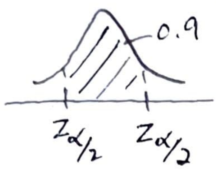
Sohaib. 21K-3278-D Prob-A03

Q1. $\mu = 2.1$

$\bar{x} = 1.8 \quad \sigma = \frac{20}{60} = \frac{1}{3} \quad \alpha = 0.1$



$$P\left(-Z_{\alpha/2} < \frac{\bar{x} - \mu}{\sigma/\sqrt{n}} < Z_{\alpha/2}\right) = 0.9$$

$Z_{\alpha/2} = Z_{0.05} = 1.645$

$$P\left(\bar{x} - Z_{\alpha/2}\frac{\sigma}{\sqrt{n}} < \mu < \bar{x} + Z_{\alpha/2}\frac{\sigma}{\sqrt{n}}\right) = 0.9$$

$$1.8 \pm Z_{\alpha/2}\frac{\sigma}{\sqrt{n}}$$

$$1.8 \pm 1.645 \cdot \frac{1}{3\sqrt{50}}$$

$$1.8 \pm 0.077546$$

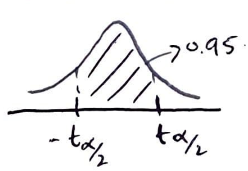
$\Rightarrow 1.7224 < \mu < 1.8775$ ↗ is the 90% CI
true value distraction

Since the population mean was 2.1 hours therefore, the results of the study dont follow the confidence interval.

Q2. $n = 10 \quad \bar{x} = \frac{\Sigma x}{n} = 217.7$

$$s = \sqrt{\frac{\Sigma(x^2) - \frac{[\Sigma(x)]^2}{10}}{9}} = \sqrt{\frac{476605 - \frac{(2177)^2}{10}}{9}} \Rightarrow 17.489$$

Use t distribution



$$P(-t_{\alpha/2} < T < t_{\alpha/2}) = 0.95$$

$$P\left(\bar{x} - \frac{s}{\sqrt{n}}t_{\alpha/2} < \mu < \bar{x} + \frac{s}{\sqrt{n}}t_{\alpha/2}\right) = 0.95$$

$t_{0.025,9} = +2.262$

$$217.7 \pm (2.262) \cdot \frac{17.489}{\sqrt{10}}$$

$$\Rightarrow 205.189 < \mu < 230.210$$

↳ is the 95% CI

21k-3278-D- Prob- A03

Q3.

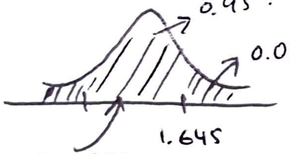
$n = 30$, $\alpha = 0.05$, $\sigma = 5230$ $\bar{x} = 43,260$.

$H_0 : \mu = 42000$

$H_1 : \mu > 42000$

Test value.

$$Z = \frac{\bar{x} - \mu}{\sigma / \sqrt{n}} = \frac{43260 - 42000}{5230/\sqrt{30}} = 1.31956.$$



right tail test.

$\boxed{\text{Do not reject } H_0}$

1.31956 lies in the acceptance region.

Accept Ho since there is insufficient data to support that mean salary is greater than 42000.

21K-3278-D.

Q4.

$\boxed{n = 51}$ Typo: in the question $n=50$ but 51 values are given below

$\bar{x} = 28.9411$

~~$\sigma = 28.11$~~ $\sigma = 28.7$.

$\alpha = 0.05$.

$H_0 \quad : \quad \mu \leq 24$

$H_a \quad : \quad \mu > 24$.

$$Z = \frac{\bar{x} - \mu_0}{\sigma / \sqrt{n}} = \frac{28.9411 - 24}{28.7 / \sqrt{51}} \Rightarrow 1.23$$

P_value approach.

1.23

$$\begin{aligned} p \text{ value} &= P(z \geq 1.23). \\ &= 1 - P(z \leq 1.23) \\ &= 1 - 0.8907 = \underline{0.1093} \end{aligned}$$

rule

if p value < α → reject

since $0.1093 > 0.05$

therefore $\boxed{\text{Do not reject } H_0}$

⇒ Cant conclude $\mu > 24$.

21K-3278-D

Q5.

Ho : $\mu = 5.8$

Ha : $\mu \neq 5.8$

(two tail test)

$\bar{x} = 3.85$

$n = 20$

$\alpha = 0.05$

$\sigma = 2.519$

Since $n < 30$, we use t-distribution.

test value.

$$t = \frac{\bar{x} - \mu}{s/\sqrt{n}} = \frac{3.85 - 5.8}{2.519/\sqrt{20}} = -3.4619 \qquad v = 19$$

$$t_{\alpha/2,\, v} = t_{0.025,\, 19} = -2.093$$

Since $-3.4619 < -2.093$ lies in the rejection region.

therefore $\boxed{\text{Reject Ho}}$

there is sufficient data to claim that average is not 5.8.

