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Q1) Breaking $\sim N(\mu, \sigma^2)$ $\sigma = 2$, $n = 9$, $\bar{x} = 98$,

$100(1-\alpha)\%$ 95%

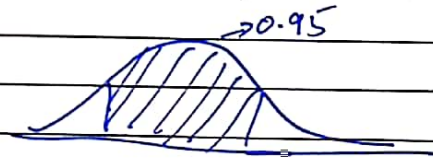$\Rightarrow 1 - \alpha = 0.95 \Rightarrow \alpha = 0.05$ $\alpha/2 = 0.025$
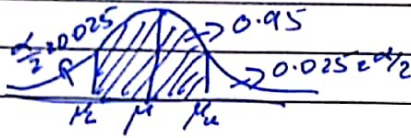
$z_{\alpha/2} = 1.96$

$\bar{x} - z_{\frac{\alpha}{2}} \frac{\sigma}{\sqrt{n}} \le \mu \le \bar{x} + z_{\frac{\alpha}{2}} \frac{\sigma}{\sqrt{n}}$

$98 - 1.96 \left(\frac{2}{\sqrt{9}}\right) \le \mu \le 98 + 1.96 \left(\frac{2}{\sqrt{9}}\right)$

$96.69 \le \mu \le 99.31$

Q2) Life $\sim N(\mu, \sigma^2)$ $\sigma = 25$, $n = 20$, $\bar{x} = 1014$

(a) 95% Confidence Interval

$z_{\alpha/2} = 1.96$

$1014 - z_{\frac{\alpha}{2}}\left(\frac{25}{\sqrt{20}}\right) \le \mu \le 1014 + z_{\frac{\alpha}{2}}\left(\frac{25}{\sqrt{20}}\right)$

$1003.043 \le \mu \le 1024.957$

(b) $z_\alpha = 1.6449 \Rightarrow \mu \ge 1014 - z_\alpha\left(\frac{25}{\sqrt{20}}\right)$

$\mu \ge 1004.805$

(c) $\alpha = 0.05$ $\alpha/2 = 0.025$

$|CI| = \bar{x} + z_{\alpha/2}\left(\frac{\sigma}{\sqrt{n}}\right) - \bar{x} + z_{\alpha/2}\left(\frac{\sigma}{\sqrt{n}}\right) = 2 z_{\alpha/2} \sigma/\sqrt{n}$

$\Rightarrow 2 z_{\alpha/2}\left(\frac{\sigma}{\sqrt{n}}\right) = 6$

$1.96\left(\frac{25}{\sqrt{n}}\right) = 3 \Rightarrow \sqrt{n} = 16.33$

$\sqrt{n} = 16.33 \Rightarrow n = 266.78$

Q3) $n = 12$ $\bar{x} = 2259.92$

(a) $S = \frac{1}{n-1}\sum(x_i - \bar{x})^2 = \frac{1}{12-1}\sum[x_i - 2259.92]^2$

$\Rightarrow S = 1256.17$

$t_{\alpha/2, 12-1} = 2.2010$

$2259.92 - t\left(\sqrt{S/n}\right) \le \mu \le 2259.92 + t\left(\sqrt{S/n}\right)$

$2237.40 \le \mu \le 2282.44$

(b) $t_{\alpha, 12-1} = 1.7595$, $S = 1256.17$

$\mu \ge 2259.92 - t\left(\sqrt{S/n}\right)$

$\mu \ge 2241.9$