Name: KEY　　　　Math 153　　　　Unit Exam #3

1) Read the sentences below and then identify each **underlined (bold)** number by labeling it with the proper statistical symbol.
Joe wanted to figure out the average number of T.V's per house in Maryland. He randomly selected **50** houses from the phone book and called each one to ask them how many T.V's they had. The average number he calculated for the people that answered the phone was **3.2** and the standard deviation was **1.3**.

$n = 50$

$\bar{x} = 3.2$

$s = 1.3$

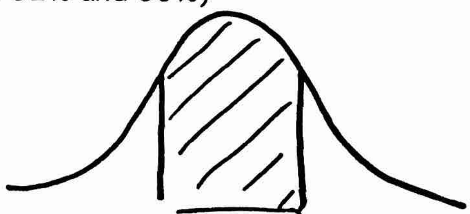
2) If 80 students were surveyed at a school and 56 of them said they like to watch the T.V show "The Big Bang Theory" what would be the value of p-hat, and then calculate the standard error of the sampling distribution using this information?

$$\hat{p} = \frac{56}{80} = .7 \qquad \sigma_{\hat{p}} = \sqrt{\frac{\left(\frac{56}{80}\right)\left(\frac{24}{80}\right)}{80}} \approx .0512$$

3) An SRS of 500 college students were asked whether they enjoy shopping at the mall. Somehow it is known that 54% of all college students enjoy shopping at the mall. Given that information what is the probability that the poll will be within 2 percentage points of the true p? (Between 52% and 56%)

$$z = \frac{.56 - .54}{\sqrt{\frac{(.54)(.46)}{500}}} \approx \frac{.02}{.0223} \approx .90$$

$$z = \frac{.52 - .54}{\sqrt{\frac{(.52)(.48)}{500}}} \approx \frac{-.02}{.0223} \approx -.90$$



$\boxed{.6319}$

4) A population of manufactured products where the random variable X is the weight of the item. Prior experience has shown that the weight has a normal distribution with mean 16.0 ounces and standard deviation of 4.0 ounces.

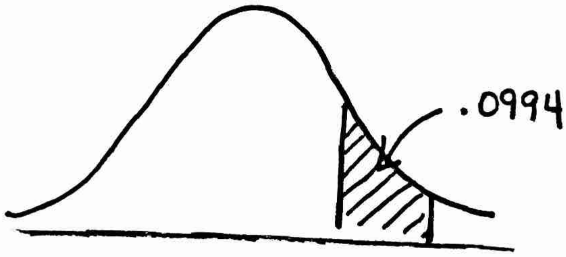
a. What is the probability that the weight of a single item randomly selected will be more than 21.5 ounces?

$$Z = \frac{21.5 - 16}{4} = \frac{5.5}{4} = 1.38$$

b. What is the probability that if the manufacturer takes a sample of 100 items, that the sample has a mean weight between 16.5 and 17.0 ounces?

$$Z = \frac{17-16}{\left(\frac{4}{\sqrt{100}}\right)} = 2.5$$

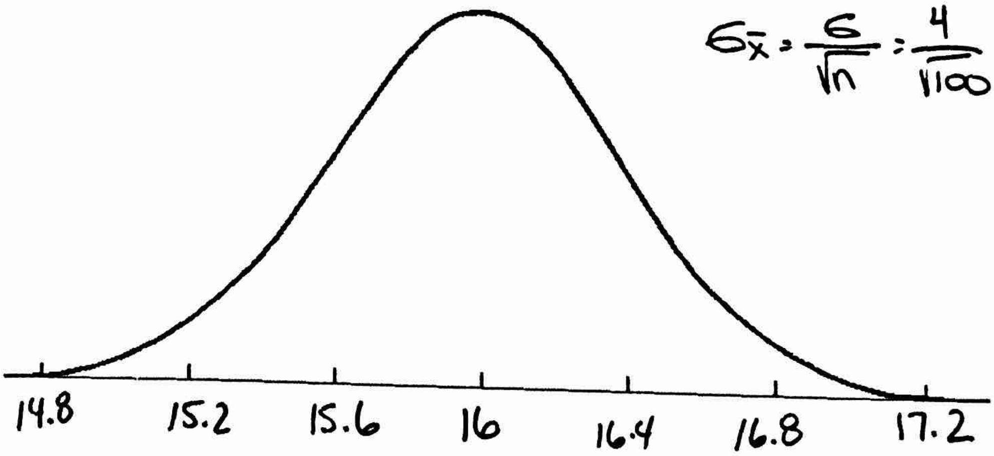
$$Z = \frac{16.5-16}{\left(\frac{4}{\sqrt{100}}\right)} = 1.25$$



c. Sketch and label a normal distribution to show the sampling distribution of $\overline{X}$ for the sample size of 100.

