EXERCISES 4

1. In Orange County, 51% of the adults are males. (It doesn't take too much advanced mathematics to deduce that the other 49% are females.) One adult is randomly selected for a survey involving credit card usage.
(a) Find the prior probability that the selected person is a male.
(b) It is later learned that the selected survey subject was smoking a cigar. Also, 9.5% of males smoke cigars, whereas 1.7% of females smoke cigars (based on data from the Substance Abuse and Mental Health Services Administration). Use this additional information to find the probability that the selected subject is a male.

2. An aircraft emergency locator transmitter (ELT) is a device designed to transmit a signal in the case of a crash. The Altigauge Manufacturing Company makes 80% of the ELTs, the Bryant Company makes 15% of them, and the Chartair Company makes the other 5%. The ELTs made by Altigauge have a 4% rate of defects, the Bryant ELTs have a 6% rate of defects, and the Chartair ELTs have a 9% rate of defects (which helps to explain why Chartair has the lowest market share).
(a) If an ELT is randomly selected from the general population of all ELTs, find the probability that it was made by the Altigauge Manufacturing Company.
(b) If a randomly selected ELT is then tested and is found to be defective, find the probability that it was made by the Altigauge Manufacturing Company.

3. A hospital has 300 nurses. During the past year, 48 of the nurses earned a pay raise. At the beginning of the year, the hospital offered a special training seminar, which was attended by 138 of the nurses. Twenty-seven of the nurses who earned a raise had attended the training seminar.
(a) What is the probability that a nurse who attended the seminar earned a pay raise?
(b) If a nurse is selected at random, what is the probability that the person attended the seminar *and* earned a pay raise?
(c) What is the probability that a nurse who earned a pay raise had attended the training seminar?

4. Dr. Foster remembers to take his umbrella with him 80% of the days.
It rains on 30% of the days when he remembers to take his umbrella, and it rains on 60% of the days when he forgets to take his umbrella.
What is the probability that he remembers his umbrella when it rains?

5. While watching a game of Champions League football in a bar, you observe someone who is clearly supporting Manchester United in the game. What is the probability that they were actually born within 25 miles of Manchester? Assume that the probability that a randomly selected person in a typical local bar environment is born within 25 miles of Manchester is 1/20 , and that the chance that a person born within 25 miles of

Manchester actually supports United is 7/10 . Assume also that the probability that a person not born within 25 miles of Manchester supports United with probability 1/10.
6. It is believed that a sought after treasure will be in a certain sea area with probability 2/5. A search in that area will detect the treasure with probability 9/10 if it is there (you may assume that the probability of not detecting when the treasure is not there is 1). What is the probability of the treasure being in the area given that the area is searched and no treasure is found?

7. In a factory, machine X produces 60% of the daily output and machine Y produces 40% of the daily output.
2% of machine X's output is defective, and 1.5% of machine Y's output is defective.
One day, an item was inspected at random and found to be defective. What is the probability that it was produced by machine X?

8. A genetic test is used to determine if people have a predisposition for thrombosis, which is the formation of a blood clot inside blood vessel that obstructs the flow of blood through the circulatory system. It is believed that 3% of people actually have this predisposition. The genetic test is 99% accurate if a person actually has the predisposition, meaning that the probability of a positive test result when a person actually has the predisposition is 0.99. The test is 98% accurate if a person does not have the predisposition. What is the probability that a randomly selected person who tests positive for the predisposition by the test actually has the predisposition?

9. Lupus is a medical phenomenon where antibodies that are supposed to attack foreign cells to prevent infections instead see plasma proteins as foreign bodies, leading to a high risk of blood clotting. It is believed that 2% of the population suffer from this disease. The test is 98% accurate if a person actually has the disease. The test is 74% accurate if a person does not have the disease. There is a line from the Fox television show House that is often used after a patient tests positive for lupus:"It's never lupus." Do you think there is truth to this statement?
(a) Use a tree diagram to solve this problem.
(b) Solve the problem using Bayes' Theorem.

10. Jose visits campus every Thursday evening. However, some days the parking garage is full, often due to college events. There are academic events on 35% of evenings, sporting events on 20% of evenings, and no events on 45% of evenings. When there is an academic event, the garage fills up about 25% of the time, and it fills up 70% of evenings with sporting events. On evenings when there are no events, it only fills up about 5% of the time. If Jose comes to campus and finds the garage full, what is the probability that there is a sporting event?
(a) Use a tree diagram to solve this problem.
(b) Solve the problem using Bayes' Theorem

Answers

1.a)0.51; b)0.853
2. a)0.8; b)0.703
3. a)0.196; b)0.09; c)0.563
4. 0.67
5. 0.27
6. 0.0625
7. 0.67
8. 0.605
9. Yes, P(NLIY)=0.93
10. 0.56