

The Random Secretary

One classical problem of probability goes like this: A secretary addresses 50 different letters and envelopes

to 50 different

people, but the letters are randomly mixed before being put into envelopes. What is the probability that at least one letter gets into the correct envelope? Although the probability might seem like it should be small, it's actually 0.632. Even with a million letters and a million envelopes, the probability is 0.632. The solution is beyond the scope of this text—way beyond.

Example 13

If you bet \$5 on the number 13 in roulette, your probability of winning is $1/38$ and the payoff odds are given by the casino as 35:1.

- Find the actual odds against the outcome of 13.
- How much net profit would you make if you win by betting on 13?
- If the casino was not operating for profit and the payoff odds were changed to match the actual odds against 13, how much would you win if the outcome were 13?

Solution

- With $P(13) = 1/38$ and $P(\text{not } 13) = 37/38$, we get

$$\text{actual odds against } 13 = \frac{P(\text{not } 13)}{P(13)} = \frac{37/38}{1/38} = \frac{37}{1} \text{ or } 37:1$$

- Because the payoff odds against 13 are 35:1, we have

$$35:1 = (\text{net profit}):(\text{amount bet})$$

So there is a \$35 profit for each \$1 bet. For a \$5 bet, the net profit is \$175. The winning bettor would collect \$175 plus the original \$5 bet. After winning, the total amount collected would be \$180, for a net profit of \$175.

- If the casino were not operating for profit, the payoff odds would be changed to 37:1, which are the actual odds against the outcome of 13. With payoff odds of 37:1, there is a net profit of \$37 for each \$1 bet. For a \$5 bet the net profit would be \$185. (The casino makes its profit by paying only \$175 instead of the \$185 that would be paid with a roulette game that is fair instead of favoring the casino.)

4-2 Basic Skills and Concepts

Statistical Literacy and Critical Thinking

1. Florida Lottery Let A denote the event of placing a \$1 straight bet on the Florida Play 4 lottery and winning. The chance of event A occurring is 1 in 10,000. What is the value of $P(A)$? What is the value of $P(\bar{A})$?

2. Probability Given that the following statement is incorrect, rewrite it correctly: "The probability of a baby being born a boy is 50–50."

3. Interpreting Weather While this exercise was being created, Weather.com indicated that there was a 20% chance of rain for the author's home region. Based on that report, which of the following is the most reasonable interpretation?

- $1/5$ of the author's region will get rain today.
- In the author's region, it will rain for $1/5$ of the day.
- In the author's region, there is a $1/5$ probability that it will rain at some point during the day.

4. Subjective Probability Estimate the probability that the next time you ride in a car, you will *not* be delayed because of some car crash blocking the road.