

1. What is the probability that six cards drawn randomly from a normal deck will all be black? If they are all black, what is the probability that they belong to the same suit? (J&S Sec. 39.4)
2. A manufacturer buys components from three different suppliers. 50% from supplier S_1 , 30% from supplier S_2 and 20% from supplier S_3 . A component from S_1 is found to be faulty with probability 0.05, from S_2 with probability 0.07 and from and from S_3 with probability 0.06. What is the probability that a component chosen at random is not faulty? (J&S, Sec. 39.4)
3. In the game of Texas Hold'em poker, you can see 5 cards, and you have two draws to make a straight (a sequence of five consecutive numbers.) An inside straight draw means you need to see one of 4 possible cards appearing in the two draws. What is the probability of making the straight? For an outside straight draw, 8 cards could make your straight; what is the probability of making it?
4. Consider flipping a coin four times. If it is a fair coin, evaluate the probability of seeing tails 0, 1, 2, 3, or 4 times. This distribution is called a binomial distribution. Calculate the mean number of times tails comes up, and the standard deviation of the number. What fraction of times does it come up within one standard deviation of the mean? Repeat with 8 flips. (See J&S Sec. 40.1-40.3).
5. Rolling two six-sided die, find the distribution of the sum of the results. Evaluate the mean and the standard deviation of this distribution.
6. 8000 coins are spread randomly on the floor of a room. If you divide the room into 32 regions with the same area, what is the average number of coins you would find in an area? If the distribution has a Poisson distribution (J&S, Sec. 40.5), what is the standard deviation of the number of coins you find? Repeat with 100 sub-areas.
7. Invert the previous problem. Suppose you want to estimate the total number of coins in the room by measuring their number in a sub-area. If you find 80 coins in 1/100 of the area, what is the expected number and the error on that number? If you find 250 coins in 1/32 of the area, what is the expected number and its error? How large a fraction would you have to count to get a 3% error in your estimate?

8. The heights of a group of 345 students are described by a Gaussian function, with mean 180 cm and standard deviation 4.2 cm. Estimate the number with height greater than 195 cm and the number with heights in the range [170cm, 180cm] (J&S Sec. 40.9; note there is an error in Example 40.8.)
9. Find the sample mean and variance for the following sample of numbers (J&S Chapter 41):
{12, 32, 13, 33, 2, 19, 31, 41, 29, 32}
10. You measure two quantities, u and v , with errors given by σ_u and σ_v . Find the errors in the following, assuming u and v are independent:
- $4u$
 - $4u - 3v$
 - $3uv$
 - $\ln(4u)$
 - v^4
 - $uv + u^2$