

Name: _____ Period: _____ Date: _____

Statistics Review

MM4D1. Using simulation, students will develop the idea of the central limit theorem.

MM4D2. Using student-generated data from random samples of at least 30 members, students will determine the margin of error and confidence interval for a specified level of confidence.

MM4D3. Students will use confidence intervals and margin of error to make inferences from data about a population. Technology is used to evaluate confidence intervals, but students will be aware of the ideas involved.

1. Suppose we are interested in the average weight of chickens in America.

a) What would be the population? **Chickens in America**

b) What would be the variable of interest? **The average weight of chickens in America**

c) Find the 95% confidence interval for the average weight of chickens when a sample of 25 chickens produced an average weight of 4.6 pounds. Assume $\sigma = 2.5$. Answer with a complete sentence!

1st Identify the given values

$$\bar{X} = 4.6$$

$$n = 25$$

$$\sigma = 2.5$$

$$c = 95\%$$

2nd determine the critical value at the given confidence level (find z-score)

$$\text{proportion to left} = \frac{1 - 0.95}{2} = \frac{100\% - 95\%}{2} = 0.0250 \text{ (convert to decimal)}$$

Find p in z-chart and identify the z-score

$$z_{95\%} = -1.96 \quad \text{Use absolute value}$$

3rd Find standard error

$$\sigma_{\bar{x}} = \frac{2.5}{\sqrt{25}} = \frac{2.5}{5} = 0.5$$

4th Find Margin of Error (Always a positive number – use absolute value)

$$E = 1.96(0.5) = 0.98$$

5th Determine the Confidence Interval

$$4.6 \pm 0.98$$

$$(3.62, 5.58)$$

6th Write confidence interval in sentence form.

I am 95% confident that the average weight of chickens in America is between 3.62 lbs. and 5.58 lbs.

2. What is the critical value (z^*) that corresponds to a confidence level of 90%? $Z_{90\%} = 1.65$

3. Find a 99% confidence interval for the mean diameter of cabbage if we sampled 36 heads of cabbage from a physics class which had a sample average of 15 cm. Assume that the population standard deviation is 1.8 cm. Answer with a complete sentence!

1st Identify the given values

$$\bar{X} = 15$$

$$n = 36$$

$$\sigma = 1.8$$

$$c = 99\%$$

2nd determine the critical value at the given confidence level (find z-score)

$$\text{proportion to left} = \frac{1-0.99}{2} = \frac{100\% - 99\%}{2} = 0.0050 \text{ (convert to decimal)}$$

Find p in z-chart and identify the z-score

$$z_{.99\%} = -2.58 \quad \text{Use absolute value}$$

3rd Find standard error

$$\sigma_{\bar{x}} = \frac{1.8}{\sqrt{36}} = \frac{1.8}{6} = 0.3$$

4th Find Margin of Error (Always a positive number – use absolute value)

$$E = 2.58(0.3) = 0.774$$

5th Determine the Confidence Interval

$$15 \pm 0.774$$

$$(14.226, 15.774)$$

6th Write confidence interval in sentence form.

I am 99% confident that the average diameter of cabbage is between 14.226 cm. and 15.774 cm.

a) What is the margin of error? $E = 0.774$

4. A study of the career paths of hotel managers sent questionnaires to an SRS of hotels belonging to major US hotel chains. There were 114 responses. The average response of these 114 general managers had spent with their current company was 11.78 years. Construct and interpret the 99% confidence interval for the mean number of years general managers of major-chain hotels have spent with their current company. Assume the standard deviation of this variable is 3.2 years.

1st Identify the given values

$$\bar{X} = 11.78$$

$$n = 114$$

$$\sigma = 3.2$$

$$c = 99\%$$

2nd determine the critical value at the given confidence level (find z-score)

$$\text{proportion to left} = \frac{1-0.99}{2} = \frac{100\% - 99\%}{2} = 0.0050 \text{ (convert to decimal)}$$

Find p in z-chart and identify the z-score

$$z_{.99\%} = -2.58 \quad \text{Use absolute value}$$

3rd Find standard error

$$\sigma_{\bar{x}} = \frac{3.2}{\sqrt{114}} = 0.300$$

4th Find Margin of Error (Always a positive number – use absolute value)

$$E = 2.58(0.300) = 0.774$$

5th Determine the Confidence Interval

$$11.78 \pm 0.774 \\ (11.006, 12.554)$$

6th Write confidence interval in sentence form.

I am 99% confident that the average number of years general managers of major-chain hotels have spent with their companies is between 11.006 years and 12.554 years.

a) How large would the sample need to be to ensure that the error does not exceed 0.5 years?

For this problem, solve the margin of error equation, $E = Z_c \sigma_{\bar{x}} = Z_c \frac{\sigma}{\sqrt{n}} = E$, for n (the sample size, set E (margin of error) to 0.5, and plug the other given values in.

$$Z_c \frac{\sigma}{\sqrt{n}} = E$$

$$\sqrt{n} Z_c \frac{\sigma}{\sqrt{n}} = E \sqrt{n}$$

$$Z_c \sigma = E \sqrt{n}$$

$$\frac{Z_c \sigma}{E} = \frac{E \sqrt{n}}{E}$$

$$\sqrt{n} = \frac{Z_c \sigma}{E}$$

$$n = \left(\frac{Z_c \sigma}{E} \right)^2 = \left(\frac{2.58(3.2)}{0.5} \right)^2 = 273$$

5. Mr. Cook is interested in knowing the average class size for all classes at WHS. Because each teacher has 6 classes this makes for quite a bit of data! To lighten his workload he decides to take a random sample of 10 classes and go from there. Use the following data:

33, 28, 24, 18, 24, 24, 26, 27, 31, 30

- Identify the population. **All classes at WHS.**
- Identify the variable of interest. **Average class size for all classes at WHS**
- Construct a 90% confidence interval for the average class size at WHS. Assume that the standard deviation of class sizes is 3.2 students. Answer with a complete sentence.

1st Identify the given values

$$\bar{X} = \frac{33 + 28 + 24 + 18 + 24 + 24 + 26 + 27 + 31 + 30}{10} = 26.5$$

$$n = 10$$

$$\sigma = 3.2$$

$$c = 90\%$$

2nd determine the critical value at the given confidence level (find z-score)

$$\text{proportion to left} = \frac{1 - 0.90}{2} = \frac{100\% - 90\%}{2} = 0.0500 \text{ (convert to decimal)}$$

Find p in z-chart and identify the z-score

$$z_{90\%} = -1.65 \quad \text{Use absolute value}$$

3rd Find standard error

$$\sigma_{\bar{x}} = \frac{3.2}{\sqrt{10}} = 1.012$$

4th Find Margin of Error (Always a positive number – use absolute value)

$$E = 1.65(1.012) = 1.670$$

5th Determine the Confidence Interval

$$26.5 \pm 1.670$$

$$(24.830, 28.170)$$

6th Write confidence interval in sentence form.

I am 90% confident that the average class size at WHS is between 24.83 students and 28.17 students.

$$n = \left(\frac{Z_c \sigma}{E} \right)^2 = \left(\frac{1.65(3.2)}{1} \right)^2 = 28 \text{ classes}$$