QG

Sample 1 : $n = 12$ $\quad \mu = 85$ $\quad \sigma = 4$

sample 2 : $n = 10$ $\quad \mu = 81$ $\quad \sigma = 5$.

$\alpha = 0.05$.

Since $n = 10$ and $12 < 30$ so we use t-distribution

$v = 12 + 10 - 2 = 20$.

Ho : $\mu_1 - \mu_2 = 2$

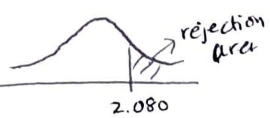
Ha : $\mu_1 - \mu_2 > 2$

$$t = \frac{(x_1 - x_2) - d_0}{sp\sqrt{1/n_1 + 1/n_2}} \qquad sp = \sqrt{\frac{s_1^2(n_1 - 1) + s_2^2(n_2 - 1)}{n_1 + n_2 - 2}}$$

$$\text{find } sp = \sqrt{\frac{(4)^2(11) + 5^2(9)}{10 + 12 - 2}} \Rightarrow 4.478$$

test value.

$$t = \frac{(85 - 81) - 2}{4.478\sqrt{1/12 + 1/10}} \Rightarrow 1.04$$



$$t_{\alpha/2,\, 21} = 2.080$$

Since $1.04 < 2.080$ failed to reject Ho

there is sufficient evidence

$\boxed{\text{accept Ho}}$

Q7.

(a) $r = \dfrac{S_{xy}}{\sqrt{S_{xx}\, S_{yy}}}$

$S_{xy} = \Sigma (x-\bar{x})(y-\bar{y}) = 46$

$S_{xx} = \Sigma (x-\bar{x})^2 = 34$

$S_{yy} = \Sigma (y-\bar{y})^2 = 86$

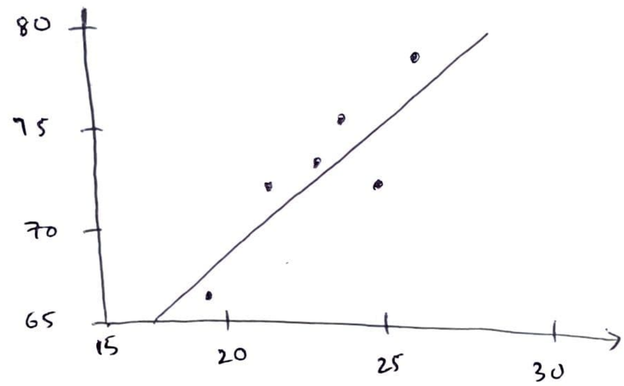
$\bar{x} = 23$
$\bar{y} = 73$ from calculator

$r = \dfrac{46}{\sqrt{34 \times 86}}$

$r = 0.85$

indicates a strong +ve corelation b/w both.

(b) $\hat{b_0} + \hat{b_1} x$



$b_1 = \dfrac{S_{xy}}{S_{xx}}$

$b_1 = \dfrac{46}{34}$

$\boxed{b_1 = 1.35}$

$b_0 = \bar{y} - b_1 \bar{x}$

$b_0 = 73 - (1.35)(23)$

$\boxed{b_0 = 41.88}$

$\hat{y} = \hat{b_0} + \hat{b_1} x$

$\boxed{\hat{y} = 41.88 + 1.35x}$

(c) $y = b_0 + b_1 x = 41.88 + 1.35(30) \Rightarrow 82.47$

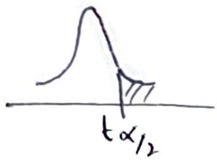
(d)

$H_0 : \rho = 0$

$H_a = \rho \neq 0$

$\alpha = 0.05.$

$t = 3.22$, $df = 6-2 = 4$



$$t = r\sqrt{\frac{n-2}{1-r^2}}$$

$t = 3.2365.$

$t_\alpha = t_{0.05} = \pm 2.776.$

Hence we reject null hypothesis

Q8-

(a) $b_1 = \dfrac{S_{xy}}{S_{xx}}$

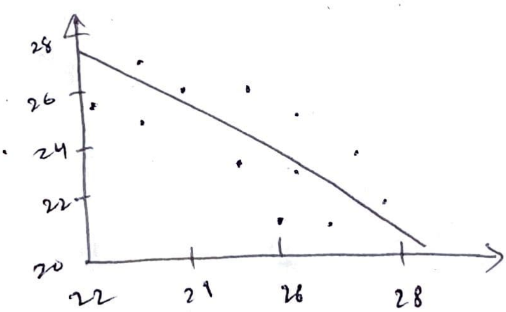
$b_1 = -0.69.$

$b_0 = \bar{y} - b_1 \bar{x}$

$b_0 = 24.77 - (-0.69)(25.97)$

$b_0 = 42.58.$

$\boxed{\hat{y} = 42.58 - 0.69x}$



(b) $42.58 + (-0.69)(24.5)$

$\boxed{= 25.77}$