```
MANOVA          Y BY CAT(1,2) DRUG(1,3)/
                PARTITION(DRUG)=(1,1)/
                DESIGN=CAT,DRUG(1),DRUG(2),CAT BY DRUG/
```

The first component is denoted by DRUG(1), and the second by DRUG(2). The output is given in Figure 1.8.

Figure 1.8

```
TESTS OF SIGNIFICANCE FOR Y USING SEQUENTIAL SUMS OF SQUARES

SOURCE OF VARIATION                SUM OF SQUARES     DF   MEAN SQUARE          F     SIG. OF F

WITHIN CELLS                           106.00000     12       8.83333
CONSTANT                               882.00000      1     882.00000   99.84906           0.0
CAT                                     18.00000      1      18.00000    2.03774          .179
DRUG(1)                                 12.00000      1      12.00000    1.35849          .266
DRUG(2)                                 36.00000      1      36.00000    4.07547          .066
CAT BY DRUG                            144.00000      2      72.00000    8.15094          .006

- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -

ESTIMATES FOR Y

CONSTANT

 PARAMETER          COEFF.      STD. ERR.      T-VALUE      SIG. OF T    LOWER .95 CL    UPPER .95 CL

         1   7.0000000000         .70053      9.99245           .000         5.47368         8.52632

CAT

 PARAMETER          COEFF.      STD. ERR.      T-VALUE      SIG. OF T    LOWER .95 CL    UPPER .95 CL

         2  -1.0000000000         .70053     -1.42749           .179        -2.52632          .52632

DRUG(1)

 PARAMETER          COEFF.      STD. ERR.      T-VALUE      SIG. OF T    LOWER .95 CL    UPPER .95 CL

         3   0.0                  .99070      0.0             1.000        -2.15854         2.15854

DRUG(2)

 PARAMETER          COEFF.      STD. ERR.      T-VALUE      SIG. OF T    LOWER .95 CL    UPPER .95 CL

         4  -2.0000000000         .99070     -2.01878           .066        -4.15854          .15854

CAT BY DRUG

 PARAMETER          COEFF.      STD. ERR.      T-VALUE      SIG. OF T    LOWER .95 CL    UPPER .95 CL

         5  -2.0000000000         .99070     -2.01878           .066        -4.15854          .15854
         6   4.0000000000         .99070      4.03756           .002         1.84146         6.15854
```

The default contrasts used for partitioning are deviation contrasts (see Section 1.89). The deviation contrasts are not orthogonal, so the two contrasts for DRUG(1) and DRUG(2) are not independent.

1.9 Types of Contrasts

The MANOVA procedure allows specification of six different contrast types: deviation, difference, Helmert, simple, repeated, and polynomial. The user can also input any other contrast matrix via the SPECIAL keyword.

For example, to specify user-supplied orthogonal contrasts for the DRUG factor, the following commands can be used:

```
MANOVA          Y BY CAT(1,2) DRUG(1,3)/
                CONTRAST(DRUG)=SPECIAL(1 1 1 -1 2 -1 1 0 -1)/
                PARTITION(DRUG)=(1,1)/
                DESIGN=CAT,DRUG(1),DRUG(2),CAT BY DRUG(1),
                       CAT BY DRUG(2)/
```

The first set of coefficients (1 1 1) is always the weights for obtaining the constant term. Following the weights vector are the contrasts. The number of contrasts should be equal to the degrees of freedom for the factor. The first contrast (-1 2 -1) defines a contrast between level 2 and the combination of levels 1 and 3 for factor DRUG. The second contrast (1 0 -1) requests a comparison between levels 1 and 3 of DRUG. For most applications, the user shoud be sure that each set of contrast coefficients sum to zero.

Since the inner product of the two contrasts is 0 and the sample sizes in all cells are equal, i.e., (-1)(1) + 2(0) + (-1)(-1) = 0, the two contrasts are independent. In this example, the DRUG(1) partition can be used to test the hypothesis $\beta_2 = (\beta_1 + \beta_3)/2$ while the second contrast tests $\beta_1 = \beta_3$. The ANOVA table is given in Figure 1.9.