**ChE 320\_Spr\_17\_HW 5 Solution**

**4-2** (page 155)



Mean = Sum/N = 399.851/16 = 24.99

Variable N Mean SE Mean StDev Sum

X 16 24.99 0.159 0.636 399.851

**4-5**

E

E, and  are unbiased estimators of μ.

The variances are V and V; compare the MSE (variance in this case),



Because both estimators are unbiased, examination of the variances would conclude that  is the “better” estimator with the smaller variance.

**4-14**

Show that is a biased estimator of μ.

Using 



Therefore, is a biased estimator of μ.

b) Bias = 

c) Bias decreases as *n* increases.

**4-16**

a) == P(Z ≤ −4) = 0.

The P-value is approximately 0 when a sample size of 16.

b) For α = 0.05, fail to reject H0 if 



The probability of failing to reject the null hypothesis if the true mean elongation force is 13.5 kg is approximately 0, with a level of significance of α = 0.05.

c) 1 - β = 1 – 0= 1

**4-18**

a) 0.05 = 

What Z value will give a probability of 0.05? Using Table 1 in the appendix, Z value is −1.645.

Thus,  = −1.645,  = 13.8766

b) For α = 0.05, fail to reject H0 if 



The probability of failing to reject the null hypothesis if the true mean elongation force is 13.5 kg is approximately 0, with a level of significance of α = 0.01.

c) 1 - β = 1 – 0 = 1

**4-20**

Use n = 5, everything else held constant:

a) P(≤ 98.5) + P( ≥101.5)

=+

= P(Z ≤ −1.68) + P(Z ≥ 1.68)

= 0.093

b) β = P(98.5 ≤≤ 101.5 when μ = 103)

=

= P(−5.03 ≤ Z ≤ −1.68)

= P(Z ≤ −1.68) − P(Z ≤ −5.03)

= 0.04648 − 0

= 0.04648

c) β = P(98.5 ≤≤ 101.5 when μ = 105)

=

= P(−7.27≤ Z ≤ −3.91)

= P(Z ≤ −3.91) − P(Z ≤ −7.27)

= 0.00005 − 0

= 0.00005