

CSE230: Discrete Mathematics

Assignment 3

Deadline: 21st August, 2022

1. Two events have $P(A) = \frac{1}{4}$, $P(B|A) = \frac{1}{2}$ and $P(A|B) = \frac{1}{3}$. Compute $P(A \cap B)$, $P(B)$, $P(A \cup B)$.
2. A, B, and C are events with $P(A) = 0.3$, $P(B) = 0.4$, and $P(C) = 0.5$, A and B are disjoint, A and C are independent, and $P(B|C) = 0.1$. Find $P(A \cup B \cup C)$.
3. A group of students went on a school excursion. 2 of the students are to be randomly selected from the group to lead the side. If the group has 10 more boys than girls and that there are 756 equiprobable ordered selections, what is the probability that two boys or two girls got selected?
4. Plumber Bob does 40% of the plumbing jobs in a small town. 30% of the people in town are unhappy with their plumbers, but 50% of Bob's customers are unhappy with his work. If your neighbor is not happy with his plumber, what is the probability that it was Bob?
5. You are going to meet a friend at the airport. Your experience tells you that the plane is late 70% of the time when it rains, but is late only 20% of the time when it does not rain. The weather forecast that morning calls for a 40% chance of rain. What is the probability that the plane will be late?
6. The alpha fetal protein test is meant to detect spina bifida in unborn babies, a condition that affects 1 out of 1,000 children who are born. The literature on the test indicates that 5% of the time a healthy baby will cause a positive reaction. We will assume that the test is positive 100% of the time when spina bifida is present. Your doctor has just told you that your alpha fetal protein test was positive. What is the probability that your baby has spina bifida?
7. A student is taking a multiple-choice exam in which each question has four possible answers. She knows the answers to 60% of the questions and guesses at the others. What is the probability that she guessed given that she got question 12 right?
8. 20% of people are "accident-prone" and have a probability of 0.15 of having an accident in a 1-year period in contrast to a probability of 0.05 for the other 80% of people. (a) If we pick a person at random, what is the probability that they will have an accident this year? (b) What is the probability a person is accident-prone if they had an accident last year? (c) What is the probability that they will have an accident this year if they had one last year?

9. Two masked robbers try to rob a crowded bank during the lunch hour but the teller presses a button that sets off an alarm and locks the front door. The robbers, realizing they are trapped, throw away their masks and disappear into the chaotic crowd. Confronted with 40 people claiming they are innocent, the police give everyone a lie detector test. Suppose that guilty people are detected with probability 0.95, and innocent people appear to be guilty with probability 0.01. What is the probability that Mr. Jones is guilty given that the lie detector says he is?
10. An undergraduate student has asked a professor for a letter of recommendation. He estimates that the probability he will get the job is 0.8 with a strong letter, 0.4 with a medium letter, and 0.1 with a weak letter. He also believes that the probabilities that the letter will be strong, medium, or weak are 0.5, 0.3, and 0.2. What is the probability that the letter was strong given that he got the job.