ANOVA exercise 1

Case #	rural	suburban	Urban
1	1	3	2
2	3	1	1
3	0	3	0
4	1	3	4
5	0	5	3

1) Null hypothesis

   Place of residence has nothing to do with the # hours studying

2) Computing all the means

$$\overline{X_T} = \frac{\sum X_i}{N}$$
$$= \frac{1+3+0+1+0+3+1+3+3+5+2+1+0+4+3}{15}$$
$$= 2$$

$$\overline{X_{Rural}} = \frac{1+3+0+1+0}{5} = 1$$

$$\overline{X_{Suburban}} = \frac{3+1+3+3+5}{5} = 3$$

$$\overline{X_{Urban}} = \frac{2+1+0+4+3}{5} = 2$$

3) Computing $SS_{Total} = \sum(X_i - \overline{X_T})^2$

$$SS_{Total} = (1-2)^2 + (3-2)^2 + (0-2)^2 + (1-2)^2 + (0-2)^2 + (3-2)^2 + (1-2)^2 + (3-2)^2 + (3-2)^2 + (5-2)^2 + (2-2)^2 + (1-2)^2 + (0-2)^2 + (4-2)^2 + (3-2)^2$$

$$SS_{Total} = 34$$

4) Computing $SS_{Between} = \sum(\overline{X_G} - \overline{X_T})^2 \times N_G$

$$SS_{Between} = (1-2)^2 \times 5 + (3-2)^2 \times 5 + (2-2)^2 \times 5 = 10$$

5) Computing $SS_{Within} = SS_{Total} - SS_{Between} => SS_{Within} = 24$

6) Computing df for between; and df for within

$$df_{between} = K - 1 = 3 - 1 = 2$$

$$df_{within} = N - K = 15 - 3 = 12$$

7) Computing Mean Sum of Square (MSS) for between and MSS for within'

$$MSS_{Between} = \frac{SS_{between}}{df_{between}} = \frac{10}{2} = 5$$

$$MSS_{within} = \frac{SS_{within}}{df_{within}} = \frac{24}{12} = 2$$

8) Computing f ratio

$$F_{df_{between};df_{within}} = \frac{MSS_{between}}{MSS_{within}} = \frac{5}{2} = 2.5$$

9) Determine the p value

P > .05

10) Decision regarding the null hypothesis, type of error committed

Do not reject the null hypothesis, committing type II error.

11) Eta-square (E^2)

$$E^2 = \frac{SS_{Between}}{SS_{Total}}$$

$$E^2 = \frac{10}{34} = 29.4\%$$

12) Interpreting eta-square

E^2 *is PRE* (*proportional Reduction in Error*)

Knowing the independent variable reduces errors in estimating the value of the dependent variable by X%.

Knowing the type of residence reduces errors in estimating number of hours studying by 29.4%.