1690	280
1641	266
49	144

Decision

		Retain H_0	Reject H_0
TRUTH	H_0 true	✓	Type I error
	H_0 false	Type II error	✓

decision theory

POWER

Prob $= \alpha = P(\text{Reject } H_0 \mid H_0 \text{ true})$

$\beta = P(\text{Retain } H_0 \mid H_0 \text{ false})$

Power $= P(\text{Reject } H_0 \mid H_0 \text{ False})$

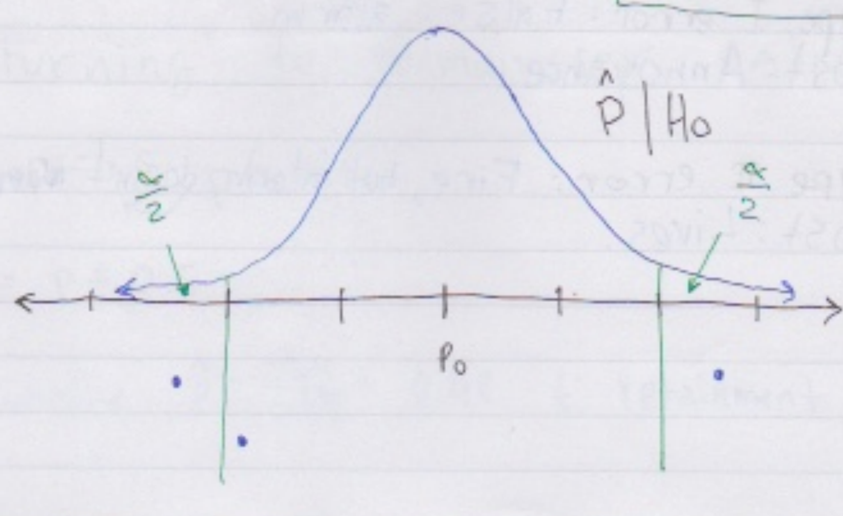
$P(\text{Type I error}) = P(\text{Rejecting } H_0 \mid H_0 \text{ true}) = \alpha$

$1 - P(\text{Type II error}) = P(\text{Rejecting } H_0 \mid H_0 \text{ false}) = \text{Power}$ ← advanced class

$P(\text{Type II error}) = P(\text{Retain } H_0 \mid H_0 \text{ false}) = \dots$ advanced class

$\boxed{12/6}$

$\boxed{\begin{array}{l} \text{If } \alpha\downarrow \Rightarrow \beta\uparrow \\ \text{If } \alpha\uparrow \Rightarrow \beta\downarrow \end{array}}$



Example: Clinical Trial

Ho: drug does not work

Ha: drug works

Type I error: Release a drug to public that is not effective
cost:

equivalent

Type II error: Do not release a drug that is efficacious
cost:

Example: Fire Alarm System

Ho: No fire.

Ha: Fire.

Type I error: False alarm
cost: Annoyance.

Type II error: Fire, but alarm doesn't sound.
cost: Lives.

Example: American Justice System

Ho: Innocent

Ha: Guilty

Type I error: Innocent person goes to jail.
Cost: Someone's lives is ruined for no reason

Type II error: Guilty person goes free.
Cost: Guilty person back in society

Example: New Scientific Theory

Ho: Old theory

Ha: New theory

α = 1% or 5%

Returning to Human sex ratio:

$H_0 = p = 0.5$ p (male)

$H_a = p \neq 0.5$

Previously $\hat{p} = \frac{164}{345} = 0.48 \in$ retainment region

In USA 2008, $n = 4,247,000$
babies born: 2,173,000 males

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

$$\boxed{\begin{array}{l} \text{Ret Region} = \left[p_0 \pm 2\frac{\alpha}{z}\sqrt{\frac{p_0(1-p_0)}{n}}\right] \\ \\ CI_{p,\,1-\alpha} = \left[\hat{p} \pm 2\frac{\alpha}{z}\sqrt{\frac{\hat{p}(1-\hat{p})}{n}}\right] \end{array}}$$

$$= [.495, .505]$$

$n\uparrow \Rightarrow \beta\downarrow \Rightarrow \text{Power}\uparrow$

$$\hat{p} = \frac{2,173,000}{4,247,000} = .512 \notin \text{Retainment Region} \Rightarrow \text{Reject } H_0$$

$\Rightarrow$ Gender ratio is not even

$H_0: p = 0.500001$ Retain H_0 OR Reject H_0
$H_a: p \neq 0.500001$

· Religion: Distance between (

Example: Alien problem

H_o: Aliens doesn't exist

H_a: Aliens do exist

α low vs. α high

Kapelner always try to prove Aliens do not exist

Kapelner becomes a little open about changing his mind

H_o: Aliens do exist

H_a: Aliens doesn't exist

α low | vs. α high

Kapelner always try to prove Aliens exist

course closed

Goat behind the door in TV show is sad now :-(

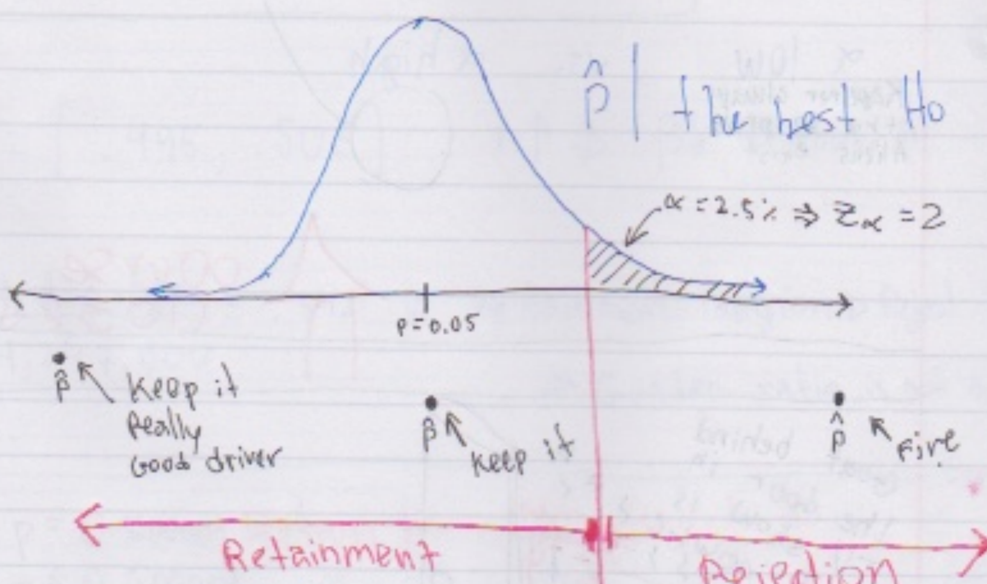
This won't be on exam

1-sided, 1-proportion hypothesis test

If more than 5% of customers give a driver a bad rating, UBER fires them.

Ho: Good driver. $p \leq p_0 = 0.05$

Ha: Bad driver. $p > p_0 = 0.05$



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

$= (-\infty, .0638]$

$\boxed{n = 1000}$

$\boxed{\hat{p} = \frac{\#\text{bad rides}}{1000 = n}}$