D. Linda wants to know the variability explained by the blocking variable experience at the .05 level of significance.

E. The 5-step approach to hypothesis testing

1. A check of each null hypothesis will be made.
   a. $H_0: \mu_1 = \mu_2 = \mu_3$ and $H_1: \mu_1 \neq \mu_2 \neq \mu_3$ for the treatment means.

   b. $H_0: \mu_1 = \mu_2 = \mu_3 = \mu_4$ and $H_1: \mu_1 \neq \mu_2 \neq \mu_3 \neq \mu_4$ for the block means.
2. The level of significance is .05.
3. The test statistic is F.
4. If F from the test statistic is beyond the critical value of F for the .05 level of significance, the null hypothesis will be rejected.
5. Apply the decision rule.

$$SS_{TOTAL} = \Sigma x^2 - \frac{(\Sigma x)^2}{N} = 616 - 588 = 28$$

$$SS_E = SS_{TOTAL} - (SS_T + SS_B) = 28.0 - (14.0 + 11.3) = 2.7$$

$$SS_T = \Sigma\left[\frac{(\Sigma x_T)^2}{b}\right] - \frac{(\Sigma x)^2}{N} = 602 - \frac{84^2}{12} = 602 - 588 = 14$$

$$SS_B = \Sigma\left[\frac{(\Sigma x_B)^2}{t}\right] - \frac{(\Sigma x)^2}{N} = 599.3 - \frac{84^2}{12} = 599.3 - 588 = 11.3$$

Unexplained variability is down from 14.0 to 2.7.

$$MS_T = \frac{SS_T}{t-1} = \frac{14}{3-1} = 7.0$$

$$MS_B = \frac{SS_B}{(b-1)} = \frac{11.3}{4-1} = 3.77$$

$$MS_E = \frac{SS_E}{(t-1)(b-1)} = \frac{2.7}{(3-1)(4-1)} = .45$$

Treatment hypothesis degrees of freedom
t - 1 = 3 -1 = 2 for numerator
(t -1)(b -1) = (3 - 1)(4 - 1) = 6 for denominator
F = 5.14

Reject H_0 because $F = \frac{MS_T}{MS_E} = \frac{7.0}{.45} = 15.56 > 5.14.$

Average salesperson sales are not equal.

Block hypothesis degrees of freedom
b - 1 = 4 -1 = 3 for numerator
(t -1)(b -1) = (3 - 1)(4 - 1) = 6 for denominator
F = 4.76

Reject H_0 because $F = \frac{MS_B}{MS_E} = \frac{3.77}{.45} = 8.38 > 4.76.$

Average weekly sales are not equal.

III. Comparing three or more treatment sample means for one-factor analysis

A. Having proven that there is a difference in the average sales of the three treatments (salespeople) in chapter 18, determining whether treatment means differ from each of the other may be of interest.

B. A range (confidence interval) will be found for the difference between 2 treatment means. A positive range for the difference of these means will indicate the difference could not be zero and the means are different.

C. The t value for $\alpha/2$ will be used.

$$(\bar{x}_3 - \bar{x}_1) \pm t\sqrt{MS_E\left(\frac{1}{n_1} + \frac{1}{n_2}\right)}$$

D. We will determine whether average sales for the first and third salesperson are different at the .05 level of significance.

Salespersons #1 and #3 Average Sales
(Data from page 109)

The number of observations within each treatment is n_1 and n_2.

$$\bar{X}_1 = \frac{\Sigma x}{n_1} = \frac{24}{4} = 6.0$$

$$\bar{X}_3 = \frac{\Sigma x}{n_3} = \frac{34}{4} = 8.5$$

t for $\alpha/2$ and N - t degrees of freedom is 12 - 3 = 9 $\rightarrow t = 2.262$

MS_E from page 109 is 1.56.

$$(\bar{x}_3 - \bar{x}_1) \pm t\sqrt{MS_E\left(\frac{1}{n_1} + \frac{1}{n_2}\right)}$$

$$(8.5 - 6.0) \pm 2.262\sqrt{1.56\left(\frac{1}{4} + \frac{1}{4}\right)}$$

$$2.5 \pm 2.262\sqrt{.78}$$

$$2.5 \pm 2.0$$

A positive range of $.5 \leftrightarrow 4.5$ indicates the means are different.