College Mathematics

conditional probability homework

1. Suppose that 2 out of every 100 people have a particular substance in their bodies.
   A certain test to detect this substance is correct 97 out of every 100 times.
   If a person takes this test, and the test says that the substance is present in his body,
   what is the probability that the person actually has that substance in his body?

2. A laboratory blood test is 95% accurate in detecting a certain disease when it is, in fact, present.
   The test is 99% accurate in providing a negative result when the disease is not present.
   Suppose that only 0.5% of the population has the disease.
   If a person tests positive for the disease, what is the probability that she actually has the disease?

3. Suppose that 63% of people talk on a cell phone while driving.
   Suppose that 5% of cell phone users have been in car accidents in the past year.
   Suppose that 1% of drivers who do not talk on a cell phone have been in car accidents in the past year.

   (a) What is the probability that a driver is a cell phone user and has been in a car accident in the past year?
   (b) Given that a driver has been in a car accident in the past year, what is the probability that he/she uses a cell phone while driving?
   (c) Given that a driver has not been in a car accident in the past year, what is the probability that he/she does not use a cell phone?

4. Suppose that 1 in 1,000,000 Americans play in the NBA (National Basketball Association).
   Suppose that 85% of NBA players are very tall (over 6'3").
   Suppose that 2% of all other Americans are very tall (over 6'3").

   (a) Given that an American is in the NBA, what is the probability that he is very tall?
   (b) Given that an American is very tall, what is the probability that he is in the NBA?

5. Suppose that 40% of babies are nursed by their mothers.
   Also, suppose that 25% of those nursed grow up without allergies.
   Furthermore, suppose that 7% of those who were not nursed grow up without allergies.

   (a) What is the probability of being bottle-fed and allergic?
   (b) What is the probability of being nursed and allergic?
   (c) Given that someone is allergy-free, what is the probability that the person was nursed as a baby?
   (d) Given that someone is allergic, what is the probability that person was bottle-fed as a baby?

6. Suppose that out of all defendants in criminal cases, 60% actually are guilty.
   Suppose that of those who are guilty, 92% are convicted.
   Finally, suppose that of those who are innocent, 3% are (unjustly) convicted.

   (a) What is the probability of any given defendant being both guilty and yet not convicted?
   (b) What is the probability of any given defendant being both innocent and yet convicted?
   (c) Given that a defendant is guilty, what is the probability of that person actually being convicted?
   (d) Given that a defendant is innocent, what is the probability of that person not being convicted?
   (e) Given that a defendant was convicted, what is the probability that the person is, in fact, guilty?
   (f) Given that a defendant was not convicted, what is the probability that the person is guilty?