4/30/2020

Week 7

Israel Nolazco

1) $\sigma \Rightarrow 40$ hrs $\quad\quad \mu = 780$ hrs
sample 30 bulbs

Find $\Rightarrow$ 96% confidence interval for the population mean of all light bulbs produced by this firm

$$96\% \Rightarrow P(-z_{\frac{\alpha}{2}} < z < z_{\frac{\alpha}{2}}) = 1-\alpha$$

$$96\% = 100(1-\alpha)\%$$

$$.96 = 1-\alpha$$

$$\boxed{\alpha = 0.04} \Rightarrow -z_{\frac{0.04}{2}} < z < z_{\frac{0.04}{2}}$$

$$\Rightarrow -z_{0.02} < z < z_{0.02}$$

Note since we are looking for 96% confidence interval then we are looking for the right hand side of the curve.

Thus $z_{0.02} = 2.05$ * from z table website

statisticshowto.com

$$780 - 2.05\left(\frac{40}{\sqrt{30}}\right) < \mu < 780 + 2.05\left(\frac{40}{\sqrt{30}}\right)$$

1) continue

$$780 - 2.05\left(\frac{40}{\sqrt{30}}\right) < \mu < 780 + 2.05\left(\frac{40}{\sqrt{30}}\right)$$

$$\Rightarrow \quad 765.02 < \mu < 794.97$$

which if we round them $\Rightarrow$ $\boxed{765 < \mu < 795}$ for an interval confidence of 96%

2) How big of asample if we wish.

96% confidence interval with 10 hrs of true mean

$$770 < \mu < 790$$

$$770 = 780 - 2.05\left(\frac{40}{\sqrt{n}}\right)$$

$$2.05\left(\frac{40}{\sqrt{n}}\right) = 780 - 770$$

$$2.05 = (780-770)\left(\frac{\sqrt{n}}{40}\right)$$

$$\left(40\left(\frac{2.05}{(780-770)}\right)\right)^2 = (\sqrt{n})^2$$

$$67.24 = n$$

The sample size would need to be about 67 light bulbs

3) 3.4, 2.5, 4.8, 2.9
3.6, 2.8, 3.3, 5.6
3.7, 2.8, 4.4, 4.0
5.2, 3.0, 4.8

$n = 15$ samples

* Note: lets go back to ch. 8.

$$\bar{X} = \frac{1}{n} \sum_{i=1}^{n} X_i$$

$$\bar{X} = \frac{3.4 + 2.5 + 4.8 + \ldots + 3.0 + 4.8}{15} = \frac{56.8}{15}$$

$\bar{X} = 3.8$

standard deviation

$$s^2 = \frac{1}{n-1} \sum_{i=1}^{n} (x_i - \bar{X})^2$$

$$s^2 = \frac{1}{14}\left[(3.4-3.8)^2 + (2.5-3.8)^2 + (4.8-3.8)^2 + \ldots + (3.0-3.8)^2 + (4.8-3.8)^2\right]$$

$$s^2 = \frac{1}{14}\left[13.2\right]$$

$$s = \sqrt{\frac{13.2}{14}} = 0.97$$

Now that we have $\bar{X}$, n & S we need to find our 95% prediction interval for the drying for the next trial of paint

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

$$.95 = (1-\alpha) \Rightarrow \alpha = 0.05$$

$$z_{\frac{\alpha}{2}} \Rightarrow z_{0.025}$$

$$-z_{0.025} < \mu < z_{0.025} \Rightarrow \text{covers the } 95\%$$

Note: Since we are looking at random sampling & doing a prediction. This looks more of a t-distribution

Therefore $V = 14$ degrees of freedom

$\boxed{z_{0.025} = 2.145}$ from table A.4

$$3.8 - 2.145(0.97)\left(\sqrt{1+\tfrac{1}{15}}\right) < \mu < 3.8 + 2.145(0.97)\left(\sqrt{1+\tfrac{1}{15}}\right)$$

$$3.8 - 2.148 < \mu < 3.8 + 2.148$$

$$\boxed{1.65 < \mu < 5.95}$$

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4)

Using method 1 $\quad n = 100 \quad$ 98% confidence

$X = 8$

$\hat{q} = 1 - \hat{p}$

$\hat{p} = \frac{X}{n} = 0.08$

$$\hat{p} - z_{\frac{\alpha}{2}} \sqrt{\frac{\hat{p}\hat{q}}{n}} < p < \hat{p} + z_{\frac{\alpha}{2}} \sqrt{\frac{\hat{p}\hat{q}}{n}}$$

$98\% = 100(1-\alpha)\%$

$.98 = 1 - \alpha \Rightarrow 0.02 = \alpha \qquad \frac{\alpha}{2} = 0.01$

$z_{0.01} = 2.325$

$$0.08 - 2.325\sqrt{\frac{(0.08)(.92)}{100}} < p$$

$$0.08 + 2.325\sqrt{\frac{(0.08)(0.92)}{100}} > p$$

$$0.08 - 0.063 < p < 0.08 + 0.063$$

$$\boxed{0.017 < p < 0.143}$$