PROBABILITY & STATISTICS

Date 4 / May / 2024.

ASSIGNMENT # 3

Saad Ahmed BCS-4D 22k-4345

Q1. 1. $H_0: \mu = 80$, $H_1: \mu < 80$
avg cost of shoes = \$80 , avg cost less than 80 dollars.

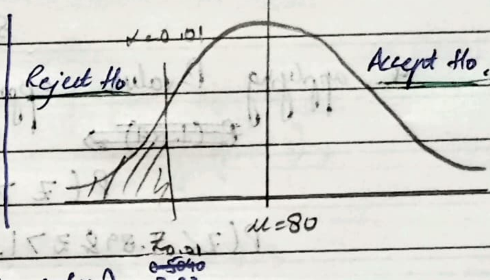
2. $\alpha = 0.10$, significance level.

3. $n = 36$, $s = 19.2$, $\bar{x} = 75$

z test: $\dfrac{\bar{x} - \mu}{s/\sqrt{n}} \Rightarrow \dfrac{75 - 80}{19.2/\sqrt{36}} \Rightarrow \dfrac{-5}{3.2} \Rightarrow$ ~~1.6375~~ -1.5625

4. ~~since < -2.33~~ applying critical value approach

since < -2.33 is rejection area, and our z value = -1.5625, thus;



5. ~~We do not reject the~~
we do not reject the null hypothesis (H_0).

6. The data provides sufficient evidence not to support the researcher's claim since the average cost of men's athletic shoes is not less than \$80 at 0.10 significance level.

Q2. 1. $H_0: \mu = \$5700$ (avg cost of fees at public college = \$5700)
$H_1: \mu > \$5700$ (avg " " " " " " > \$5700)

2. $\alpha = 0.05$, sig. level.

3. $n = 36$, $\bar{x} = \$5950$, $s = \$659$

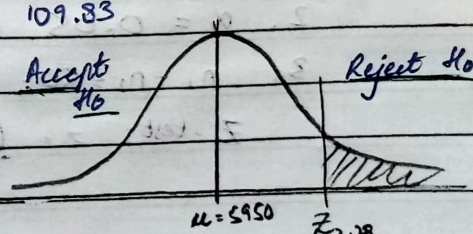
z test: $\dfrac{\bar{x} - \mu}{s/\sqrt{n}} \Rightarrow \dfrac{5950 - 5700}{659/\sqrt{36}} \Rightarrow \dfrac{250}{109.83} \Rightarrow 2.28$.

4. applying P value approach

$P(Z < 2.28) \Rightarrow 0.9887$

$P(Z > 2.28) \Rightarrow 1 - 0.9887 \Rightarrow 0.0113$

since $0.0113 < 0.05$,



5. we reject Ho, ie we reject null hypothesis.

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Q2; (continued) 6. We conclude that the data provides sufficient evidence to support the researcher's claim about avg cost of tuition fee @ 4 year old public school to be greater than \$5700 @ 0.05 sig. level.

Q3. 1. H_0: $\mu = 8$ miles per hr = (speed of wind = 8)

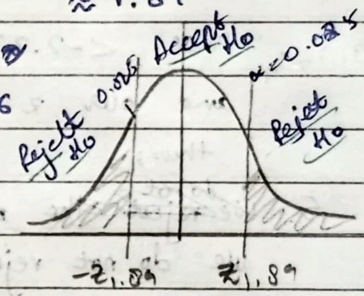
H_1: $\mu \neq 8$ miles per hr = (speed of wind may be > or < 8)

2. $\alpha = 0.05$

3. $n = 32$, $\bar{x} = 8.2$, $s = 0.6$

Z-test $\Rightarrow$ $\frac{\bar{x}-\mu}{s/\sqrt{n}} \Rightarrow \frac{8.2-8}{0.6/\sqrt{32}} \Rightarrow 1.8856$
≈ 1.89

4. applying P-value approach ~~P(1.89) =>~~



$P(Z<1.89) = 0.9706$

$P(Z>1.89) = 0.0294$.

$P(Z<-1.89 \;\&\; Z>1.89) = 0.0294 \times 2$.

$\Rightarrow 0.0588$.

since $0.0588 > 0.05$

5. we do not reject null hypothesis (H_0)

6. We conclude that the data provides sufficient evidence to support the researcher's claim that the average wind speed in a certain city is 8 miles per hour at 0.05 significance level.

Q4. 1. ~~$\mu_1 = 88.42$~~ ~~$\mu_2 = 80.61$~~

H_0: $\mu_1 = \mu_2$ (both mean are equal)

H_1: $\mu_1 \neq \mu_2$. (" " " unequal).

