Estimation of Parameters

A **Point Estimation** of a population parameter consists of a point estimator and a standard error.

Parameter	Point Estimator	Standard Error
μ	$\overline{x}$	$\dfrac{\sigma}{\sqrt{n}}$
p	$\hat{p} = \dfrac{x}{n}$	$\sqrt{\dfrac{\hat{p}\hat{q}}{n}}$
$\mu_1 - \mu_2$	$\overline{x}_1 - \overline{x}_2$	$\sqrt{\dfrac{\sigma_1^2}{n_1} + \dfrac{\sigma_2^2}{n_2}}$
$p_1 - p_2$	$\hat{p}_1 - \hat{p}_2 = \dfrac{x_1}{n_1} - \dfrac{x_2}{n_2}$	$\sqrt{\dfrac{\hat{p}_1\hat{q}_1}{n_1} + \dfrac{\hat{p}_2\hat{q}_2}{n_2}}$

When we estimate a population mean, a “large” sample size is $n \geq 30$. If the population standard deviation σ is not known, we use the sample standard deviation s instead. For a population proportion, a “large” sample size means $n\hat{p} > 5$ and $n\hat{q} > 5$. For the difference between two means and two proportions, we assume that we have two large *independent* random samples.

A $(1-\alpha)$100% Large-Sample Confidence Interval is of the form

$$(\text{Point Estimator}) \pm z_{\alpha/2}(\text{SE of the estimator}).$$

A $(1-\alpha)$100% Large-Sample Lower Confidence Bound (LCB) is

$$(\text{Point Estimator}) - z_{\alpha}(\text{SE of the estimator}).$$

A $(1-\alpha)$100% Large-Sample Upper Confidence Bound (UCB) is

$$(\text{Point Estimator}) + z_{\alpha}(\text{SE of the estimator}).$$

Commonly used values of $z_{\alpha/2}$ and z_α are listed in the following table.

$1-\alpha$	0.9	0.95	0.98	0.99
$z_{\alpha/2}$	1.645	1.960	2.326	2.576
z_α	1.282	1.645	2.054	2.326