

A

1. In transmitting dot and dash signals, a communication system changes $1/4$ of the dots to dashes and $1/3$ of the dashes to dots. If 40% of the signals transmitted are dots and 60% are dashes, what is the probability that a dot received was actually a transmitted dot?
2. On a multiple-choice exam with four choices for each question, a student either knows the answer to a question or marks it at random. If the probability that he or she knows the answer is $2/3$, what is the probability that an answer that was marked correctly was not marked randomly?
3. A judge is 65% sure that a suspect has committed a crime. During the course of the trial, a witness convinces the judge that there is an 85% chance that the criminal is left-handed. If 23% of the population is left-handed and the suspect is also left-handed, with this new information, how certain should the judge be of the guilt of the suspect?
4. In a trial, the judge is 65% sure that Susan has committed a crime. Julie and Robert are two witnesses who know whether Susan is innocent or guilty. However, Robert is Susan's friend and will lie with probability 0.25 if Susan is guilty. He will tell the truth if she is innocent. Julie is Susan's enemy and will lie with probability 0.30 if Susan is innocent. She will tell the truth if Susan is guilty. What is the probability that Susan is guilty if Robert and Julie give conflicting testimony?
5. Suppose that 5% of the men and 2% of the women working for a corporation make over \$120,000 a year. If 30% of the employees of the corporation are women, what percent of those who make over \$120,000 a year are women?
6. A stack of cards consists of six red and five blue cards. A second stack of cards consists of nine red cards. A stack is selected at random and three of its cards are drawn. If all of them are red, what is the probability that the first stack was selected?
7. A certain cancer is found in one person in 5000. If a person does have the disease, in 92% of the cases the diagnostic procedure will show that he or she actually has it. If a person does not have the disease, the diagnostic procedure in one out of 500 cases gives a false positive result. Determine the probability that a person with a positive test result has the cancer.
8. Urns I, II, and III contain three pennies and four dimes, two pennies and five dimes, three pennies and one dime, respectively. One coin is selected at random from each urn. If two of the three coins are dimes, what is the probability that the coin selected from urn I is a dime?
9. In a study it was discovered that 25% of the paintings of a certain gallery are not original. A collector in 15% of the cases makes a mistake in judging if a painting is authentic or a copy. If she buys a piece thinking that it is original, what is the probability that it is not?

10. There are three identical cards that differ only in color. Both sides of one are black, both sides of the second one are red, and one side of the third card is black and its other side is red. These cards are mixed up and one of them is selected at random. If the upper side of this card is red, what is the probability that its other side is black?
11. With probability of $1/6$ there are i defective fuses among 1000 fuses ($i = 0, 1, 2, 3, 4, 5$). If among 100 fuses selected at random, none was defective, what is the probability of no defective fuses at all?
12. Solve the following problem, asked of Marilyn Vos Savant in the "Ask Marilyn" column of *Parade Magazine*, February 18, 1996.

Say I have a wallet that contains either a \$2 bill or a \$20 bill (with equal likelihood), but I don't know which one. I add a \$2 bill. Later, I reach into my wallet (without looking) and remove a bill. It's a \$2 bill. There's one bill remaining in the wallet. What are the chances that it's a \$2 bill?

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13. There are two stables on a farm, one that houses 20 horses and 13 mules, the other with 25 horses and eight mules. Without any pattern, animals occasionally leave their stables and then return to their stables. Suppose that during a period when all the animals are in their stables, a horse comes out of a stable and then returns. What is the probability that the next animal coming out of the same stable will also be a horse?
14. An urn contains five red and three blue chips. Suppose that four of these chips are selected at random and transferred to a second urn, which was originally empty. If a random chip from this second urn is blue, what is the probability that two red and two blue chips were transferred from the first urn to the second urn?
15. The advantage of a certain blood test is that 90% of the time it is positive for patients having a certain disease. Its disadvantage is that 25% of the time it is also positive in healthy people. In a certain location 30% of the people have the disease, and anybody with a positive blood test is given a drug that cures the disease. If 20% of the time the drug produces a characteristic rash, what is the probability that a person from this location who has the rash had the disease in the first place?