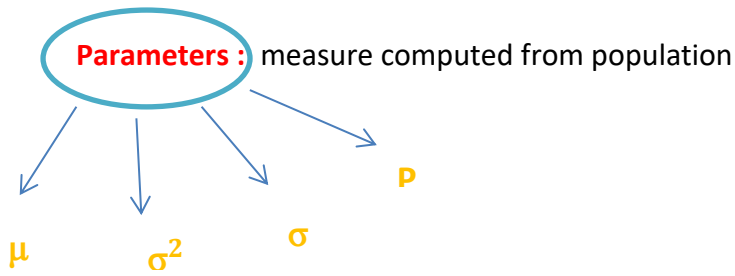


Chapter 6



Statistical Inferences

Estimation

تقدير بقيمة حقيقة للمعلمة المجهولة

Estimating the actual value of unknown parameters

Hypothesis test

Ch 7

Point Estimate

single value used to estimate the corresponding population parameter.

	Population parameters	Point estimation
Mean	μ	$\bar{x}$
Variance	σ^2	S^2
Standard deviation	σ	S
Proportion	P	$\hat{p}$
Difference between Two Population Means	$\mu_1 - \mu_2$	$\bar{x}_1 - \bar{x}_2$
Difference Between Two Population Proportions	$P_1 - P_2$	$\hat{P}_1 - \hat{P}_2$

Confidence Interval = Interval estimate

consists of two numerical values defining a range of values that most likely includes the parameter

$$\text{Parameter} \in (L, U)$$

$$L < \text{Parameter} < U$$

Lower limit

Upper limit

$(1-\alpha)$ { Confidence coefficient
Confidence Level

الطريقة العامة لكتابة الفترة التقديرية :

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

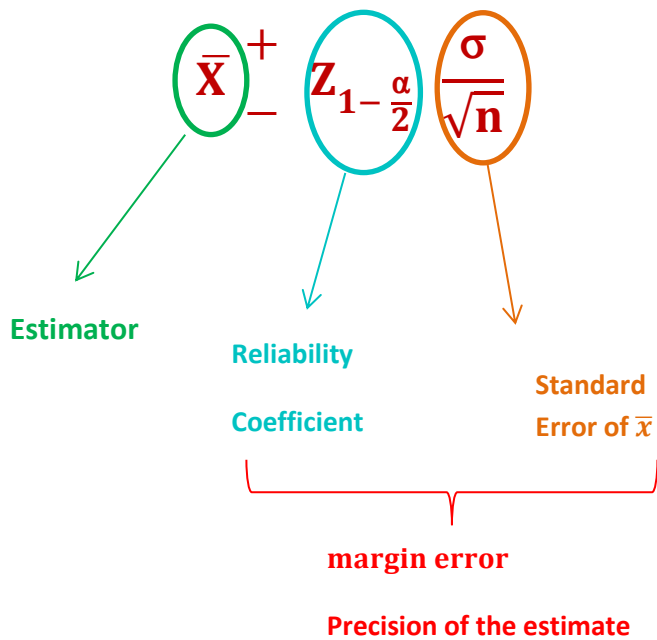
$$\text{Estimator} \pm \text{margin error}$$

Confidence Interval of μ

Interval Estimation of μ

- Normal + σ^2 Known
- Non-normal + σ^2 Known + $n \geq 30$ (large)

