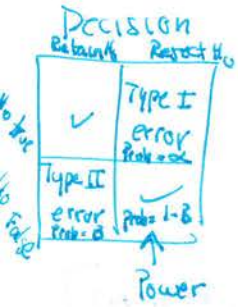
MAT 241 - 12/6 -



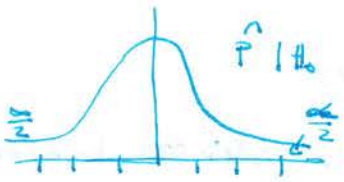
α = P(Reject H_0 | H_0 true)

β = P(Retain H_0 | H_0 false)

Power = P(Reject H_0 | H_0 false)

$\alpha \downarrow = \beta \uparrow$

$\alpha \uparrow = \beta \downarrow$



Clinical Trial

H_0: drug does not work

H_a: drug works

↓ alternate hypothesis

Type I error: Release a drug to public that is not ~~work~~ efficacious.

Type II error: Do not release a drug that is efficacious. cost: cost: Need more info

Fire alarm System

H_0: No Fire

H_a: Fire

Type I error: false alarm — Cost: Annoyance

Type II error: Fire, but alarm doesn't send — Cost: Lives

American Justice System

H_0: Innocent

H_a: Guilty

Type I: Innocent person goes to jail — cost:

Type II: Guilty person goes free — cost:

Scientific theory

H_0: old theory

H_a: new theory

α: 1% or 5%.

Return to human sex ratio

$H_0: p = 0.5$ p(male)
$H_a: p \neq 0.5$

$\alpha = 5\%$.

Previously $\hat{p} = \frac{165}{345} = .48 \notin$ Retainment Region

Let's do experiment again

In 2008 in USA $n = 4{,}247{,}000$ babies born.
2,123,000 are males.

Retainment Region = $\left[0.5 \pm 2\sqrt{\frac{0.5(1-0.5)}{4{,}247{,}000}}\right]$

$[0.495, .505]$ As $n \uparrow$ = $\beta \downarrow$ = Power $\uparrow$

Retainment Region

testing if $p = p_0$ → $\left[p_0 \pm z\frac{\alpha}{2}\sqrt{\frac{p_0(1-p_0)}{n}}\right]$

$CI_{p,\,1-\alpha} = \left[\hat{p} \pm z\frac{\alpha}{2}\sqrt{\frac{\hat{p}(1-\hat{p})}{n}}\right]$

Set of numbers of reasonable values.

$\hat{p} = \frac{2{,}123{,}000}{4{,}247{,}000} = .512 \notin$ Retainment Region ⇒ Reject H_0 ⇒ Gender ratio is not even.

$H_0: p = 0.5$ Retain H_0 or Reject H_0

$H_a: p \neq 0.5$

Alien problem

H_0: Aliens don't exists

H_a: Aliens do exists

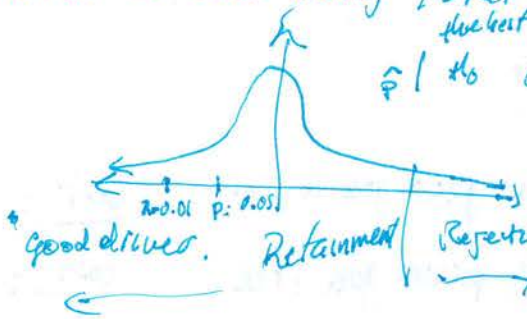
α low α High

One sided testing but In the

If more than 5% of customers give a driver a bad rating, uber fires them the best

H_0: Driver is good $p \leq p_0 = 0.05$

H_a: bead driver. $p \geq p_0 = 0.05$



$\hat{p} = \frac{\#\text{ of bad drivers}}{1000}$

$[-\infty, .0630] =$ Retainment Region $= \left(-\infty, p_0 + z\alpha\sqrt{\frac{p_0(1-p_0)}{n}}\right]$