Chapter 7–2A: Estimating A Population Mean μ with σ KNOWN.

Creating a Confidence Interval for the True Value of the Population Mean μ
for a Normal Population (or n > 30)
from a simple random sample of size n with a Confidence Level of $1-\alpha$
with σ KNOWN.

Requirements for using a Standard Normal Distribution (Z table)
to create a Confidence Interval for the Population Mean μ

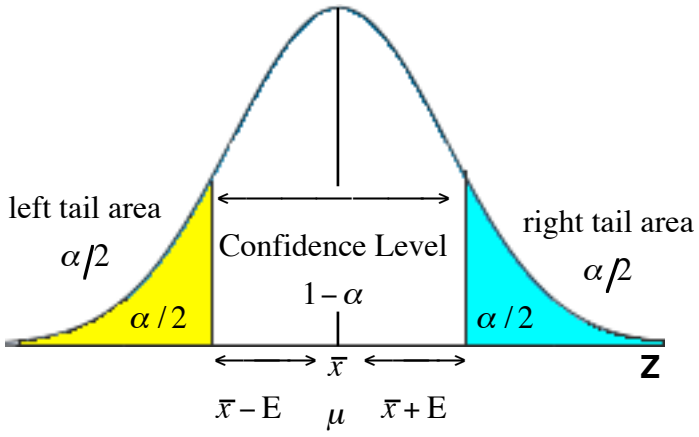
1. The population is known to be normal **OR** the sample size is greater than 30 $(n > 30)$
2. The population standard deviation σ **IS KNOWN**
3. The sample mean $\bar{x}$ has been computed based on data from a simple random sample.

The **Confidence Interval** for the **population mean μ with σ known.**

with a Confidence Level of $1-\alpha$ is given by

$$\bar{x} - E < \mu < \bar{x} + E$$

where $E = z_{\alpha/2} \cdot \dfrac{\sigma}{\sqrt{n}}$



I am $1-\alpha$ confident that the actual value for the Population Mean μ will be between

$$\bar{x} - E < \mu < \bar{x} + E$$

I am $\alpha/2$ confident that the actual value for the Population Mean μ will be greater than

$$\bar{x} + E$$

I am $\alpha/2$ confident that the actual value for the Population Mean μ will be less than

$$\bar{x} - E$$

Requirements

1. The single value for the sample mean $\bar{x}$ is the single best "guess" about what the true population mean μ really is. We call $\bar{x}$ the best **point estimate** of the true population mean μ. The sample mean is an unbiased estimator of the population mean μ. The distribution of the sample means centers about the value of the population mean. The distribution of the sample means tends to have less variation than the distribution of the population proportion and the population standard deviation.

2. If the population is **known to be normal** then we can use the Standard Normal Distribution (Z table) no mater what the sample size is. We may not know if the population is normal or we may know that it is not normal (skewed). We can use the Standard Normal Distribution (Z table) if the sample size n is greater than 30 ($n > 30$). The condition that $n > 30$ is commonly used as the guideline for using a Z table for populations that are not normal. Sample sizes slightly less than 31 may be adequate for population distributions that are close to normal. Populations that have distributions that are very skewed may require sample sizes of 100 or more. We will use the most common guideline of $n > 30$ to justify that the population we are working with is close enough to normal to use the z table.

3. The population standard deviation σ **IS known.** This requirement is a major restriction to the use of the Standard Normal Distribution (Z table) to create a Confidence Interval for the true population mean μ. In general if the work has been done that would allow you to know the value for the population standard deviation σ then you would also know the population mean μ. For this reason section 7 – 4 will consider a more practical method using the sample standard deviation s_x in place of the population standard deviation σ