- Normal + σ^2 Unknown + $n < 30$ *Small*

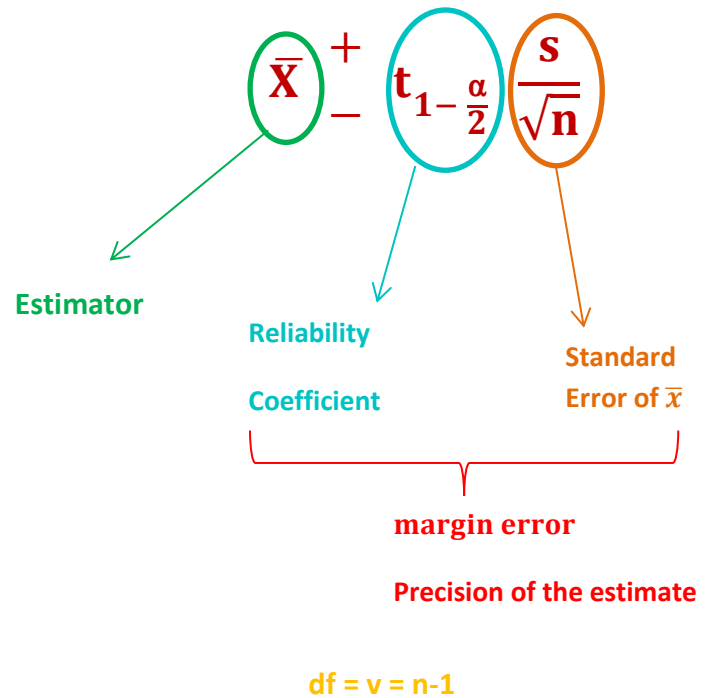


Upper limit :

$$\bar{X} + Z_{1-\frac{\alpha}{2}} \frac{\sigma}{\sqrt{n}}$$

Lower limit :

$$\bar{X} - Z_{1-\frac{\alpha}{2}} \frac{\sigma}{\sqrt{n}}$$



Upper limit :

$$\bar{X} + t_{1-\frac{\alpha}{2}} \frac{s}{\sqrt{n}}$$

Lower limit :

$$\bar{X} - t_{1-\frac{\alpha}{2}} \frac{s}{\sqrt{n}}$$

Confidence Interval for the Difference between Two Population Means $\mu_1 - \mu_2$

Interval Estimate $\mu_1 - \mu_2$

- Normal + σ_1^2 and σ_2^2 Known
- Non-normal + σ_1^2 and σ_2^2 Known + $n_1, n_2 \geq 30$ (large)

$$(\bar{X}_1 - \bar{X}_2) \pm Z_{1-\frac{\alpha}{2}} \sqrt{\frac{\sigma_1^2}{n_1} + \frac{\sigma_2^2}{n_2}}$$

Estimator: $(\bar{X}_1 - \bar{X}_2)$
 Reliability Coefficient: $Z_{1-\frac{\alpha}{2}}$
 Standard Error of $\bar{X}_1 - \bar{X}_2$: $\sqrt{\frac{\sigma_1^2}{n_1} + \frac{\sigma_2^2}{n_2}}$
 margin error
 Precision of the estimate

Upper limit :

$$(\bar{X}_1 - \bar{X}_2) + Z_{1-\frac{\alpha}{2}} \sqrt{\frac{\sigma_1^2}{n_1} + \frac{\sigma_2^2}{n_2}}$$

Lower limit :

$$(\bar{X}_1 - \bar{X}_2) - Z_{1-\frac{\alpha}{2}} \sqrt{\frac{\sigma_1^2}{n_1} + \frac{\sigma_2^2}{n_2}}$$

- Normal + $\sigma_1^2 = \sigma_2^2 = \sigma^2$ Unknown + $n_1, n_2 < 30$ Small

$$(\bar{X}_1 - \bar{X}_2) \pm t_{1-\frac{\alpha}{2}} \sqrt{\frac{S_p^2}{n_1} + \frac{S_p^2}{n_2}}$$

Estimator: $(\bar{X}_1 - \bar{X}_2)$
 Reliability Coefficient: $t_{1-\frac{\alpha}{2}}$
 Standard Error of $\bar{X}_1 - \bar{X}_2$: $\sqrt{\frac{S_p^2}{n_1} + \frac{S_p^2}{n_2}}$
 margin error
 Precision of the estimate

$$df = v = n_1 + n_2 - 2$$

Pooled estimate of the common variance σ^2 :

$$S_p^2 = \frac{(n_1 - 1)S_1^2 + (n_2 - 1)S_2^2}{n_1 + n_2 - 2}$$

Upper limit :

$$(\bar{X}_1 - \bar{X}_2) + t_{1-\frac{\alpha}{2}} \sqrt{\frac{S_p^2}{n_1} + \frac{S_p^2}{n_2}}$$

Lower limit :

