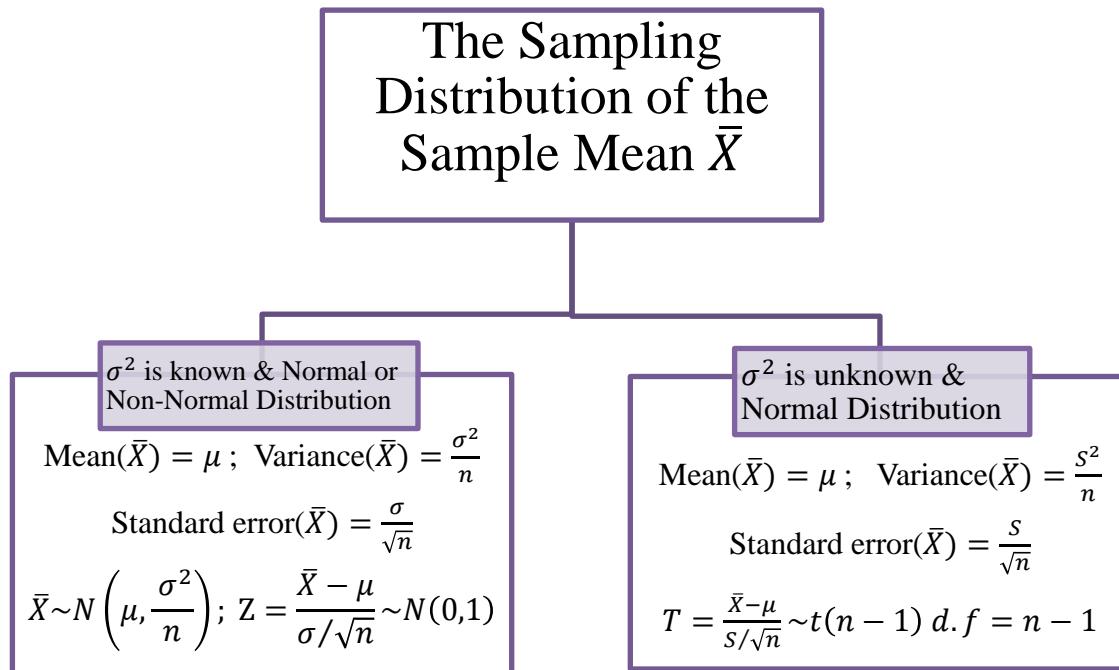


# Chapter 5: The Sampling Distributions of Sample Statistics:

## Case 1: The Sampling Distribution of the Sample Mean $\bar{X}$



## Case 2: The Sampling Distribution of the Difference between two Sample Means $\bar{X}_1 - \bar{X}_2$ :

When  $n \geq 30$  &  $\sigma_1^2$  and  $\sigma_2^2$  are Known & Normal or Non-Normal distribution.

Then

$$\text{Mean}(\bar{X}_1 - \bar{X}_2) = \mu_1 - \mu_2$$

$$\text{Variance}(\bar{X}_1 - \bar{X}_2) = \frac{\sigma_1^2}{n_1} + \frac{\sigma_2^2}{n_2}$$

$$\text{Standard error}(\bar{X}_1 - \bar{X}_2) = \sqrt{\frac{\sigma_1^2}{n_1} + \frac{\sigma_2^2}{n_2}}$$

$$\bar{X}_1 - \bar{X}_2 \sim N\left(\mu_1 - \mu_2, \frac{\sigma_1^2}{n_1} + \frac{\sigma_2^2}{n_2}\right)$$

$$Z = \frac{(\bar{X}_1 - \bar{X}_2) - (\mu_1 - \mu_2)}{\sqrt{\frac{\sigma_1^2}{n_1} + \frac{\sigma_2^2}{n_2}}} \sim N(0,1)$$

### **Case 3: The Sampling Distribution of the Sample Proportion $\hat{p}$ :**

When  $n \geq 30, np > 5, nq > 5$  and  $\hat{p} = \frac{X}{n}$ .