2. $\alpha = 0.05$.

3. $n_1 = n_2 = 50$; $\bar{x}_1 = 88.42$, $\bar{x}_2 = 80.61$; $S_1 = 5.62$, $S_2 = 4.83$

Z-test; $z = \frac{(\bar{x}_1 - \bar{x}_2) - (\mu_1 - \mu_2)}{\sqrt{(S_1^2/n_1) + (S_2^2/n_2)}} \Rightarrow \frac{(88.42 - 80.61) - (0)}{\sqrt{5.62^2/50 + 4.83^2/50}} \Rightarrow 7.45$

$z = 7.45$

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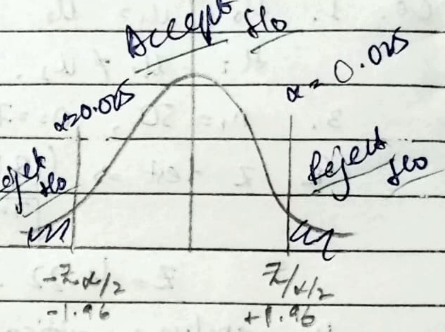
4. ~~crit~~ applying critical value approach;
@ $\alpha = 0.05 \Rightarrow$ two tailed so; $\alpha/2 = 0.025$.
@ $P(z_{\alpha/2}) \Rightarrow -1.96$.
so; either $Z < -1.96$ or $Z > 1.96$.
since $7.45 > 1.96$;



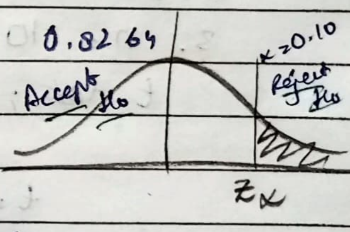
5. We reject (Ho) null hypothesis.
6. We conclude that there is sufficient evidence to support the claim that the mean are not equal, and there is significant ~~distance~~ difference in the rates at 0.05 sig. level.

Q5. 1. $H_0: \mu_1 = \mu_2$ (both genders have same no. of sports offered)
$H_1: \mu_1 > \mu_2$. (boys are offered more no. of sports).
2. $\alpha = 0.10$
3. $n_1 = n_2 = 50$; $\bar{x}_1 = 8.56$, $\bar{x}_2 = 7.94$; $s_1 = s_2 = 3.3$.

$$Z \text{ test} = \frac{(8.56 - 7.94) - 0}{\sqrt{3.3^2/50 + 3.3^2/50}} \Rightarrow 0.9394$$

$Z = 0.9394$

4. ~~applying~~ P - value approach
@ $Z = 0.9394$; $P(0.94) = 0.8264$
since ~~...~~ $(Z > 0.94)$
$1 - 0.8264 \Rightarrow 0.1736$
as $0.1736 > 0.10$,



5. We do not reject null hypothesis (Ho).
6. We conclude that there is not sufficient evidence to ~~conclude~~ support the claim by researcher that the college offers more no. of sports to boys than girls.

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Q6. 1. $H_0: \mu_1 = \mu_2$ 2. $\alpha = 0.05$.

$H_1: \mu_1 \neq \mu_2$.

3. $n_1 = 50$, $n_2 = 72$; $S_1 = 7.35$, $S_2 = 4.81$; $\bar{x}_1 = 181$, $\bar{x}_2 = 176$.

4. z test $\Rightarrow \dfrac{(181-176) - 0}{\sqrt{7.35^2/50 + 4.81^2/72}} \Rightarrow 4.22$.

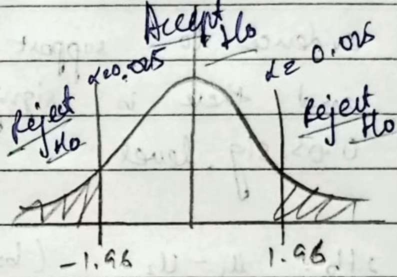
$Z = 4.22$.

4. applying critical value approach.

$\alpha/2 \Rightarrow 0.025$.

$Z_{\alpha/2} \Rightarrow -1.96, +1.96$.

since $4.22 > 1.96$;



5. We reject Ho.

6. We conclude that there is enough evidence to support the claim that the mean avg of two population is not equal.

Q7. 1. $H_0: \mu = 16.3$ (avg. no. of infection per week = 16.3)

$H_1: \mu \neq 16.3$. (avg. no. of " " " ≠ 16.3).

2. $\alpha = 0.05$.

