Quiz 6.

Q1. Claims : 75% of support on - - -

$n=25$, $Y=14$ ✓ 11 against.

Test at $\alpha=0.01$ of the claim. p-value

H_0: $p \geq 0.75$ $\quad (p=0.75)$

H_1: $p < 0.75$ $\quad (p \neq 0.75$ 也可$)$

$np \geq 5$, $nq \geq 5$

under H_0, $Y \sim Bin(25, 0.75)$

$\approx N(18.75, 4.6875)$

$p\text{-value} = P(Y \leq 14) \approx P\left(Z \leq \frac{14.5-18.75}{\sqrt{4.6875}}\right)$

$= P(Z \leq -1.963) \approx 0.025 < \alpha$.

Can not rej H_0.

$\alpha=0.05$

	$[0, 0.2)$	$[0.2, 0.3)$	$[0.3, 0.5)$	$[0.5, 1)$	$[1, 2)$	$[2, \infty)$
O_i	3	6	3	12	41	35	6
e_i	3.9	4.7	13.5	41.1	35	41	1.8
						36.8

8.6

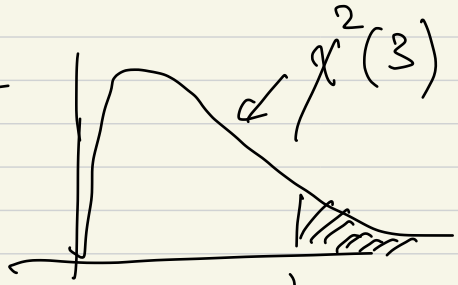
H_0: The model fits. H_1: Not. $\quad F(x) = 1 - e^{-x^2}$, $x \geq 0$.

$P(0 \leq X \leq 0.2) = F(0.2) = 0.0392$

$$P(0.2 \le X < 0.3) = F(0.3) - F(0.2) = 0.0469$$

$$\chi^2_{obs} = \frac{2.6^2}{8.6} + \frac{1.5^2}{13.5} + \frac{0.1^2}{41.1} + \frac{4.2^2}{36.8}$$

$$< 2 \notin C$$



Cannot rej H_0.

How to distinguish a problem between paired of 2-sample?

Key: 2 sets of data independant or paired??

Example 1: A new pain releaver. Test against the current on the market

6 pairs of twins, For each pair of twins, they randomly assign 1 to new drug, one to the old drug.

	twin #1	#2	#3	#4	#5	#6
old	20	17	15	..	.	
new	18	16	18	-		

Assume the diff of the times follows a normal dist. Is there sufficient evid. to suggest new drug works better?

Example 2. A drug company develop a new drug. They have 10 mice they randomly split 10 mice to 2 groups, 1 group receive the drug, the other group no treatment.

with drug	20,	17,	15	-	—
no drug	18,	16,	18	-	—

Assume both pops are roughly normal with equal variances. Can

we conclude the drug is effective at prolong life at $\alpha = 0.05$.

When to use $\hat{p}_0 = \frac{y_1 + y_2}{n_1 + n_2}$?

only when testing $H_0: p_1 = p_2$

$H_1: p_1 \neq p_2$ (or $<$, $>$)

Not for C.I. for $p_1 - p_2$.

Review: For C.I. of $p_1 - p_2$:

$\hat{p}_1 - \hat{p}_2$ sampling dist:

$$\hat{p}_1 \sim N\left(p_1, \frac{p_1 q_1}{n_1}\right)$$
$$\hat{p}_2 \sim N\left(p_2, \frac{p_2 q_2}{n_2}\right)$$

$\Rightarrow \hat{p}_1 - \hat{p}_2 \sim N\left(p_1 - p_2, \frac{p_1 q_1}{n_1} + \frac{p_2 q_2}{n_2}\right)$

C.I. for $p_1 - p_2$ is:

$$\left(\hat{p}_1 - \hat{p}_2 - z_{\frac{\alpha}{2}} \sqrt{\frac{\hat{p}_1 \hat{q}_1}{n_1} + \frac{\hat{p}_2 \hat{q}_2}{n_2}},\ \hat{p}_1 - \hat{p}_2 + z_{\frac{\alpha}{2}} \sqrt{\frac{\hat{p}_1 \hat{q}_1}{n_1} + \frac{\hat{p}_2 \hat{q}_2}{n_2}}\right)$$

Now: $H_0: p_1 = p_2$ $\quad (p_1 - p_2 = 0)$

$H_1: p_1 \neq p_2$ $\quad (p_1 - p_2 \neq 0)$

under H_0: $\hat{p}_1 - \hat{p}_2 \sim N\left(p_1 - p_2, \frac{p_1 q_1}{n_1} + \frac{p_2 q_2}{n_2}\right)$

$\sim N\left(0, \frac{\hat{p}_0 \hat{q}_0}{n_1} + \frac{\hat{p}_0 \hat{q}_0}{n_2}\right)$

$$\hat{p}_0 = \frac{y_1 + y_2}{n_1 + n_2}$$

WS 7. Q2.

H_0: The year a student is in is indep of the platform the student is assigned to.

H_1: Not independent.

platform \ year	1	2	3	4
1	✓	✓	✓	X
2	✓	✓	✓	X
3	X	X	X	X

Ex: At least 80% of our students pass the road test on 1st try.

10 past students, if 6 or fewer pass, you will not believe the claim.

But if 7 or more, ✓.

① What's the prob of you making a type I error if $p=0.8$?

$$\alpha = 1 - P(X \geq 7) = 1 - \sum_{x=7}^{10} \binom{10}{x} 0.8^x 0.2^{10-x}$$

$p=0.8$

$$= 0.1209$$

$H_0: p=0.8$

$H_1: p<0.8$

$P(\text{rej } H_0 \text{ when } H_0 \text{ is true})$

$= P(X \leq 6, \ p=0.8)$

② If $p=0.7$, what's the prob of you making a type II error?

$\beta = P(\text{not rej } H_0 \text{ when } H_0 \text{ is false})$

$= P(X \geq 7, \quad , p=0.7)$

$$= \sum_{x=7}^{10} \binom{10}{x} 0.7^{x} 0.3^{10-x}$$

$$= 0.65$$

(3) If $p = 0.7$ what's the power of your test?

$$= 1 - \beta = 0.35$$

power = Prob of rej H_0 when H_0 is false

$$= 1 - \beta$$