

1. A factory has a machine that dispenses 80 mL of fluid in a bottle. An employee believes the average amount of fluid is not 80 mL. Using 40 samples, he measures the average amount dispensed by the machine to be 78 mL with a standard deviation of 2.5. (a) State the null and alternative hypotheses. (b) At a 95% confidence level, is there enough evidence to support the idea that the machine is not working properly?

$$H_0: \mu = 80$$

$$H_A: \mu \neq 80$$

X : {controlled
mL quantities
c/ bottle}

$$\bar{X} = \frac{1}{40} \sum_{i=1}^{40} X_i \sim \mu$$

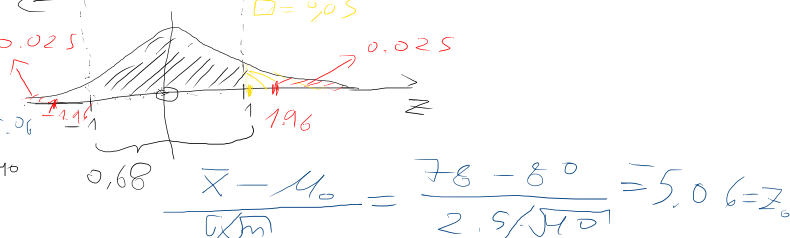
$$\bar{X} \xrightarrow[n \rightarrow \infty]{\mu} \frac{\bar{X} - \mu}{\sigma/\sqrt{n}} \sim Z = N(0, 1)$$

$$(LLN) \quad \bar{X} \sim N(\mu, \sigma/\sqrt{n}) \text{ (CLT)}$$

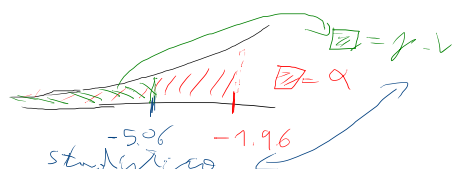
$$\bar{X} = 78 \sim \mu; n = 40$$

$$\sigma = 2.5; \alpha = 0.05$$

$$\alpha = 0.05 \quad \alpha = 0.05$$



$$\frac{\bar{X} - \mu_0}{\sigma/\sqrt{n}} = \frac{78 - 80}{2.5/\sqrt{40}} = 5.06 = Z_0$$



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$$\bar{X} = 78$$

$$n = 40$$

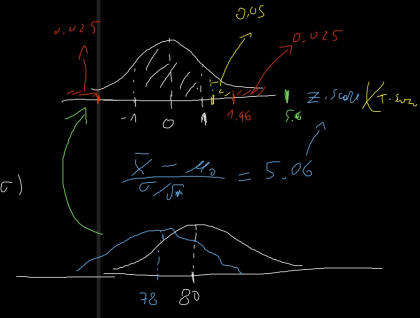
$$\frac{\sum X_i}{n} = \bar{X}$$

$$H_A: \mu \neq 80$$

$$X = \begin{cases} \text{controlled} \\ \text{mL} \\ \text{quantities} \\ \text{c/ bottle} \end{cases} \Rightarrow \begin{matrix} X_1 \\ X_2 \\ \vdots \\ X_{40} \end{matrix}$$

$$\bar{X} \rightarrow \bar{X} \sim N(\mu, \sigma)$$

$$\frac{\bar{X} - \mu}{\sigma/\sqrt{n}} \sim Z = N(0, 1)$$



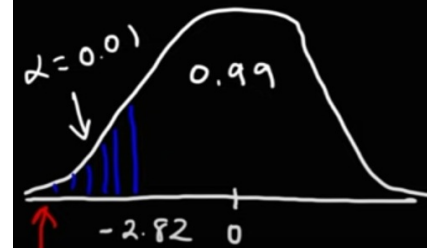
2. A company manufactures car batteries with an average life span of 2 or more years. An engineer believes this value to be less. Using 10 samples, he measures the average life span to be 1.8 years with a standard deviation of 0.15. (a) State the null and alternative hypotheses. (b) At a 99% confidence level, is there enough evidence to discard the null hypothesis?