$$\mu_{\bar{x}} = \mu = 16$$

$$\sigma_{\bar{x}} = \frac{\sigma}{\sqrt{n}} = \frac{4}{\sqrt{100}} = .4$$



5) A company that produces light bulbs is concerned about the distribution of the life expectancy of the bulbs. The company takes a simple random sample of 81 bulbs and computes the sample mean to be 950 hours per bulb.

a. Check the conditions to see if you can use a normal distribution?

Random Sample ✓

10n < Pop Size ✓

$n \geq 30$ ✓

b. Construct a 95% confidence interval for the unknown mean life expectancy assuming that the population standard deviation is 30 hours.

1-Sample Z $\qquad \bar{x} \pm z^*\left(\frac{\sigma}{\sqrt{n}}\right)$

$n = 81 \quad \sigma = 30$

$\bar{x} = 950 \qquad (943.47, 956.53)$

c. Interpret the 95% confidence interval found in (a).

We are 95% confident that the mean life expectancy of all light bulbs is between 943.47 and 956.53

6) In a simple random sample of 100 students taken at a large university, 25 are English majors.

a) **Construct and Interpret** an approximate 90%-confidence interval for the percent of students at the university who are English majors. (Make sure to check conditons)

1-Proportion (Z-Interval) $\qquad \hat{p} \pm z^* \sqrt{\frac{\hat{p}(1-\hat{p})}{n}}$

$\hat{p} = \frac{25}{100}$ $\qquad$ Random Sample ✓ $\qquad (.179, .321)$

10n < Pop Size ✓

$n = 100$

(25) $np \geq 10$ ✓

(75) $n(1-p) \geq 10$ ✓

* we are 90% confident that the true proportion of students who are English majors is between .179 & .321

b) If you wanted to become more confident in your response without changing the width of the interval what would you have to do?

Use a larger sample size

7) Using the formula for margin of error ($m = \frac{z^* \sigma}{\sqrt{n}}$) if you wanted to have a margin of error less than 10% using a 95% confidence interval (Z-score of 1.96) and the standard deviation of the population was 20, what would be the smallest sample size that you could take?

$$.10 \geq \frac{1.96(20)}{\sqrt{n}}$$

$$\sqrt{n}(.10) \geq 1.96(20)$$

$$\sqrt{n} \geq \frac{1.96(20)}{.10}$$

$$n \geq \left(\frac{1.96(20)}{.10}\right)^2$$

$n \geq 153{,}664$

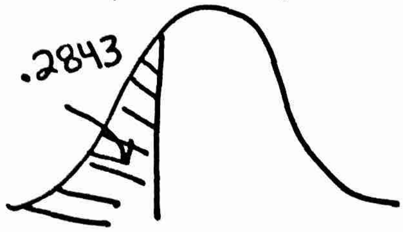
Smallest sample size is 153,664

8) The actual time it takes to cook a 25 pound turkey is a normal random variable with a mean of 5.4 hours and a standard deviation of 0.7 hours.

(μ) (σ)

a) What is the probability that a single randomly selected 25 pound turkey will take less than 5 hours to cook?

$$Z = \frac{5 - 5.4}{.7} = \frac{-.4}{.7} \approx -.57$$



b) Given that an average of 5.1 hours was found for a sample of 50 turkeys, calculate and interpret a 90% confidence interval for the average cooking time of a 25 pound turkey.

1- Sample Z

$\bar{x} = 5.1$

$n = 50$

$\sigma = .7$

(4.94, 5.26)

c) Is the parameter that you are trying to estimate in (b) actually in the interval? What is the parameter? No! 5.4 is not in the interval.