Hypothesis Assignment

HA ①

① Dean of UCLA concerned about GPA. GPA over 5yrs is 2.75
$N = 256$ Srs GPA $\mu = 2.85$ with $\sigma_{Sm} = 0.65$

a) Null Hypo & Alternate hypo

$H_0 = 2.75$

$H_1 \geq 2.75$

$$\Rightarrow \frac{2.85 - 2.75}{0.04} = \frac{0.1}{0.04} = 0.9938$$

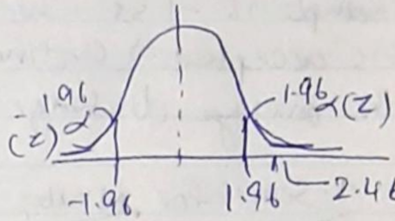
ⓑ What is std error

$$SE = \frac{\sigma_{Sm}}{\sqrt{N}} = \frac{0.65}{\sqrt{256}} = \frac{0.65}{16} = 0.04$$

ⓒ Describe how would you set CR & what would they be at $\alpha = 0.05$

$CI = 95\%$ $\alpha = 0.05$

$$Z_S = \frac{2.85 - 2.75}{0.04} = 2.46$$

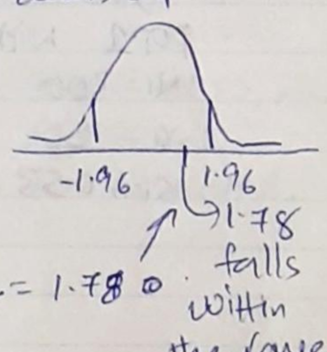


d) Test H_0 & explain
Given that the Z-score for sample is outside of 95% CI & α is under the tail, for the sample Null hypo is rejected. (GPA didn't chg?)

② Avg cost of text book = 52 $\sigma = 4.50$
Stat Stud selected a random sample of $100 = N$. $\mu_{Sn} = 52.80$
perform Hypo at 5% sig level and state your decision

$H_0 = 52$ Avg. cost is higher $H_1: \mu \neq 52$

$Z(95\%) = 1.96$

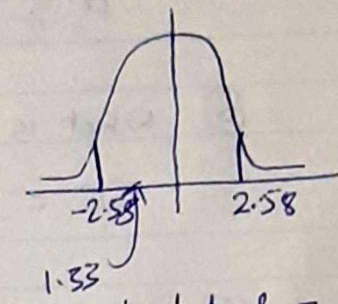


$$Z_S = \frac{52.80 - 52}{4.5/\sqrt{100}} = \frac{0.80}{0.45} = 1.78$$

Since the Z_S for sample falls ~~under~~ within the 95% CI we accept Null Hypothesis

(3) Chem pollutant $\mu = 34$ $\sigma = 8$
A group of env will test to see if its in 1% Signifian Level
Assume $N = 50$ $\mu = 32.5$.
perform Hypo test at 1% significance Level.

Z_s for 99% CI = 2.58



$H_0: \mu = 34$ $H_1: \mu \neq 34$

$$Z = \frac{32.5 - 34}{8/\sqrt{50}} = \frac{-1.5}{1.13} = -1.325 = -1.33$$

Critical value of Z at 99% CI ± 2.58 and the calculated Z_s for Sample is -1.33 which falls within 99% CI of ± 2.58, Null Hypo is accepted. ⇒ Stating that the improved filtration device is lowering the average discharge of pollutant.

(4) t-Score for $N=16$; $\mu = 10$ & $\mu_s = 12$ & $\sigma_{sm} = 1.5$

$$t = \frac{\bar{x} - \mu_0}{S/\sqrt{n}} = \frac{12-10}{1.5/\sqrt{4}} = \frac{2 \times 2}{1.5} = \frac{4}{1.5} = 2.67$$

(5) One Tailed test to determine whether pop prop of TC buyers who buy atleast #2500 in checks when Sweepstakes prizes are offered at least 10% higher when no such sweepstakes are on.

pop1 : with Sweeps
$N1 = 300$
$X1 = 120$
$S1 = 0.53$

pop2 : without Sweeps
$N2 = 700$
$X2 = 140$
$S2 = 0.20$

(5) Sample of 100 voters are asked which candidate they would vote in ele
supporting each candidate given below.

