Econ 57
Gary Smith
Spring 2017

Midterm Answers

1. [Fiona Macdonald, "Selfies have killed more people than sharks this year, reports show," *Science Alert*, September 22, 2015.] To calculate the probability of being injured while taking a selfie, we need to divide 12 by the number of selfies taken (a lot!), and compare this to 8 divided by the number of swims in shark-infested waters (not so many!). If we apply the selfie/shark mistake to other Darwinian activities, we might conclude that selfies are more dangerous than swallowing knifes and juggling chain saws. Don't.

2. No matter what the card a player turns over, the probability the other player will match it is 3/51.

3. There may be self-selection bias in that schools with less drinking may be more likely to institute a complete ban and, also, in that students who don't drinking and drunks may be more likely to attend schools that ban alcohol. The study also found: "among drinkers, students at schools with a ban engaged in as much extreme drinking and experienced the same rate of alcohol-related problems as students at schools without an alcohol ban."

4. This is a binomial problem: $P[X > 1] = \sum_{x=2}^{20} \binom{20}{x} 0.05^x 0.95^{20-x} = 0.264$

5. The expected values are lower for long-shot bets, suggesting that bettors who buy long-shot tickets like long shots—like people who buy lottery tickets with negative expected values.
   a. $\mu = 6x(1/2)^3 - x = (6/8)x - x = -(1/4)x$
   b. $\mu = 11x(1/2)^4 - x = (11/16)x - x = -(5/16)x$
   c. $\mu = 16x(1/2)^5 - x = (16/32)x - x = -(16/32)x$

6. a. $(1/38)^3$
   b. $(1 - (37/38)^{10})$
   c. $(2/38)^5$
   d. $1/(2/38) = 19$

7. This is a Bayesian problem:

$$P[\text{E if correct}] = \frac{P[\text{E}]P[\text{correct if E}]}{P[\text{X}]P[\text{correct if X}] + P[\text{Y}]P[\text{correct if Y}] + P[\text{Z}]P[\text{correct if Z}]}$$
$$= \frac{(.2)(.7)}{(.2)(.7) + (.6)(.5) + (.2)(.3)} = \frac{0.7}{2.5} = 0.28$$

8. The central limit theorem states that the probability distribution of the sum of *n* independent, identically distributed random variables approaches the normal distribution as *n* increases. This might be a reasonable assumption for the factors that determine the popping time of a corn kernel, however, the time it takes a student to do a math problem depends on the student, and the amount of time each student spends on a problem is not independent of the time spent on other problems. There might even be a bimodal distribution.

9. This is identical to the Monty Hall problem. A's probability stays at one-third because he did not learn anything useful from the warden. This can be confirmed using Bayes' Rule.

10. [True story] Sounds like the fallacious law of averages to me.