

## Exercises: for Chapters 6&7:

4. An electrical firm manufacturing light bulbs that have a length of life that is normally distributed with a standard deviation of 30 hours. A sample of 50 bulbs were selected randomly and found to have an average of 750 hours. Let  $\mu$  be the population mean of life lengths of all bulbs manufactured by this firm.

(1) Find a point estimate for  $\mu$ .

$$\hat{\mu} = \bar{X} = 750$$

(2) Construct a 94% confidence interval for  $\mu$ .

Assumptions: Normal population +  $\sigma$  known  $\Rightarrow$  use  $\bar{X} \pm Z_{\frac{\alpha}{2}} \frac{\sigma}{\sqrt{n}}$

i.  $(1 - \alpha) = 0.94 \Rightarrow \alpha = 0.06 \Rightarrow \frac{\alpha}{2} = 0.03$

ii.  $Z_{\frac{\alpha}{2}} = Z_{0.03} = 1.88$

iii. The 94% CI is

$$750 \pm (1.88) \frac{30}{\sqrt{50}}$$

$$\Rightarrow 750 \pm 7.9762$$

$$\Rightarrow (742.02, 757.98)$$

$$\text{Or } 742.02 < \mu < 757.98$$

5. The following measurements were recorded for lifetime, in years, of certain type of machine: 3.4, 4.8, 3.6, 3.3, 5.6, 3.7, 4.4, 5.2, and 4.8. Assuming that the measurements represent a random sample from a normal population, then a 99% confidence interval for the mean life time of the machine is

(A)  $-5.37 < \mu < 3.25$

(B)  $4.72 < \mu < 9.1$

(C)  $4.01 < \mu < 5.99$

**(D)**  $3.37 < \mu < 5.25$

Assumptions: Normal population +  $\sigma$  unknown +  $n = 9 < 30 \Rightarrow$  use  $\bar{X} \pm t_{\frac{\alpha}{2}, n-1} \frac{s}{\sqrt{n}}$

iv.  $(1 - \alpha) = 0.99 \Rightarrow \alpha = 0.01 \Rightarrow \frac{\alpha}{2} = 0.005$

v.  $t_{\frac{\alpha}{2}, n-1} = t_{0.005, 8} = 3.355$

vi.  $\bar{X} = 4.311, S = 0.8418$

vii. The 99% CI is

$$4.311 \pm (3.355) \frac{0.8418}{\sqrt{9}}$$

$$\Rightarrow 4.311 \pm 0.9414$$

$$\Rightarrow (3.37, 5.25)$$