	Obser	Expected	x^2		
H	41	25	$(41-25)^2/25$	256	$\frac{374}{25} = 14.96$
R	19	25	$(19-25)^2/25$	36	
W	24	25	$(24-25)^2/25$	1	
C	16	25	$(16-25)^2/25$	81	

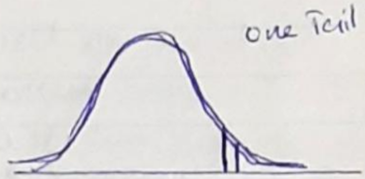
Chi value with $df=4; \alpha=0.05 \Rightarrow 9.49$
Chi value with $df=3; \alpha=0.05 \Rightarrow 7.815$
Chi value with $df=3; \alpha=0.01 \Rightarrow 11.345$
x^2 with $df=3$ for $\alpha=0.05$ stands at 7.815
x^2 with sample is 14.96 which is outside of 7.815 and also is outside of $df=3; \alpha=0.01$ (99%) suggesting that voters do not prefer 4 candidates equally.

(4) Avg ht of 7^{th} graders has increased. (H_0)
Avg ht of 7^{th} gra 5yrs ago was 145 with $\sigma=20cm$.
She takes a random of 200 students & finds avg ht of sample is 147cm
Single tailed hypo testing using 0.5 signi level to eval H_0 & H_1

$\mu=145$ $\sigma=20$ $\mu_s=147$ $\alpha=0.05$

one Tail test

$$Z_s = \frac{\bar{x}-\mu}{\sigma/\sqrt{n}} = \frac{147-145}{20/\sqrt{200}} = \frac{2\times\sqrt{200}}{20} = 1.414$$



Z_s for One tail with $\alpha=0.05 = 1.645$

As the Zscore of sample is within the upper tail of <0.05, we can accept Null Hypothesis and state with significant confidence that Average Height of 7^{th} graders has increased.

(9) Pizza shop owner. Buy cheese slab of 4.5lb ⇒ 72oz.
7 random samples: 70, 69, 73, 68, 71, 69 & 71 oz.
Are these diff due to chance or distributor giving less cheese.

a) State hypo

$$H_0: \mu = 72; \quad H_a: \mu \neq 72$$

(b) Calculate test statistic. $n = 7$.
For sample provided: Mean = 70.14 & $\sigma = 1.676$ (using excel)

$$t_c = \frac{\bar{x} - \mu}{s/\sqrt{n}} = \frac{70.14 - 72}{1.676/\sqrt{7}} = -\frac{1.86 \times \sqrt{7}}{1.676} = -\frac{2.645}{1.676} = -2.93$$

(c) $\alpha = 0.1$ $\quad \alpha = 0.05$ $\quad \alpha = 0.01$

$t_{\alpha/2, n-1} \Rightarrow$ $t_{0.05,6}$ $\quad t_{0.025,6}$ $\quad t_{0.005,6}$

1.943 $\quad$ 2.446 $\quad$ 3.707

As $t_c \Rightarrow$ $\cancel{>} t$ $\quad t_c > t$ $\quad t_c \not< t$

↑reject $\quad$ ↑reject $\quad$ ↑accept.

(8) Planting techique to improve (increase) yield on pea plants
$\mu = 145$ $\sigma = 100$. After altering plant techinique sample $N = 144$
& finds avg. # to be $\mu_{sm} = 147$. He wonders if stat. significance
H_0 = Increase in yield $\quad H_a$ = No significant increase

$H_0: \mu = 145$

$H_a: \mu > 145$

$$Z_s = \frac{\bar{x} - \mu}{\sigma/\sqrt{N}} = \frac{147 - 145}{100/\sqrt{144}} = \frac{2 \times 12}{100} = 0.24$$

If we choose significance level $\alpha = 0.05 \Rightarrow Z_\alpha = 1.65$
As the value of test statistic is 0.24 which is significantly less than Z_α we can accept Null Hypothesis.

