Econ 57
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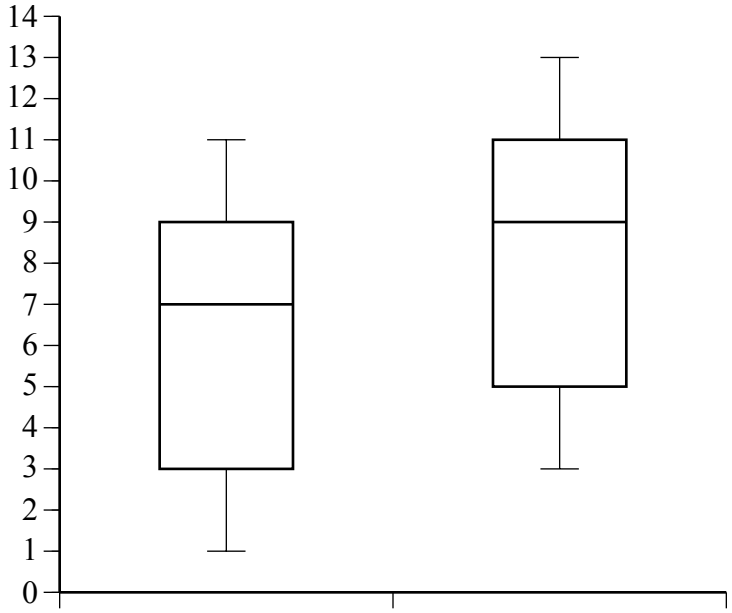
Midterm Answers

1. a. The bars should not overlap.
   b. The total area of the bars is not 1, and the vertical axis should start at 0.

2. The box retains its shape but is shifted upward by 2:



3. a. People who marry and divorce self-select.
   b. Women may be less likely to marry men who are in poor health and more likely to divorce men whose health suffers the most during marriage.
   c. Randomly selected people would have to be forced to marry and divorce, or we could monitor the health of people as they don't marry, marry and stay married, or marry and divorce.

4. An outlier would skew the mean price upward, not the median price.

5. There are 36 possible letters and digits. The probability of a perfect match with randomly chosen characters is $(1/36)^6 = 4.6 \times 10^{-10}$. The probability that at least one of three tries will be successful is equal to one minus the probability that none will be successful $1 - (1 - (1/36)^6)^3 = 1.4 \times 10^{-9}$, or about 1 in 725,594,150. With one try a day, the expected wait is 725,594,150 (almost two million years).

6. The first number picked can be anything. Given the first number, the second number has to be one of the two remaining numbers in that group. For example, if the first number picked is 7, then the second number has to be either a 1 or a 4. If the first two numbers are in the same group, then the third number has to be the third number in that group. Thus, the probability that the first three numbers picked will be in the same group is 1(2/8)(1/7). For the next three numbers, given that the first three numbers are in a group, the fourth number picked can be anything, the fifth number has to be one of the two numbers that goes with the fourth number and the sixth number has to be the third number in that group. This probability is 1(2/5)(1/4). If the

first 6 numbers are okay, then the last three numbers have to be correct for the third group. Thus the overall probability is

$$1\frac{2}{8}\frac{1}{7}1\frac{2}{5}\frac{1}{4} = \frac{1}{280}$$

7. Converting to Z-values, corporate stock's Z = (0 - 15)/20 = -0.75 and Treasury bond's Z = (0 - 6)/9 = -0.67. Bonds are more likely to have a negative return.

8. Using Bayes' Rule,

$$P\left[\text{careless} \mid \text{fire}\right] = \frac{P[\text{careless}]P[\text{fire} \mid \text{careless}]}{P[\text{careless}]P[\text{fire} \mid \text{careless}] + P[\text{not careless}]P[\text{fire} \mid \text{not careless}]}$$

$$= \frac{0.01(0.010)}{0.01(0.010) + 0.99(0.001)}$$

$$= \frac{10}{109}$$

Using a contingency table with 100,000 homes:

	fire	no fire	total
careless	10	990	1,000
careful	99	98,901	99,000
total	109	99,891	100,000

The probability that a home destroyed by fire was occupied by a careless person is 10/109: 0.092. This 9% figure is much larger than the 1% of the total population that is careless, but it is still far from certain that a house destroyed by fire was occupied by a careless household.

9. a. The expected value of the payout is \$100,000(0.001) + \$0(0.999) = \$100 for the 99% of the households who are careful and \$100,000(0.01) + \$0(0.99) = \$1,000 for the 1% who are careless. The overall expected value is 0.99(\$100) + 0.01(\$1,000) = \$109, which is less than \$500.
   b. For a Careless household, is the expected value of the payoff is \$1,000, which is larger than \$500.
   c. For a Careful household, is the expected value of the payoff is \$100, which is smaller than \$500.
   d. If only the Careless buy policies, the insurance company will lose money because the expected value of the payoff is \$1,000, which is larger than \$500.

10. As the number of trials increases, it is increasingly certain that the success proportion x/n will be close to the success probability π, but less likely that it will be exactly equal to π. Thus the probability is larger for the
   a. small college, because the probability that x/n will exactly equal π declines as n increases.
   b. large college, because the probability that x/n will be close to π increases as n increases.
   c. small college, because the probability that x/n will be far from π declines as n increases.