Sample estimate of two variables

Ratio of variances

$$\frac{S_x^2}{\sigma_x^2} \div \frac{S_y^2}{\sigma_y^2} \sim F_{(m-1,\, n-1)}$$

$$P\left(b_{min} < \frac{\sigma_y^2}{\sigma_x^2} \right) = \frac{1-\alpha}{2}$$

$$P\left(\frac{S_y^2}{S_x^2} b_{min} < \frac{\sigma_y^2}{S_y^2} \div \frac{\sigma_x^2}{S_x^2} \right) = \frac{1-\alpha}{2}$$

$$F_L \sim F_{(n-1,\, m-1)}$$

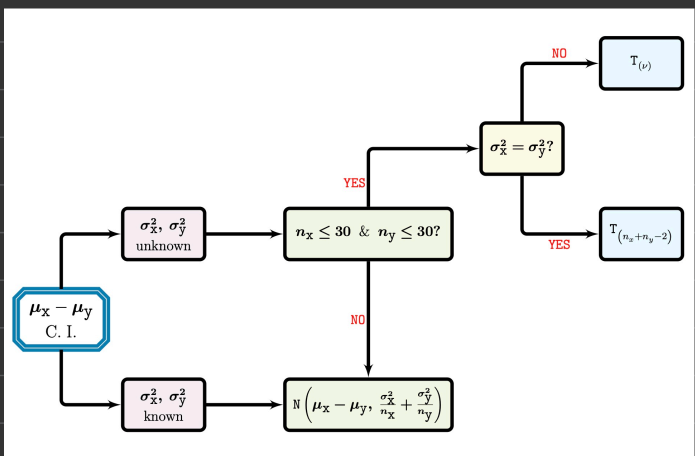
$$P\left(\frac{S_y^2}{S_x^2} b_{min} < F_L \right) = \frac{1-\alpha}{2}$$

$$\frac{S_y^2}{S_x^2} b_{min} = F_{(n-1,\, m-1),\frac{\alpha}{2}L}$$

$$\frac{S_y^2}{S_x^2} b_{max} = F_{(n-1,\, m-1),\frac{\alpha}{2}U}$$

Definition

$$F_{(a,b),\frac{\alpha}{2}L} = \frac{1}{F_{(b,a),\frac{\alpha}{2}U}}$$



MSE

$$MSE(\hat{\theta}) = E[(\hat{\theta} - \theta)^2]$$
$$= Var(\hat{\theta}) + B(\hat{\theta})^2$$

$$\frac{(\bar{X}-\bar{Y})-(\mu_X-\mu_Y)}{\sqrt{\frac{\sigma_X^2}{n_X}-\frac{\sigma_Y^2}{n_Y}}} \sim N(0,1)$$

Hypothesis testing

- Posit behaviour/value
- Investigate validity
- Quantify possibility of making incorrect decision

Null hypothesis (H_0)

- = sign ← always
- mutually exclusive and exhaustive with alternative hypothesis (H_1)

Rejection region

- Values that result in rejection of

Type I error

P(reject H_0 | true H_0)

Type II error

P(not reject H_0 | H_0 false)

H_0: $\pi = 0.5$

H_1: $\pi_a < 0.5$

X = # that buy A

$X \sim bi(20, 0.5)$

$\alpha = P(X \leq 5)$

$= \sum_{i=1}^{5} \binom{20}{i} \times 0.5^i \times (1-.5)^{n-i}$

$= 0.021$

$\beta = P(X > 5 \mid n=20, \pi=0.4)$

$= 1 - P(X \leq 5 \mid n=20, \pi=0.4)$

$= 1 - \sum_{i=1}^{5} \binom{20}{i} 0.4^i \, 0.6^{n-i}$

$X_i \sim \text{bernoulli}(\frac{1}{4})$

Doesn't understand $\bar{X} >$

Group A: understand $\pi \geq 80\%$
Group B: guess $\pi = 0.25$
Group C: idea $\pi = 0.75\%$

H_0: student belongs to C
H_1: student does not belong to

a) $P(\text{reject } H_0 \mid H_0 \text{ true})$
$= P($