1.33 Optional MANOVA Output

Other output related to multivariate significance tests can be obtained by using the PRINT subcommand. Such optional output includes

1 The error matrix. For every error matrix used in the model,

```
PRINT=ERROR(SSCP)/
```

can be used to obtain the error SSCP matrix, S_e. Although only one error matrix, the within-cells error matrix, was used in Figure 1.32a, more than one error matrix is sometimes used (e.g., in multivariate nested designs). The error matrix for Figure 1.32a is given in Figure 1.33a.

Figure 1.33a

```
WITHIN CELLS SUM-OF-SQUARES AND CROSS-PRODUCTS

                RCAN            RLI            RCI

RCAN         137.89515
RLI          101.90797      261.87433
RCI           81.03938      217.53449      423.98046
```

The error variance-covariance and error correlation matrices can also be obtained, by specifying

```
PRINT=ERROR(COV,COR)/
```

2 The hypothesis SSCP matrix. The matrix S_h for each effect can be obtained by specifying

```
PRINT=SIGNIF(HYPOTH)/
```

This matrix is adjusted for the covariates (if any). The hypothesis SSCP matrix for the TR effect in Figure 1.32a is given in Figure 1.33b.

Figure 1.33b

```
EFFECT .. TR

ADJUSTED HYPOTHESIS SUM-OF-SQUARES AND CROSS-PRODUCTS

                RCAN            RLI            RCI

RCAN          6.18306
RLI           8.26479       28.07315
RCI          15.81805       41.86935       69.55358
```

3 Roy-Bargmann step-down analysis (Roy and Bargmann, 1958). For each effect, step-down tests (which depend on the ordering of the response variables) can be performed by specifying

```
PRINT=SIGNIF(STEPDOWN)/
```

The number of tests for effects in a step-down analysis is equal to the number of response variables in the model. For the first response variable, the test statistic is the same as the univariate F statistic. The test statistic for the second response variable is identical to the univariate test statistic that would result if the first response variable were treated as a covariate. The test statistic for the third response variable is adjusted for the first two variables, and so on. A significant test statistic for the kth response variable indicates that this variable is important for testing the hypothesis that the effect is zero and cannot be accounted for by a linear combination of the preceding $k - 1$ variables. Since testing begins with the last variable and proceeds backwards until a significant result is obtained, the variables assumed to be important in testing an effect should appear early in the step-down ordering. MANOVA uses the ordering of the response variables given in the MANOVA variable list. The step-down analysis for the TR effect in Figure 1.32a is given in Figure 1.33c.

Figure 1.33c

```
ROY-BARGMAN STEPDOWN F - TESTS

VARIABLE    HYPOTH. MS    ERROR MS    STEP-DOWN F    HYPOTH. DF    ERROR DF    SIG. OF F

RCAN          1.54577     1.37895        1.12097             4         100         .351
RLI           4.78488     1.88446        2.53912             4          99         .045
RCI           4.57059     2.48108        1.84218             4          98         .127
```