

Probability Examples

1. A college library has four copies of a certain book; the copies are numbered 1, 2, 3, and 4. Two of these are randomly selected. The first book selected will be placed on 2-hour reserve, and the second one may be checked out on an overnight basis.
 - a. How many outcomes are in the sample space?
 - b. Construct a tree diagram of the sample space.
 - c. Let A denote the event that at least one of the books selected is an even-numbered copy. What outcomes are in A ?
 - d. Suppose that copies 1 and 2 are first printings, whereas copies 3 and 4 are second printings. Let B denote the event that exactly one of the copies selected is a first printing. What outcomes are in B ?

2. A library has five copies of a certain text on reserve of which two copies (1 and 2) are first printings and the other three (3, 4, and 5) are second printings. A student examines these books in random order, stopping only when a second printing has been selected.
 - a. Construct a tree diagram of the sample space.
 - b. What outcomes are contained in the event that exactly one book is examined before the experiment terminates?
 - c. What outcomes are contained in the event that the experiment terminates with the examination of book 5?

3. Suppose that starting at a certain time, batteries coming off an assembly line are examined one by one to see whether they are defective. The experiment terminates as soon as a defective battery is obtained.
 - a. Give five possible experimental outcomes.
 - b. What can be said about the number of outcomes in the sample space?
 - c. What outcomes are in the event E , that the number of batteries examined is an even number?

4. Determine the number of outcomes in the sample space.
 - a. How many telephone numbers are possible in the AISD system? (The numbers begin with either 414 or 841.)
 - b. How many telephone numbers are possible in one area code?
 - c. How many possible non-custom license plates are available in California?
 - d. How many possible passwords are available for login on hotmail? (Assume logins are between 8 and 12 characters and must contain only numbers or letters).

8. New spark plugs have just been installed in a small airplane with a four-cylinder engine. For each spark plug, the probability that it is defective and will fail during its first 20 minutes of flight is $1/10,000$, independent of the other spark plugs.
- For any given spark plug, what is the probability that it will not fail during the first 20 minutes of flight?
 - What is the probability that none of the four spark plugs will fail during the first 20 minutes of flight?
 - What is the probability that at least one of the spark plugs will fail?
 - If a plane rental company has 25 of these small airplanes, what is the probability that at least one of the spark plugs will fail?
9. A Psychological test identifies people as being one of eight types. For instance, Type 1 is "Rationalist" and applies to 15% of men and 8% of women. Type 2 is "Teacher" and applies to 12% of men and 14% of women. Each person fits one and only one type.
- What is the probability that a randomly selected male is either "Rationalist" or "Teacher"?
 - What is the probability that a randomly selected female is not a "Teacher"?
 - Suppose college roommates have a particularly hard time getting along with each other if they are both "Rationalist." A college randomly assigns roommates of the same sex. What proportion of male roommate pairs will have this problem? Of female roommate pairs?
 - If half of the college is male and half female, what percent of all roommate pairs will be both "Rationalists"?
10. Jeanie is a bit forgetful, and if she doesn't make a "to do" list, the probability that she forgets something she is supposed to do is .1. Tomorrow she intends to run three errands, and she fails to write them on her list.
- What is the probability that Jeanie forgets all three errands?
 - What is the probability that Jeanie remembers at least one of the three errands?
 - What is the probability that Jeanie remembers the first errand but not the second or third?
11. Find the probability that at least 1 of 5 fellow employees in San Francisco has a listed number. Assume that telephone numbers are independent and that for San Francisco, 39.5% of the numbers are unlisted.
12. The IRS reports that among all taxpayers audited, 70% end up owing more money. One new auditor randomly selected 12 tax returns, audited them, and boasted that he collected additional taxes from all of them.
- What is the probability of accomplishing this feat?
 - What is the probability that actually none of them owed money?
 - What is the probability that at least one of them did not owe money?