2. A company manufactures car batteries with an average life span of 2 or more years. An engineer believes this value to be less. Using 10 samples, he measures the average life span to be 1.8 years with a standard deviation of 0.15. (a) State the null and alternative hypotheses. (b) At a 99% confidence level, is there enough evidence to discard the null hypothesis?

$$H_0: \mu \geq 2$$

$$H_a: \mu < 2$$

$$n = 10 \quad \bar{x} = 1.8 \quad s = 0.15 \quad \mu_0 = 2$$



$$t_c = \frac{\bar{x} - \mu_0}{s/\sqrt{n}}$$
$$= \frac{1.8 - 2}{0.15/\sqrt{10}} = \frac{-0.2}{0.047434}$$

$$t_c \approx -4.22$$

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$$H_0: \mu = 80$$

$$H_A: \mu \neq 80$$

$$X: \left\{ \begin{array}{l} \text{cont. data} \\ \text{ml per} \\ \text{1 bot.} \end{array} \right\} \rightarrow \begin{array}{l} X_1 \\ X_2 \\ X_3 \\ \vdots \\ X_{40} \end{array}$$

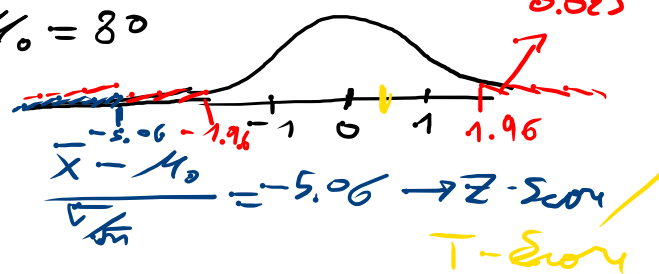
$$\bar{X} \xrightarrow{\text{LLN}} \mu \quad \bar{X} \sim N(\mu, \sigma)$$

$$\frac{\bar{X} - \mu}{\sigma/\sqrt{n}} \sim Z = N(0, 1)$$

$$\bar{X} = 78 \quad n = 40$$

$$\sigma = 2.5 \quad \alpha = 0.05$$

$$\mu_0 = 80$$



$$\bar{X} = \frac{\sum X_i}{n}$$

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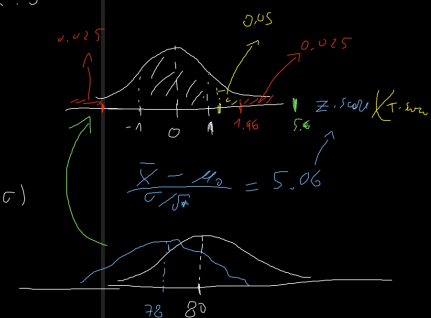
$$n = 40 \quad \alpha = 0.05 \quad \frac{\sum X_i}{n} = \bar{X}$$

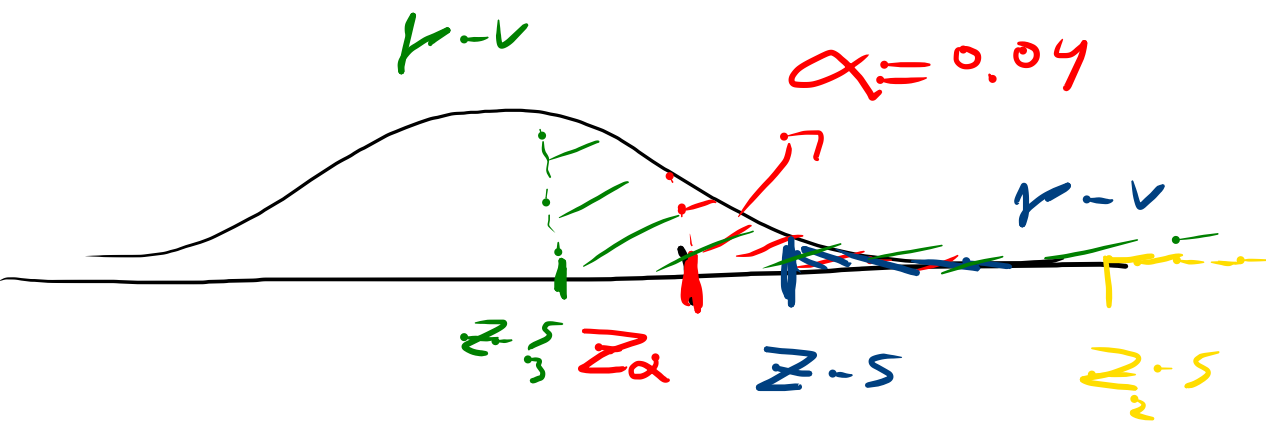
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$$p-v < \alpha$$

