

Math 110

Quiz 4 Sample Solutions

October 28, 2008

Be sure to show the calculations that lead to your answers.

1. What does the Law of Averages say?

If a chance process (represented by drawing a numbered ticket at random from a box) is repeated a large number of times, the chance error in the sum of the draws is likely to be large in absolute terms but small relative to the number of draws.

2. An ecology class of 50 students has 25 men and 25 women. Eight students are chosen at random from the class to participate in river cleanup trip, what are the chances that 5 (=62.5%) or more of the students will be male?

Five or more out of eight represents a percentage of 62.5% or more. We use percentages throughout the problem. The tickets in a box model for the program have either a 1 (for male) or 0 (for female). There are 25 of each type of ticket. First, the EV for percent is 50% and the SD for the box is $(1 - 0)\sqrt{\frac{25}{50}\frac{25}{50}} = .5\%$. The SE for percentage for 8 draws with replacement is then $\frac{.5}{\sqrt{8}} \times 100\% \approx 17.7\%$. Because draws are made without replacement, we must use the correction factor, which is $\sqrt{\frac{50-8}{50-1}} \approx .93$. The SE for 8 draws without replacement is then $.93 \times 17.7 \approx 16.5\%$. We are now ready to use the normal with mean 50% and SD 16.5%. The z -value is $\frac{62.4-50}{16.5} \approx .75$. The corresponding area from the z -table is approximately 55%. We want the area of the associated right tail, which is $\frac{100-55}{2} \approx 22.5\%$. So the chances of 62.5% of the sample being female is approximately 22.5%.

3. A gambler is playing roulette. On each play, he bets \$1 on *six numbers*, which pays 5 to 1. That is, if one of his block of six numbers comes up, he will win \$5 on a \$1 bet. Otherwise, he loses \$1.

- (a) Construct a box model for this bet. (*Hint*: There are a total of 38 slots on a roulette wheel.)

The box should contain 38 ticket with six labeled 5 and the remainder labeled -1.

- (b) Compute the average and SD of the box?

The box average is $\frac{1}{19}$. The SD is $(5 - (-1))\sqrt{\frac{6}{38}\frac{32}{38}} \approx 2.2$.

- (c) If the bet is played 25 times, compute the EV and the SE for the bet.

The expected value is $25 \cdot \frac{-1}{19} \approx -1.3$. The SE is $\sqrt{25} \cdot 2.2 = 11$.

- (d) What are the gambler's chances of winning \$5 or more on these 25 spins of the wheel? (*Hint*: Think probability histogram.)

The z -value for 5 is $z = \frac{5-(-1.3)}{11} \approx .57$. The area for $z = .57$ is 43%. The associated right tail has area $(100 - 43)/2 = 28.5\%$. So there is a 28.5% chance of winning \$5 or more.