NAME ______________________________

STAT 291 - Statistics for the Mathematical Sciences I

Confidence Intervals

1. **Parameter:** In each of the intervals that we will look at the interest is in finding a reliable estimate of some parameter. The first step in our process will be to clearly define what the parameter represents in the particular situation we are considering.

2. **Assumptions:** As with hypothesis testing, each method we discuss will make certain assumptions about the way we collected our data and the nature of the population, or populations, from which they came. These assumptions are just as important here as they are in hypothesis testing.

3. **Point Estimate:** Our intervals will each start with the most reasonable estimate we have, which will generally be a statistic calculated from our data, that summarizes for the data the same characteristic as the parameter measures for the population.

4. **Confidence Bound on the Error of Estimation:** From our assumptions, we will use our data to determine how far out on each side of the point estimate we need to go to account for the variability, or error, that is a result of having only a sample of data, and not the whole population. In most cases the bound is the same value in both directions, but this is not always the case.

5. $100(1-\alpha)\%$ **Confidence Interval:** The interval is found by subtracting the lower bound from the point estimate and adding the upper bound to the point estimate. We then have a certain confidence that the true value of the parameter is within these values.

6. **Conclusion:** Once again, we will be careful to state the conclusion in terms of the problem. In the conclusion we will give the bounds, with the units of measurement, and state our level of confidence.

Confidence Interval Details: For μ, large sample or σ known

1. **Parameter:** μ is the mean ____________ for all __________________

2. **Assumptions:** There are, once again, two options here:
   1. If we have $n \geq 30$: We have independent, random observations from some population, and the sample size is large enough that we can use the Central Limit Theorem.
   2. If we have a small sample, but σ is known: We have independent, random observations from a normally distributed population with known variance.

3. **Point Estimate:** $\bar{X}$

4. **Confidence Bound on the Error of Estimation:**

$$Z_{1-\alpha/2} \cdot \frac{\sigma}{\sqrt{n}}$$

5. $100(1-\alpha)\%$ **Confidence Interval:** 3.-4., and 3.+4.

6. **Conclusion:** We are ____% confident that the mean ____________ for all __________________ is between (lower bound) and (upper bound).

Confidence Interval Details: For μ, σ unknown

1. **Parameter:** μ is the mean ________ for all ____________

2. **Assumptions:** We have independent, random observations from a normally distributed population, with unknown variance.

3. **Point Estimate:** $\bar{X}$

4. **Confidence Bound on the Error of Estimation:**

$$t_{n-1,1-\alpha/2} \cdot \frac{s}{\sqrt{n}}$$

5. $100(1-\alpha)\%$ **Confidence Interval:** 3.-4., and 3.+4.

6. **Conclusion:** We are __% confident that the mean ________ for all ____________ is between (lower bound) and (upper bound).

Confidence Interval Details: For p

1. **Parameter:** p is the true proportion of all ____________ that ___________________

2. **Assumptions:** We have independent, random observations from a binomial experiment, and there are enough trials that we can use the Central Limit Theorem.

3. **Point Estimate:** $\hat{p}$

4. **Confidence Bound on the Error of Estimation:**

$$Z_{1-\alpha/2} \cdot \sqrt{\frac{\hat{p} \cdot (1-\hat{p})}{n}}$$

5. $100(1-\alpha)\%$ **Confidence Interval:** 3.-4., and 3.+4.

6. **Conclusion:** We are ___% confident that the proportion of all ____________ that ___________________ is between (lower bound) and (upper bound).