

Midterm Answers

- Survivorship bias. Agents earning low commissions are more likely to quit.
- $P[\text{at least once}] = 1 - P[\text{never}] = 1 - (1 - 0.0412)^{10} = 0.343$
- The expected value of the payout is $0.01(\$1,000,000) = \$10,000$ so it should charge \$20,000.
- We can use Bayes' Rule, letting "H" mean enjoyed Homicide and "NoH" mean didn't not enjoy Homicide:

$$\begin{aligned}
 P[\text{H if W}] &= \frac{P[\text{H}]P[\text{W if H}]}{P[\text{H}]P[\text{W if H}] + P[\text{noH}]P[\text{W if noH}]} \\
 &= \frac{(0.40)(0.90)}{(0.40)(0.90) + (0.60)(0.20)} = \frac{0.36}{0.48} = 0.75
 \end{aligned}$$

- There are three ways to draw a red side and, in two of these cases, the other side of the card is also red. So the probability is $2/3$
- The probability of 10 heads and the probability of 10 tails are both $(1/2)^{10} = 1/1024$. The probability of one or the other is $2/1024$. The probability that a fairly flipped coin will land either all heads or all tails in 3 or more of the sixty 10-flip sets is given by the binomial distribution:

$$\begin{aligned}
 P[x \geq 3] &= \binom{60}{3} \left(\frac{2}{1024}\right)^3 \left(\frac{1022}{1024}\right)^{57} + \binom{60}{4} \left(\frac{2}{1024}\right)^4 \left(\frac{1022}{1024}\right)^{56} + \dots \\
 &= 0.000235
 \end{aligned}$$

- true
 - false
 - false
- yes
 - yes
 - no
 - no
- The probability of rolling a 1 on either or both dice is equal to 1 minus the probability of two non-1s: $1 - (5/6)(5/6) = 11/36$. The expected wait is one dividend by this probability: $1/(11/36) = 36/11$
- The purpose of the figure was to illustrate that correlation is not causation. Global temperatures have been rising over time and the number of pirates has been dropping but neither is causing the other.

The unintended lesson of this figure is that it is a terrific example of graphical gaffes. The vertical axis omits the origin, which exaggerates the increase in global temperatures. The horizontal axis is backwards, starting with higher numbers and then declining. The spacing of the numbers on the horizontal axis is not

reflective of the difference between the numbers (the distance between 17 and 400 is the same as the distance between 400 and 5000 and the distance between 5,000 and 15,000. The numbers on the horizontal axis are not in numerical order, in that 45,000 is placed between 20,000 and 35,000. The claim that there were 17 pirates in 2000 is suspiciously precise and obviously much too low. The dates on the line are evenly spaced even though the difference between the years alternates between 20 and 40. The original graph (too cluttered to put on the exam) was also chart junk: using a world map as a background and seven skull-and-crossbones images for the seven data points.

