Lecture 23

12/6/17

Hypothesis Testing

		Decision: Retain H_0	Decision: Reject H_0
H_0	True	✓	Type 1 Error Prob = α
H_0	False	Type 2 Error Prob = β	✓ Prob = power

Consider $\alpha \downarrow \Rightarrow \beta \uparrow$ $\quad n \uparrow \Rightarrow \beta \downarrow$ $\quad n \uparrow \Rightarrow \alpha$ no change

$\alpha \uparrow \Rightarrow \beta \downarrow$ $\quad n \downarrow \Rightarrow \beta \uparrow$

Clinical trial for a drug

H_0: Drug doesn't work

H_a: Drug works

Type I Error: Selling a drug that doesn't work

Type II Error: Not selling a drug that does work

Fire Alarm Test

H_0: No fire

H_a: Fire

Type I Error: False alarm

Type II Error: Fire, but alarm doesn't go off

American Court System

H_0: Innocent

H_a: Guilty

Type I Error: Innocent person goes to jail

Type II Error: Guilty person goes free

Scientific Theory

H_0: Old theory

H_a: New theory

$\alpha = 1\%$ or 5%

Human Sex Ratio ($p = p(\text{male})$)

$H_0: p = 0.5$

$H_a: p \neq 0.5$

$\alpha = 5\%$

2008 - All American births

$n = 4,247,000$

Retainment Region $= \left[0.5 \pm 2\sqrt{\frac{0.5(1-0.5)}{4,247,000}}\right] = [.495, .505]$

Number of males: 2,173,000

$\hat{p} = \frac{2,173,000}{4,247,000} = .512 \notin$ Retainment Region

$\Rightarrow$ Reject H_0 $\Rightarrow$ Sex ratio not even

H_0: Aliens do not exist

H_a: Aliens exist

α: low - stubborn, does not believe

high - willing to believe

Uber fires bad drivers if the driver has more than a 5% bad rating.

H_0: Good driver: $p \leq p_0 = 5\%$

H_a: Bad driver: $p > p_0 = 5\%$

Take a sample, then run test.

Retainment Region $= \left(-\infty, p_0 + z_\alpha\sqrt{\frac{p_0(1-p_0)}{n}}\right)$

$n = 1000$

Retainment Region $= (-\infty, .64]$