(1) Heart rate $\mu = 72$, $N = 25$ in aerobics to lower HR.
After 6 mo.L group eval to check if HR is lower.
$\mu_{HR} = 69$ $\sigma = 6.5$. Was aerobics effective in lowering HR.

$$t = \frac{\bar{x} - \mu_0}{s/\sqrt{n}} = \frac{69 - 72}{6.5/\sqrt{25}} = -\frac{3 \times 5}{6.5} = -2.307 = -2.31$$

with a 95% CI & df = 25 − 1 = 24, t_s-score value for:

$t_{\alpha/2, 24} = 2.064$
The calculated t-value is greater than sample stating that exercise has significant effect on exercise & reduces lower HR.

(2) $\mu = 15$ → life of runnin shoes. H_0: long lasting prod $\mu > 15$
$N = 30$ $\mu_s = 17$ mos. $\sigma = 5.5$.
Two tailed test using a level of significance of $p < 0.05$

$$t = \frac{\bar{x} - \mu}{s/\sqrt{N}} = \frac{15 - 17}{5.5/\sqrt{30}} = -\frac{2 \times \sqrt{30}}{5.5} = -\frac{10.96}{5.5} = -1.99 \approx 2.00$$

$t_{\alpha/2, 29} = 2.045$
As the t-score is less than $p < 0.05$, we accept Null and the claim that shoes last > 15 mo is true.

(5) $\mu = 16$ $\mu \neq 16$
Random Sample: $n = 10$ $S = 2.05$ $\bar{x} = 18$

$$t = \frac{\bar{x} - \mu}{s/\sqrt{N}} = \frac{18 - 16}{2.05/\sqrt{10}} = \frac{2 \times \sqrt{10}}{2.05} = 3.085$$

df = 10 − 1 = 9
@ 95% CI ⇒ $t_{\alpha/2, 9} = 2.262$ → Reject ⇒ Two tailed
@ 99% CI ⇒ $t_{\alpha/2, 9} = 2.821$ → Reject → One-tailed
@ 99.5% CI ⇒ $t_{\alpha/2, 9} = 3.250$ → Approve
Manager can approve Null Hypo @ 99.5% CI level.

(3) Two Test → paired T-Test.

Control : $\bar{x} = 30$; $S = 6.63$; $n = 15$

Relax : $\bar{x} = 26$; $S = 6.2$; $n = 15$

diff of Mean = $30 - 26 = 4$.

diff of SD ⇒ $\sqrt{(S_1)^2 - (S_2)^2} = \sqrt{(6.63)^2 - (6.2)^2} = 2.34$

with $df = 28\ (15-1)+15-1)$ and $\alpha = 0.5$

$t_{\alpha/2, 28} = 2.048$. $\quad t = \frac{4}{2.34} = 1.702 \Rightarrow 1.71$

1-Tail: $t_{\alpha/2, 28} = 1.701$

(4) Table of data with same test as above.

Pairs	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Contr	38	40	35	36	35	32	31	30	28	26	24	27	18	34	22
Relax	35	32	30	34	30	32	28	29	22	22	18	17	17	25	21
diff	3	8	5	2	5	0	3	3	6	4	6	4	1	9	1
		11	16	18	23	23	26	29	35	39	45	49	50	59	60

Sum(diff) = 60 ⇒ $\mu = \frac{60}{15} = 4$

Sum $(\text{dif})^2 = 332$ ⇒

Std. dev. (using excel) ⇒ 2.56

diff:	3	8	5	2	5	0	3	3	6	4	6	4	1	9	1	= 60/15 = 4
	9	16	25	4	25	0	9	9	36	16	36	16	1	81	1	= 332
mean diff	-1	4	1	-2	1	-4	-1	-1	2	0	2	0	-3	5	-3	
mean dif^2	1	16	1	4	1	16	1	1	4	0	4	0	9	25	9	= 92

Var = $92/(15-1) = 92/14 = 6.57$

$SD = \sqrt{6.57} = 2.56$.