3. $n = 10$; $\bar{x} = 17.7$; $s = 1.8$.

t test; $t = \dfrac{\bar{x} - \mu}{s/\sqrt{n}} \Rightarrow \dfrac{17.7 - 16.3}{1.8/\sqrt{10}} \Rightarrow 2.46$

$t = 2.46$.

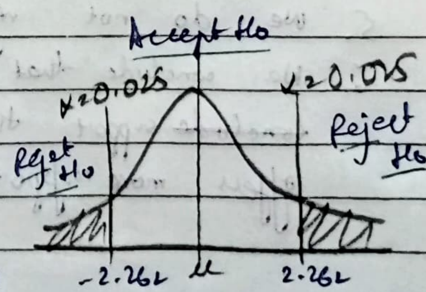
4. applying critical value approach.

$\alpha/2 = 0.025$.

$df \Rightarrow 10 - 1 \Rightarrow 9$.

critical value $\Rightarrow -2.262, 2.262$.

Since; $t = 2.46$; $2.46 > 2.262$;



5. hence; we reject null hypothesis (Ho)

6. We conclude that the data provided sufficient evidence to support the claim that the avg no of infections per week is not equal to 16.3 at 0.05 sig. level.

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Q8. 1. $H_0: \mu = 60$ (avg. salary is 60 dollars per day).

$H_1: \mu < 60$ (avg. salary is less than 60 dollars per day).

2. $\alpha = 0.10$

3. $n = 8$; $\bar{x} = 58.875$; $S = \cancel{5.072}$ 5.083

t test; $\dfrac{58.875 - 60}{5.083/\sqrt{8}}$

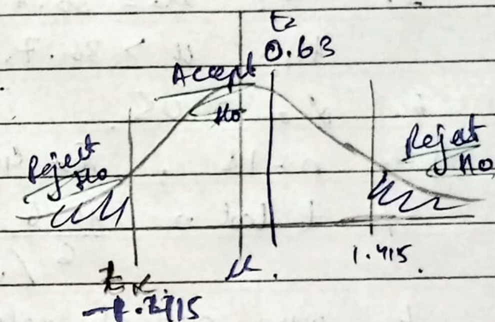
$\Rightarrow \dfrac{-1.125}{1.7971} \Rightarrow -0.63.$

~~4. using critical value approach.~~

~~$Z_\alpha \Rightarrow Z_{0.10} \Rightarrow -2.33$.~~

~~since $-0.63 < -2.33$;~~

~~5. We reject (Ho) null hypothesis~~



$t = -0.63 \Rightarrow t = 0.63.$

4. using critical value approach;

$\alpha = 0.10$;

$df \Rightarrow 8-1 \Rightarrow 7.$

$t \Rightarrow 1.415$ or -1.415.

since ~~$-0.63 > -1.415$~~; $0.63 < 1.415$

5. We do not reject (Ho) null hypothesis.

6. We can conclude that there is sufficient evidence to support the claim that the avg. salary of substitute teacher is 60 dollars per day.

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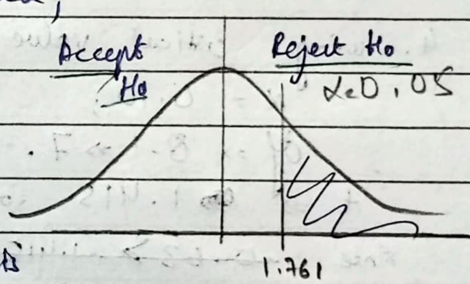
Q9. ~~1. Ho : $\mu_1 = \mu_2$ (jogger and avg adult oxygen volume intake =)~~
~~H_1 : $\mu_1 > \mu_2$. (" " " " " " " >).~~
~~2. $\alpha = 0.05$.~~
~~3. $n_1 = 15$~~
~~$\bar{x}_1 = 40.6$~~
~~$s_1 = 6$~~

1. H_0 : $\mu = 36.7$ (jogger have same oxygen uptake)
   H_1 : $\mu > 36.7$. (jogger has more oxygen uptake).
2. $\alpha = 0.05$.
3. $n = 15$; $\bar{x} = 40.6$; $s = 6$

   t test $\Rightarrow \dfrac{40.6 - 36.7}{6/\sqrt{15}} \Rightarrow 2.5174 \approx 2.52$.

4. using critical value approach;
   $\alpha = 0.05$.
   df $\Rightarrow 15 - 1 \Rightarrow 14$.
   t value $\Rightarrow 1.761$



   since. $2.52 > 1.761$,
5. We reject (Ho) null hypothesis
6. We conclude that the data ~~pof~~ provides sufficient evidence to ~~conclude that~~ support the physician's claim that the jogger's maximal volume of oxygen uptake is greater than the average of all adults at 0.05 sig. level.