610)