Then

$$\text{Mean } (\hat{p}) = p$$

$$\text{Variance } (\hat{p}) = \frac{pq}{n}$$

$$\text{Standard error}(\hat{p}) = \sqrt{\frac{pq}{n}}$$

$$\hat{p} \sim N\left(p, \frac{pq}{n}\right)$$

$$Z = \frac{\hat{p} - p}{\sqrt{\frac{pq}{n}}} \sim N(0,1)$$

### **Case 4: The Sampling Distribution of Difference between two Sample Proportions $\hat{p}_1 - \hat{p}_2$ :**

When  $n_1 \geq 30, n_2 \geq 30, n_1 p_1 > 5, n_1 q_1 > 5, n_2 p_2 > 5, n_2 q_2 > 5$  and  $\hat{p}_1 = \frac{X_1}{n_1}, \hat{p}_2 = \frac{X_2}{n_2}$ ;

$$\hat{p}_1 - \hat{p}_2 = \frac{X_1}{n_1} - \frac{X_2}{n_2}.$$

Then

$$\text{Mean } (\hat{p}_1 - \hat{p}_2) = p_1 - p_2$$

$$\text{Variance } (\hat{p}_1 - \hat{p}_2) = \frac{p_1 q_1}{n_1} + \frac{p_2 q_2}{n_2}$$

$$\text{Standard deviation } (\hat{p}_1 - \hat{p}_2) = \sqrt{\frac{p_1 q_1}{n_1} + \frac{p_2 q_2}{n_2}}$$

$$\hat{p}_1 - \hat{p}_2 \sim N\left(p_1 - p_2, \frac{p_1 q_1}{n_1} + \frac{p_2 q_2}{n_2}\right)$$

$$Z = \frac{(\hat{p}_1 - \hat{p}_2) - (p_1 - p_2)}{\sqrt{\frac{p_1 q_1}{n_1} + \frac{p_2 q_2}{n_2}}} \sim N(0,1)$$