$df \Rightarrow 15 - 1 = 14$

@ $\alpha = 0.05 \Rightarrow t_{\alpha/2, 14} = 2.145$

$S.E = \frac{\sigma}{\sqrt{N}} = \frac{2.56}{\sqrt{15}} = 0.66$

$t = \frac{\mu}{SE} = \frac{4}{0.66} = 6.06$.

So, $6.06 > 2.145$

Relax group is significantly different than control grp.

Chi Square Assignment

1. poker machine deals at random from infile deck. 1600=N

	Observed	Expected	$(o-e)^2/e$		
S	404	400	16/400	0.04	
H	420	400	400/400	1	1.04
D	400	400	0/400	0	1.04
C	376	400	576/400	1.44	$2.48 = x^2$

$x^2 = 2.48$ df $\Rightarrow 4-1=3$

@ $\alpha = 0.05$ Chi score with df = 3 $\Rightarrow$ 7.81
and calculated chi is 2.48 which is below 7.81
we can accept that cards are sorted randomly.

2. Same as 1 but with Jokers and total cards are 1662

	O	E	$(o-e)^2/e$	x^2
S	404	400	16/400	0.04
H	420	400	400/400	1
D	400	400	0/400	0
C	356	400	1936/400	4.84
J	82	62	400/62	6.45
				12.33

1662/4 = 415.5
A set has 2 jokers; set = 54
2/54 = 0.037
0.037 × 1662 = 62
1662 − 62 = 1600

$x^2 = 12.33$

Deg of Free = 5−1 = 4.

@ $\alpha = 0.05 \Rightarrow$ Chi Score $= \alpha_{.05, 4} \Rightarrow 9.49$

As $12.33 > 9.49 \Rightarrow$ Reject the possibility of cards being sorted Randomly

3. e: 4 stops 3 spots 9: stop & spot $\Rightarrow$ Total = 16
O: 50 Stripe 41 spots 85 Stripe & Spot $\Rightarrow$ Total = 176.

	O	E	$(o-e)^2/e$	x^2
S	50	4/16 × 176 = 44	36/44	0.82
S	41	3/16 × 176 = 33	64/33	1.94
S&S	85	9/16 × 176 = 99	256/99	1.98
				4.74

$x^2 = 4.74$
$\alpha = 0.05$ df = 3−1 = 2
chi-score $\Rightarrow$ 5.99
Calculated is 4.74

As the calculated chi score is significantly less than chi sq score we can acept Genetist hypothesis and her predicted phenotypic outcome is True.

(4) In garden pea Y > G & Inflated > constricted form.
Genes assort independently if follow 9:3:3:1 ⇒ 16. (dihibrid cross)

G, Inflated	193	$3/16 \times 994 =$	186	$49/186 =$	0.263
Y, Constrict	184	$3/16 \times 994 =$	186	$4/186 =$	0.022
Y, Inflated	556	$9/16 \times 994 =$	559	$9/559 =$	0.016
G, Constricted	61	$1/16 \times 994 =$	62	$1/62 =$	0.016
	994		994		0.317

Chi Score with $\alpha = 0.05$ & $df = 3$ ⇒ 7.82
As the calculated Chi Score 0.317 is significantly less than Chi sq for $\alpha = 0.05$ & $df = 3$, we can accept hypothesis.

(5) Dept Store A has 4 competitor B, C, D, E. $\alpha = 0.05$ Shopper pref

Store	O	E	$(o-e)^2/e$
A	262	220	$42^2/220$
B	234	220	$14^2/220$
C	204	220	$16^2/220$
D	190	220	$30^2/220$
E	210	220	$10^2/220$

$= 14.61$

Chi Squ Score with $\alpha = 0.05$ & $df = 4$ $= 9.49$.

As calculated Chi Score is $14.61 > 9.49$ reject the hypothesis and confirm proportions are <u>not same</u>