# Chapter 9: Multiple Comparisons

9.1 a. Yes

b. No

9.3 a. $l_1 = 4\mu_1 - \mu_2 - \mu_3 - \mu_4 - \mu_5$

b. $l_2 = 3\mu_2 - \mu_3 - \mu_4 - \mu_5$

c. $l_3 = \mu_3 - 2\mu_4 + \mu_5$

d. $l_4 = \mu_3 - \mu_5$

9.5 Reject $H_o$ if $F = \frac{SSC}{MS_{Error}} > 4.11 \quad (F_{0.05}, df_1 = 1, df_2 = 36)$

$SSC = \frac{(\hat{l})^2}{\sum_i (a_i^2/n_i)} = \frac{10(\hat{l})^2}{\sum_i a_i^2}$

Using the transformed data, $MS_{Error} = 0.2619$

a. $\hat{l}_1 = -8.51 \Rightarrow SSC_1 = 60.35 \Rightarrow F = 230.43 \Rightarrow$ Reject $H_o$

b. $\hat{l}_2 = -5.51 \Rightarrow SSC_2 = 50.60 \Rightarrow F = 193.20 \Rightarrow$ Reject $H_o$

d. Yes

e. Yes

9.8 a. Fisher's LSD: Pairs Not Significantly Different: (4,1), (2,3)

b. Tukey's W: Pairs Not Significantly Different: (4,1), (4,2), (1,2), (2,3), (3,S)

c. SNK procedure: Pairs Not Significantly Different: (4,1), (2,3)

9.9 a. Tukey's W

b. Fisher's LSD

9.10 Using the computer output, the Dunnett procedure indicates that all four agents had significantly larger average weight loss than the standard agent.

9.11 a. $l_1 = \mu_{A_1} + \mu_{A_2} + \mu_{A_3} + \mu_{A_4} - 4\mu_S$

b. $l_2 = \mu_{A_1} - \mu_{A_2} + \mu_{A_3} - \mu_{A_4}$

c. $l_3 = \mu_{A_1} + \mu_{A_2} - \mu_{A_3} - \mu_{A_4}$

d. $l_4 = \mu_{A_1} + \mu_{A_3} - 2\mu_S$

9.12 Using Scheffe's Method:

$S_i = 1.0066\sqrt{\sum_i a_i^2}$

Declare contrast $l_i$ significantly different from 0 if $|\hat{l}_i| > S_i$

The tests are summarized as follows:

| Contrast | $a_1$ | $a_2$ | $a_3$ | $a_4$ | $a_5$ | $\sum_i a_i^2$ | $\hat{l}$ | $S_i$ | Conclusion |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 1 | 1 | 1 | 1 | -4 | 20 | 8.5 | 4.502 | Significant |
| 2 | 1 | -1 | 1 | -1 | 0 | 4 | -.94 | 2.013 | Not Significant |
| 3 | 1 | 1 | -1 | -1 | 0 | 4 | .56 | 2.013 | Not Significant |
| 4 | 1 | 0 | 1 | 0 | -2 | 6 | 3.78 | 2.466 | Significant |

9.13 a. Using Dunnett's 1-sided procedure with LowTar designated the Control Treatment and $\alpha = 0.05$:

$D = 0.123 \Rightarrow$

LowTar has significantly lower average tar content than all four of the other brands.

b. Bonferroni 95% C.I.'s on the differences $\mu_i - \mu_{LowTar}$ with $t_{495,\frac{.05}{8}} \approx z_{.0063} = 2.50$, we obtain $(\bar{y}_i - \bar{y}_{LowTar}) \pm 2.50\sqrt{2(.159)/100}$

| Brand | C.I. |
|---|---|
| A | (.436, .718) |
| B | (.990, 1.272) |
| C | (1.785, 2.067) |
| D | (3.807, 4.089) |

9.17 a. Using Fisher's LSD we obtain

| Comparison | LSD | $\lvert\bar{y}_i - \bar{y}_j\rvert$ | Conclusion |
|---|---|---|---|
| 3DOK1 vs 3DOK5 | 4.501 | 7.120 | Sign. Evid. Means Differ |
| 3DOK1 vs 3DOK7 | 4.352 | 8.667 | Sign. Evid. Means Differ |
| 3DOK5 vs 3DOK7 | 4.135 | 1.557 | Not Sign. Evid. Means Differ |

9.24 b. Using a 1-sided Dunnett's procedure:

| Comparison | $D$ | $\bar{y}_i - \bar{y}_A$ | Conclusion |
|---|---|---|---|
| B vs A | 0.229 | 0.283 | Sign. Evid. B's Mean Differs From Control |
| C vs A | 0.229 | 0.194 | Not Sign. Evid. C's Mean Differs From Control |
| D vs A | 0.229 | 0.287 | Sign. Evid. D's Mean Differs From Control |

# Chapter 10: Categorical Data

10.1 a. Yes

b. $(0.15, 0.25)$ is a 90% C.I. for $\pi$.

10.3 a. 95% C.I. for $\pi$ : $(0.780, 0.820)$

10.5 b. Yes

c. 95% C.I. for $(0.245, 0.515)$