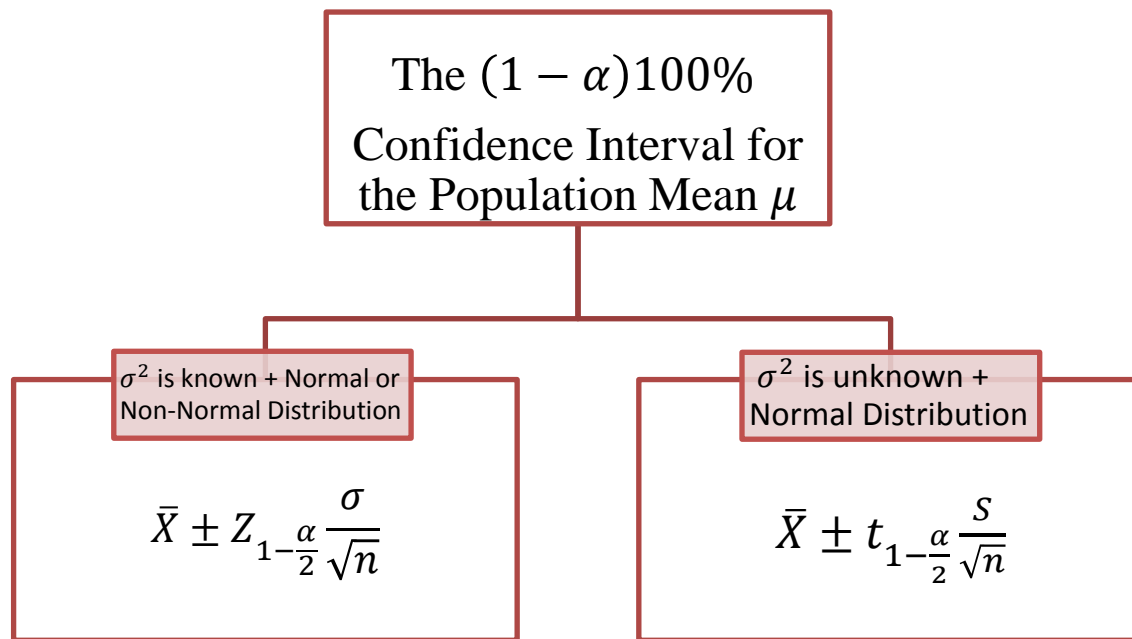
## **Chapter 6:**

### **1. The Point Estimates for the Population Parameters:**

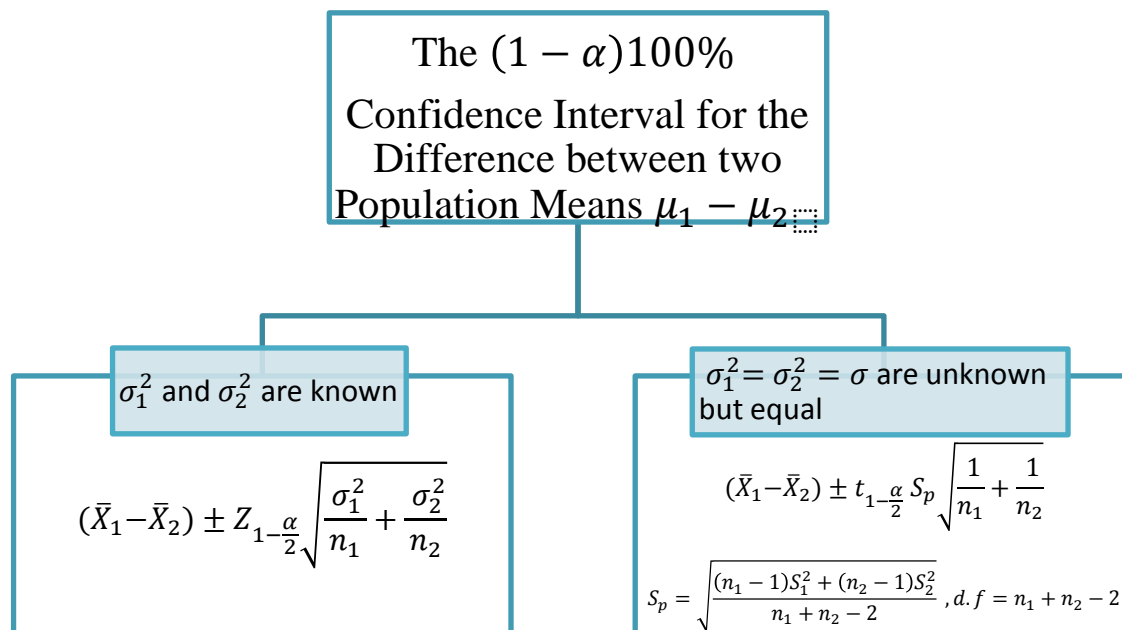
	Population Parameter	Point Estimator
Mean	$\mu$	$\bar{X}$
Variance	$\sigma^2$	$S^2$
Standard Deviation	$\sigma$	$S$
Proportion	$p$	$\hat{p}$
The Difference between two Means	$\mu_1 - \mu_2$	$\bar{X}_1 - \bar{X}_2$
The Difference between two Proportions	$p_1 - p_2$	$\hat{p}_1 - \hat{p}_2$

### **2. The Confidence Intervals for the Population Parameters:**

**Case 1: The Confidence Interval for the Population Mean  $\mu$ :**



**Case 2: The Confidence Interval for the Difference between two Population Means  $\mu_1 - \mu_2$ :**



### **Case 3: The Confidence Interval for the Population Proportion $p$ :**

When  $n \geq 30, np > 5, nq > 5$  and  $\hat{p} = \frac{x}{n}$ .

Then the  $(1 - \alpha)100\%$  confidence interval for  $p$  is

$$\hat{p} \pm Z_{1-\frac{\alpha}{2}} \sqrt{\frac{\hat{p}\hat{q}}{n}}$$

### **Case 4: The Confidence Interval for the Difference between two Population Proportions $p_1 - p_2$ :**

When  $n_1 \geq 30, n_2 \geq 30, n_1p_1 > 5, n_1q_1 > 5, n_2p_2 > 5, n_2q_2 > 5$  and  $\hat{p}_1 = \frac{x_1}{n_1}, \hat{p}_2 = \frac{x_2}{n_2}$ ,

$$\hat{p}_1 - \hat{p}_2 = \frac{x_1}{n_1} - \frac{x_2}{n_2}.$$

Then the  $(1 - \alpha)100\%$  confidence interval for  $p_1 - p_2$  is

$$(\hat{p}_1 - \hat{p}_2) \pm Z_{1-\frac{\alpha}{2}} \sqrt{\frac{\hat{p}_1\hat{q}_1}{n_1} + \frac{\hat{p}_2\hat{q}_2}{n_2}}$$

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### **The General Formulas:**

$$Z = \frac{\text{value} - \text{mean}}{\text{standard error}}$$

$$\text{estimator} \pm (\text{reliability coefficient} \times \text{standard error})$$

Where

Standard error = standard deviation

Estimator = Point estimate

Reliability coefficient = table value =  $Z_{1-\frac{\alpha}{2}}$  or  $t_{1-\frac{\alpha}{2}}$

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