

Conditional Probability Exercises

Exercise 1

A class in advanced physics is composed of 10 juniors, 30 seniors, and 10 graduate students. The final grades show that 3 of the juniors, 10 of the seniors, and 5 of the graduate students received an *A* for the course. If a student is chosen at random from this class and is found to have earned an *A*, what is the probability that he or she is a senior?

Exercise 2

A random sample of 200 adults are classified below by sex and their level of education attained.

Education	Male	Female
Elementary	38	45
Secondary	28	50
College	22	17

If a person is picked at random from this group, find the probability that

- a) the person is a male, given that the person has a secondary education.
- b) the person does not have a college degree, given that the person is female.

Exercise 3

In an experiment to study the relationship of hypertension and smoking habits, the following data are collected for 180 individuals:

	Nonsmokers	Moderate Smokers	Heavy Smokers
H	21	36	30
NH	48	26	19

Here H and NH stand for Hypertension and Nonhypertension, respectively. If one of these individuals is selected at random, find the probability that the person is

- a) experiencing hypertension, given that the person is a heavy smoker.
- b) a nonsmoker, given that the person is experiencing no hypertension.

Exercise 4

In the senior year of a high school graduating class of 100 students, 42 studied mathematics, 68 studied psychology, 54 studied history, 22 studied both mathematics and history, 25 studied both mathematics and psychology, 7 studied history but neither mathematics nor psychology, 10 studied all three subjects, and 8 did not take any of the three. Randomly select a student from the class and find the probability of the following events.

- a) A person enrolled in psychology takes all three subjects
- b) A person not taking psychology is taking both history and mathematics

Exercise 6

The probability that a married man watches a certain television show is 0.45, and the probability that a married woman watches the show is 0.5. The probability that a man watches the show, given that his wife does, is 0.8. Find the probability that

- a) a married couple watches the show;
- b) a wife watches the show, given that her husband does;
- c) at least one member of a married couple watches the show.

Exercise 7

A fair coin is flipped twice. What is the probability that both flips land on heads given that

- a) the first flip lands on heads
- b) at least one flip lands on heads

Exercise 8

A paint-store chain produces and sells latex and semigloss paint. Based on long-range sales, the probability that a customer will purchase latex paint is 0.75. Of those that purchase latex paint, 60% also purchase rollers. But only 30% of semigloss paint buyers purchase rollers. A randomly selected buyer purchases a roller and a can of paint. What is the probability that the paint is latex?

Exercise 9

Denote by A , B , and C the events that a grand prize is behind doors A , B , and C , respectively. Suppose you randomly picked a door, say A . The game host opened a door, say B , and showed there was no prize behind it. Now the host offers you the option of either staying at the door that you picked (A) or switching to the remaining unopened door (C). Use probability to explain whether you should switch or not.

Exercise 10

Every morning during college weeks, a period of 6 weeks, a student rolls a die. If the outcome is a six, then he will study; otherwise he goes back to sleep. During examination week, rather than rolling a die, our student flips a coin and he will study if he flips heads. If our student is studying one morning, what is the probability that it is examination week?

Exercise 11

A truth serum has the property that 90 % of the guilty suspects are properly judged while, of course, 10 % of the guilty suspects are improperly found innocent. On the other hand, innocent suspects are misjudged 1 % of the time. If the suspect was selected from a group of suspects of which only 5 % have ever committed a crime, and the serum indicates that he is guilty, what is the probability that he is innocent?

Exercise 12

A large industrial firm uses three local motels to provide overnight accommodations for its clients. From past experience it is known that 20% of the clients are assigned rooms at the Ramada Inn, 50% at the Sheraton, and 30% at the Lakeview Motor Lodge. If the plumbing is faulty in 5% of the rooms at the Ramada Inn, in 4% of the rooms at the Sheraton, and in 8% of the rooms in the Lakeview Motor Lodge, what is the probability that

- a) a client will be assigned a room with faulty plumbing?
- b) a person with a room having faulty plumbing was assigned accommodations at the Lakeview Motor Lodge?

Exercise 13

A certain form of cancer is known to be found in women over 60 with probability 0.06. A blood test exists for the detection of the disease, but the test is not infallible. In fact, it is known that 10% of the time, the test gives a false negative and 5% of the time the test gives a false positive. If a woman over 60 is known to have taken the test and received a favorable (i.e., negative) result, what is the probability that she has the disease?

Exercise 14

A firm is accustomed to training operators who do certain tasks on a production line. Those operators who attend the training course are known to be able to meet their production quotas 90% of the time. New operators who do not take the training course only meet their quotas 65% of the time. Forty percent of new operators attend the course. Given that a new operator meets her production quota, what is the probability that she attended the program?