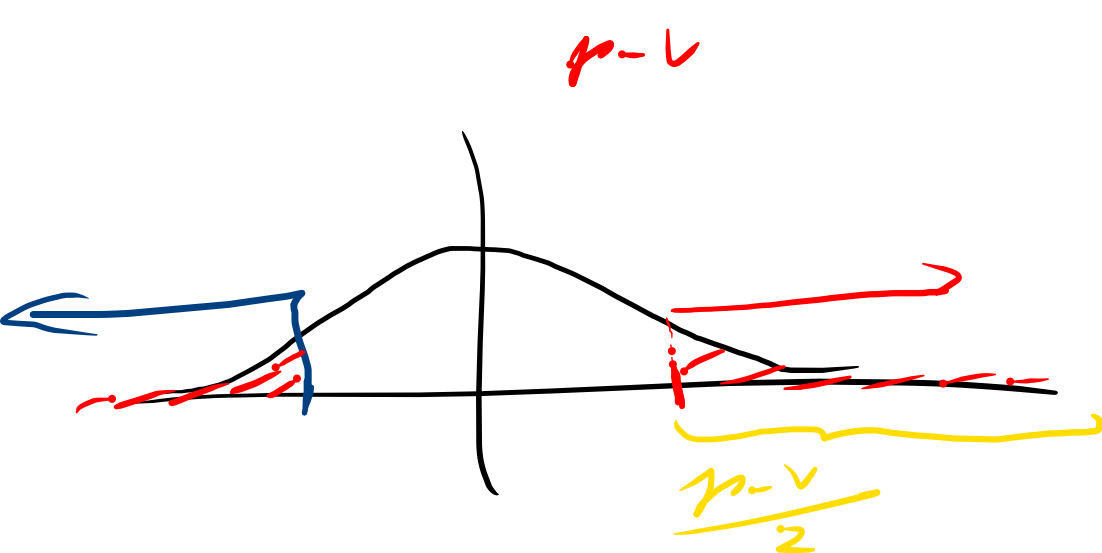
$$|z_\alpha| < |z_{.5}|$$

$$p-v \rightarrow \frac{0.05}{0.5}$$

$$p-v \rightarrow 0.00000001$$

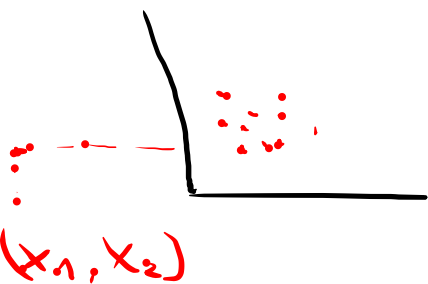
$$p-v \rightarrow 0.001$$

$$p-v \rightarrow 0.04$$



$$\frac{\bar{X} - \mu_0}{\sigma/\sqrt{n}} \rightarrow Z \sim 0$$

$$\bar{X} > \mu_0 \Rightarrow \bar{X} - \mu_0 > 0$$



$$X = \begin{pmatrix} x_1 \\ x_2 \\ \vdots \\ x_n \end{pmatrix}$$