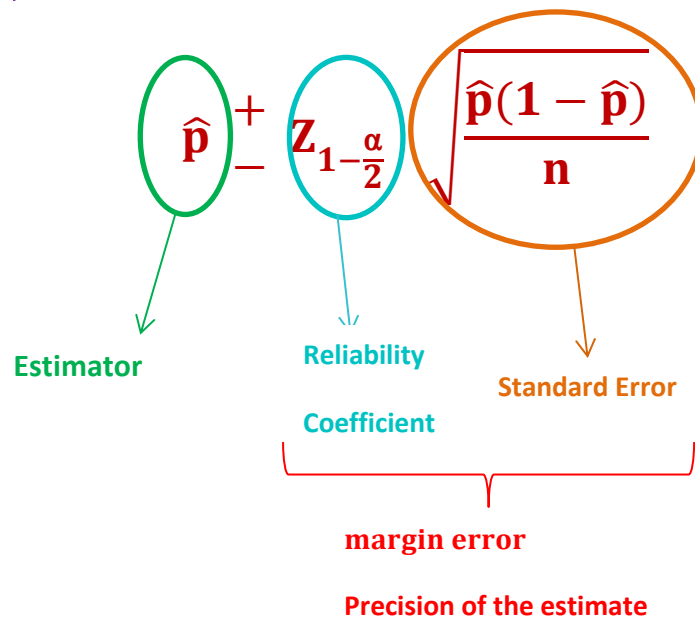
$$(\bar{X}_1 - \bar{X}_2) - t_{1-\frac{\alpha}{2}} \sqrt{\frac{S_p^2}{n_1} + \frac{S_p^2}{n_2}}$$

Confidence Interval for a Population Proportion (P)

Interval Estimate (P)

- $n \geq 30$ (large)

, ($\hat{q} = 1 - \hat{p}$)



Upper limit :

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

Lower limit :

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

Confidence Interval for the Difference between Two Population Proportion $P_1 - P_2$

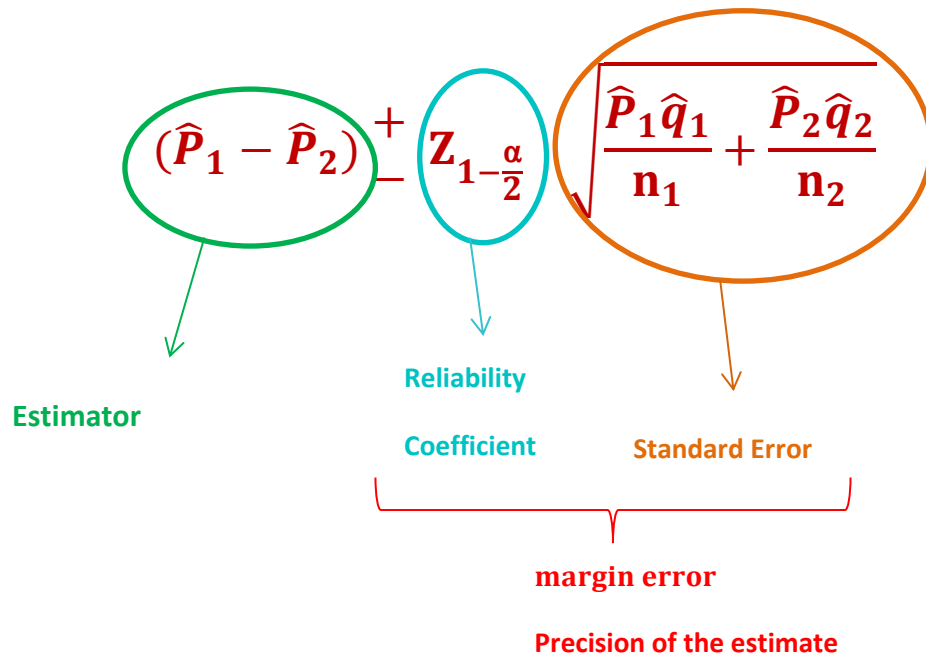
Interval Estimate $P_1 - P_2$

$$n_1 \geq 30 \text{ (large)}$$

$$(\hat{q}_1 = 1 - \hat{p}_1)$$

$$n_2 \geq 30 \text{ (large)}$$

$$(\hat{q}_2 = 1 - \hat{p}_2)$$



Upper limit :

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

Lower limit :

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

$$\hat{p}_1 = \frac{x_1}{n_1} = \frac{\text{جزء}}{\text{كل}}$$

$$\hat{p}_2 = \frac{x_2}{n_2} = \frac{\text{جزء}}{\text{كل}}$$