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Exam - group 3

1 $n = 17$, $\bar{x} = \frac{(\Sigma x_i)}{n} = \frac{361.5}{17} = 21.26$, $\alpha = 0.05$

$$S = \sqrt{\frac{\Sigma(x_i^2) - \frac{(\Sigma x_i)^2}{n}}{n-1}} = \sqrt{\frac{7906.91 - \frac{(361.5)^2}{17}}{16}}$$

$$= \sqrt{\frac{7906.91 - 7687.19}{16}} = 3.706$$

ⓐ A 95% Confidence Interval on μ

$$\boxed{\bar{x} \pm Z_{\alpha/2}\, \sigma/\sqrt{n}}$$

$$\bar{x} \pm 1.96 \frac{\sigma}{\sqrt{n}}$$

$$21.26 \pm 1.96 \left(\frac{3.706}{\sqrt{17}}\right)$$

$$21.26 \pm 1.7617$$

$(19.49, 23.02)$ or $19.49 < \mu < 23.02$

ⓑ $\frac{(n-1)s^2}{\chi^2_{\alpha/2, n-1}} < \sigma^2 < \frac{(n-1)s^2}{\chi_{(1-\alpha/2), n-1}}$

$(n-1)s^2 = \Sigma x_i^2 - \frac{(\Sigma x_i)^2}{n}$

$\alpha = 0.01$

$\alpha/2 = 0.005$

$n-1 = 16$

$= 7906.91 - 7687.19$

$= 219.72$

$$\frac{219.72}{\chi_{\alpha/2, n-1}} < \sigma^2 < \frac{219.72}{\chi_{(1-\alpha/2), n-1}}$$

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contd
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$$\frac{219.72}{\chi_{0.005,16}} < \sigma^2 < \frac{219.72}{\chi_{(1-0.005),16}}$$

$$\frac{219.72}{34.267} < \sigma^2 < \frac{219.72}{5.142}$$

$$6.412 < \sigma^2 < 42.730$$

$$2.532 < \sigma < 6.537$$

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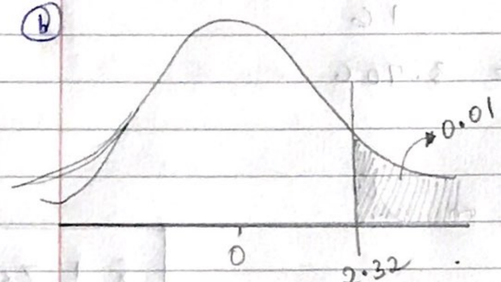
2ⓐ $H_0 : P = 0.45$

$H_a : P > 0.45$

ⓑ



Rejection region
$Z_\alpha \geq 2.32$

$$Z = \frac{\hat{p} - p}{\sqrt{\hat{p}\hat{q}/n}}$$

Where $\hat{p} = x/n = 717/1050 = 0.68$

$p = 0.45$, $\hat{q} = 1 - 0.68 = 0.32$, $n = 1050$

$$Z = \frac{0.68 - 0.45}{\sqrt{\frac{0.68 \times 0.32}{1050}}} = \frac{0.23}{0.0144} = 15.97$$

Since the calculated Zvalue of 15.98 is greater than the Ztable value of 2.32, we reject Ho and conclude that there is a justification of the claim of unfair advantage.

ⓒ $p = p(Z_c \geq Z_\alpha) = 1 - \phi(15.97) = 1 - 1 = 0$

0 is less than $\alpha = 0.01$, so we reject Ho.

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3 $H_0 : \mu_a = \mu_B$

$\alpha = 0.01$

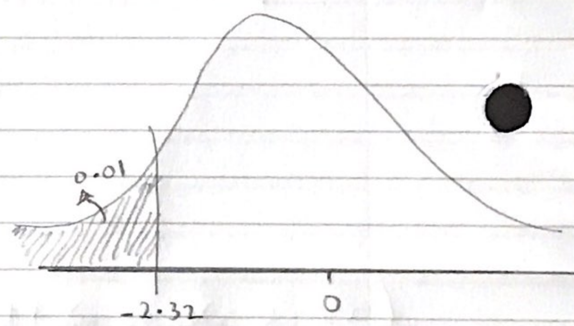
$H_a : \mu_a < \mu_B$

$\bar{X}_a - \bar{X}_b = 26.99 - 35.76 = -8.77$

$S.E(x_a - x_b) = \sqrt{\left(\frac{S_a^2}{n_a} + \frac{S_b^2}{n_b}\right)} = \sqrt{\frac{4.69^2}{68} + \frac{6.43^2}{74}} = 0.954$

$$Z = \frac{(x_a - x_b) - (\mu_a - \mu_b)}{S.E}$$

$$= \frac{-8.77 - 0}{0.954} = -9.19$$



Since the calculated Z value of -9.19 is less than the Z at $\alpha = 0.01$ of -2.33, we reject H_0 and conclude that 28 days old concrete have a generally higher compressive strength than those that are 7 days old.

(B) p-value : $p = P(Z_c \leq Z_\alpha) = P(-9.19) = 0.0$ which is less than $\alpha = 0.01$, so we reject H_0.