

Solutions to ANALYSIS OF COVARIANCE PROBLEMS

ANCOVA
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Q.1 a) $\bar{Y}_5^{Adj} = 7.4 + 0.7(24.2) = 24.34$

$$\bar{Y}_1^{Adj} = 24.34 + 4.50 = 28.84$$

b)
$$\frac{\frac{SSE(R) - SSE(F)}{4}}{\frac{SSE(F)}{30-6}} \geq F_{.05, 4, 24} = 2.776$$

$$\Rightarrow \frac{24}{4} \frac{(SSE(R) - 118)}{118} \geq 2.776$$

$$\Rightarrow SSE(R) - 118 \geq 2.776(118)\left(\frac{1}{6}\right) = 54.59$$

$$\Rightarrow SSE(R) \geq 118 + 54.59 = 172.59$$

Q.2. a) $H_0: \delta_1 = \delta_2 = 0$ $H_A: \delta_1$ and/or $\delta_2 \neq 0$

$$T.S. F_{obs} = \frac{\frac{0.534 - 0.438}{26 - 24}}{\frac{1 - 0.534}{24}} = \frac{\frac{-0.096}{2}}{\frac{.466}{24}} = 2.472$$

$RR: F_{obs} \geq F_{.05, 2, 24} = 3.403$ Don't Reject H_0

Q.2. b) $H_0: \beta_1 = \beta_2 = 0$ $H_A: \beta_1$ and/or $\beta_2 \neq 0$

$$T.S. F_{obs} = \frac{\frac{.438 - .204}{28 - 26}}{\frac{1 - .438}{26}} = \frac{\frac{.234}{2}}{\frac{.562}{26}} = \frac{.234}{.0216} = 10.833$$

RR: $F_{obs} \geq F_{.05, 2, 26} = 3.369$ Reject H_0

c) Method 3: $\bar{Y}_2^{Adj} = 17.258 + 0.721(29) = 38.167$

Method 1: $\bar{Y}_1^{Adj} = 38.167 + 3.224 = 41.391$

Method 2: $\bar{Y}_2^{Adj} = 38.167 - 4.650 = 33.517$

Q.3. a.i. T.S. $F_{obs} = \frac{\frac{0.66 - 0.60}{8 - 6}}{\frac{0.66}{6}} = \frac{0.03}{0.11} = 0.273$

a.ii. RR: $F_{obs} \geq F_{.05, 2, 6} = 5.143$

b.i. T.S. $F_{obs} = \frac{\frac{0.60 - 0.10}{10 - 8}}{\frac{1 - 0.60}{8}} = \frac{0.25}{0.05} = 5.00$

b.ii. RR: $F_{obs} \geq F_{.05, 2, 8} = 4.459$

c) Writer 1 28 Writer 2 13 Writer 3 18

Q.4.

P.4.a. $n-1=14 \Rightarrow n=15$

P.4.b. $R^2_{\text{Mod 3}} = \frac{0.1354}{0.1592} = 0.8505$

P.4.c. $r_{xy} = \text{sign}(\hat{\beta}) \sqrt{R^2_{yx}} = -\sqrt{\frac{0.1254}{0.1592}} = -0.8875$

P.4.d. $H_0: \beta_1 = 0 \quad H_A: \beta_1 \neq 0$

T.S: $t_{\text{obs}} = \frac{-0.0505}{0.0241} = -2.095$

R.N: $|t_{\text{obs}}| \geq t_{0.025, 12} = 2.179$

Q.5.

P.5.a. $H_0: \gamma_1 = 0 \quad H_A: \gamma_1 \neq 0$

T.S: $F_{\text{obs}} = \frac{\frac{.432 - .363}{37-36}}{\frac{1-.432}{36}} = \frac{0.069}{0.0158} = 4.367$

R.N: $F_{\text{obs}} \geq F_{0.05, 1, 36} = 4.119$ Reject H_0

P.5.b. $H_0: \beta_1 = 0 \quad H_A: \beta_1 \neq 0$

T.S. $F_{\text{obs}} = \frac{\frac{.363 - .267}{38-37}}{\frac{1-.363}{37}} = \frac{0.094}{0.0172} = 5.460$

R.N: $F_{\text{obs}} \geq F_{0.05, 1, 37} = 4.111$

P.5.c. Experimental $12.10 + 10.06 = 32.16$ Control $7.38 + 0.59(8) = 12.10$