

1. The Census Bureau has established that income of heads of household in a particular city is normal with a mean of \$41,500 and a standard deviation of \$18,700.

- a) Suppose we take an SRS of 100 heads of household. What are the mean and standard deviation of the average income of our sample of 100 ( $\mu_{\bar{x}}$  and  $\sigma_{\bar{x}}$ )?

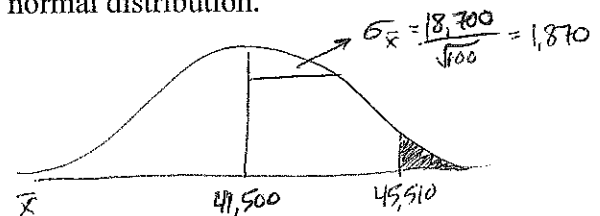
$$\mu_{\bar{x}} = \mu = \$41,500$$

$$\sigma_{\bar{x}} = \frac{\sigma}{\sqrt{n}} = \frac{18,700}{\sqrt{100}} = \$1,870$$

- b) What is the probability that a randomly chosen sample of 100 heads of household will have a mean of \$45,510 or more? Make and shade a sketch of the appropriate normal distribution.

$$Z = \frac{45,510 - 41,500}{1,870} = 2.14$$

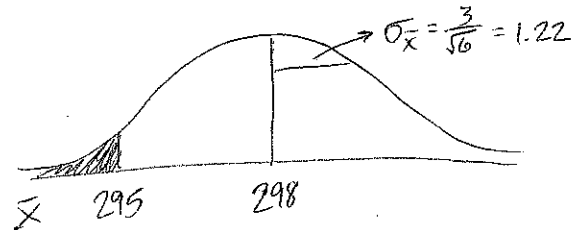
$$1 - .9838 = .0162$$



2. A bottling company uses a filling machine to fill plastic bottles with cola. The bottles are supposed to contain 300 milliliters (ml). In fact, the contents vary according to a normal distribution with mean  $\mu = 298$  ml and standard deviation  $\sigma = 3$  ml. What is the probability that the mean contents of the bottles in a six-pack is less than 295 ml?

$$Z = \frac{295 - 298}{3/\sqrt{6}} = \frac{-3}{1.22} = -2.45$$

$$.0071$$



3. In which year did Columbus discover America? 1492

- a) A Gallup Poll found that 210 out of 501 American teens 13-17 yrs old knew this year. Is this a parameter or a statistic? Represent this value using the correct notation.

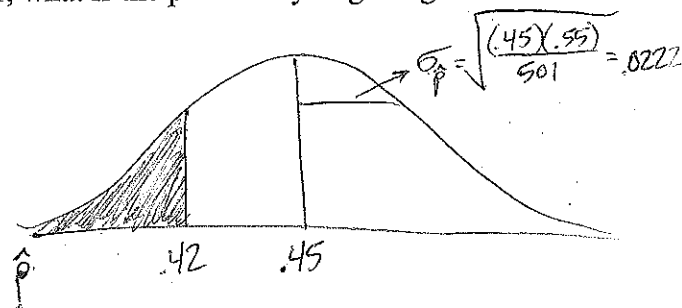
Statistic

$$\hat{p} = \frac{210}{501} = .42$$

- b) If 45% of all American teens 13-17 yrs old know this year, what is the probability of getting a result as small or less than the result in part a)?

$$Z = \frac{.42 - .45}{.0222} = -1.35$$

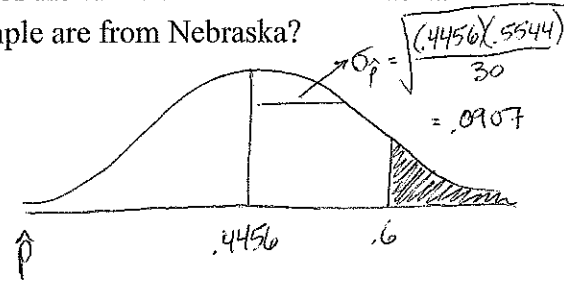
$$.0885$$



4. Take a sample of 30 runners in the Lincoln Marathon, where 44.56% of the runners were from Nebraska. What is the probability that more than 60% of the runners in your sample are from Nebraska?

$$Z = \frac{.6 - .4456}{.0907} = 1.70$$

$$1 - .9554 = \boxed{.0446}$$

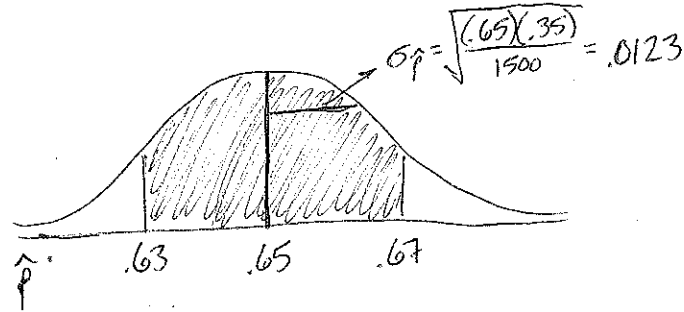


5. A polling organization asks a SRS of 1500 freshman college students whether they applied to a college other than the one they are attending. In fact, 65% of all freshmen applied to another college. What is the probability that the random sample of 1500 students will give a result within 2 percentage points of the true proportion of freshmen who applied to another college? In other words, what is the probability of obtaining a sample proportion between 63% and 67%?

$$Z = \frac{.67 - .65}{.0123} = 1.63 \rightarrow .9484$$

$$Z = \frac{.63 - .65}{.0123} = -1.63 \rightarrow .0516$$

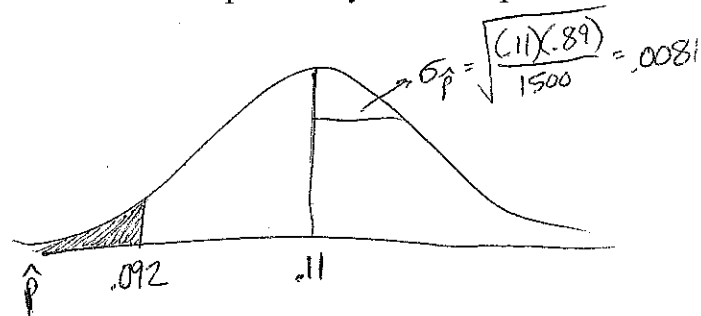
$$.9484 - .0516 = \boxed{.8968}$$



6. One way to check for sources of bias in a sample survey is to compare the sample with known facts about the population. About 11% of American adults are black. The proportion  $p$  of black adults in an SRS of 1500 adults should therefore be close to 0.11. If a national sample contains only 9.2% of black adults, should we suspect that the sample is underrepresenting black adults? Find the probability that a sample contains no more than 9.2%.

$$Z = \frac{.092 - .11}{.0081} = -2.22$$

$$\boxed{.0132}$$



7. A *USA Today* poll asked a random sample of 1012 U.S. adults what they do with the milk in the bowl after they have eaten the cereal. Of the respondents, 67% said that they drink it. Suppose that 70% of U.S. adults actually drink the cereal milk. Find the probability of obtaining a sample of 1012 adults in which 67% or fewer say they drink the cereal milk.

$$Z = \frac{.67 - .7}{.0144} = -2.08$$

$$\boxed{.0188}$$

