PBIB designs represent a large class of designs, many of which can be found in Cochran and Cox (1957). An example with t = 15, b = 15, k = 4, and r = 4 is given on p. 456 of that text. The MANOVA commands and the output ANOVA table are given in Figure 1.22a and Figure 1.22b.

Figure 1.22a

```
RUN NAME        15 X 15 PARTIALLY BAL. INC. BLOCK DESIGN.
COMMENT         DATA ARE TAKEN FROM COCHRAN & COX(1957) P.456.
VARIABLE LIST   BLOCKS, TREATMNT, DEP
INPUT MEDIUM    CARD
N OF CASES      UNKNOWN
INPUT FORMAT    FIXED(2F2.0,8X,F3.0)
MANOVA          DEP BY BLOCKS(1,15), TREATMNT(1,15)/
                DESIGN = BLOCKS, TREATMNT/

READ INPUT DATA
 1 1        2.6
 1 9        2.5
 113        2.0
 115        2.4
 2 1        2.7
  ..         .
  ..         .
  ..         .
15 4        2.5
15 8        3.2
1510        2.4
1511        3.1
END INPUT DATA
FINISH
```

Figure 1.22b

TESTS OF SIGNIFICANCE FOR DEP USING SEQUENTIAL SUMS OF SQUARES

SOURCE OF VARIATION	SUM OF SQUARES	DF	MEAN SQUARE	F	SIG. OF F
RESIDUAL	2.68589	31	.08664		
CONSTANT	448.26654	1	448.26654	5173.80518	0.0
BLOCKS	4.92333	14	.35167	4.05887	.001
TREATMNT	1.56411	14	.11172	1.28948	.268

1.23 Latin and Other Squares

A Latin square is a design in which each treatment appears exactly once in each row and column. The main interest is still on the estimation of treatment differences, but two restrictions are put on the randomization of the treatment assignment. The model of this design is

$$Y_{ijk} = \mu + \alpha_i + \beta_j + \gamma_k + \epsilon_{ijk}$$

where α_i, β_j and γ_k are the row, column and treatment effects respectively. An example of a 4 × 4 Latin square is shown in Table 1.23a.

Table 1.23a

		Column 1	2	3	4
Row	1	A	C	D	B
	2	D	B	C	A
	3	C	A	B	D
	4	B	D	A	C

The following MANOVA specifications may be used to analyze a 4 × 4 Latin square.

```
MANOVA          Y BY ROW(1,4),COL(1,4),TRT(1,4)/
                DESIGN=ROW,COL,TRT/
```