Applied Multivariate Statistics for the Social Sciences Analyses with SAS and IBM s SPSS 6th edition Pituch Test Bank

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CHAPTER 2

1. (a) $\mathbf{A} + \mathbf{C} = \begin{bmatrix} 3 & 7 & 6 \\ 9 & 0 & 6 \end{bmatrix}$

(b) $\mathbf{A} + \mathbf{B}$ is not meaningful; matrices must be of the same dimension to add.

(c) $\mathbf{AB} = \begin{bmatrix} 13 & 12 \\ 14 & 24 \end{bmatrix}$

(d) **AC** is not meaningful; the number of rows of **C** is not equal to the number of columns of **A.**

(e) **u'D u** in parts is:

u'D= (10, 20)

And (10, 20)(**u**) = $(10,20)\begin{bmatrix} 1 \\ 3 \end{bmatrix} = 10 + 60 = 70.$

(f) **u'v** = (1)(2) + (3)(7) = 23.

(g) $(\mathbf{A} + \mathbf{C}) = \begin{bmatrix} 2 & 4 & 1 \\ 3 & -2 & 5 \end{bmatrix} + \begin{bmatrix} 1 & 3 & 5 \\ 6 & 2 & 1 \end{bmatrix} = \begin{bmatrix} 3 & 7 & 6 \\ 9 & 0 & 6 \end{bmatrix}$

Thus, $(\mathbf{A} + \mathbf{C})' = \begin{bmatrix} 3 & 9 \\ 7 & 0 \\ 6 & 6 \end{bmatrix}$

(h) $3\mathbf{C} = \begin{bmatrix} 3 & 9 & 15 \\ 18 & 6 & 3 \end{bmatrix}$

(i) $|\mathbf{D}| = (4 \times 6) - (2 \times 2) = 20$

(j) $\mathbf{D}^{-1} = \frac{1}{20}\begin{bmatrix} 6 & -2 \\ -2 & 4 \end{bmatrix} = \begin{bmatrix} 6/20 & -2/20 \\ -2/20 & 4/20 \end{bmatrix}$

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(k) $|\mathbf{E}| = 1\begin{vmatrix}3 & 1\\ 1 & 10\end{vmatrix} - (-1)\begin{vmatrix}-1 & 1\\ 2 & 10\end{vmatrix} + 2\begin{vmatrix}-1 & 3\\ 2 & 1\end{vmatrix} = 3$

(l) $\mathbf{E}^{-1}$ =? Matrix of cofactors $= \begin{bmatrix}29 & 12 & -7\\ 12 & 6 & -3\\ -7 & -3 & 2\end{bmatrix}$

Therefore, $\mathbf{E}^{-1} = \frac{1}{3}\begin{bmatrix}29 & 12 & -7\\ 12 & 6 & -3\\ -7 & -3 & 2\end{bmatrix}$

(m) $\mathbf{u'D^{-1}} = \left(0, {}^{10}/_{20}\right)$. Thus, $\mathbf{u'D^{-1}u} = \left(0, {}^{10}/_{20}\right)\begin{bmatrix}1\\ 3\end{bmatrix} = {}^{30}/_{20}$

(n) $\mathbf{BA} = \begin{bmatrix}8 & 0 & 11\\ 7 & 6 & 7\\ 18 & 4 & 23\end{bmatrix}$

(o) $\mathbf{X'X} = \begin{bmatrix}51 & 64\\ 64 & 90\end{bmatrix}$

2. $\begin{bmatrix}y_1\\ y_2\\ \vdots\\ y_N\end{bmatrix} = \begin{bmatrix}e_1\\ e_2\\ \vdots\\ e_N\end{bmatrix} + \begin{bmatrix}1 & x_{11} & x_{12}\\ 1 & x_{21} & x_{22}\\ \cdots & \cdots & \cdots\\ 1 & x_{N1} & x_{N2}\end{bmatrix}\begin{bmatrix}b_0\\ b_1\\ b_2\end{bmatrix}$

y = e + X b

(*N* x 1) (*N* x 1) (*N* x 3) (3 x 1)

3. **S** (covariance matrix) $= \frac{1}{4}\begin{bmatrix}26.8 & 24 & -14\\ 24 & 24 & -14\\ -14 & -14 & 52\end{bmatrix}$

4. (a) $r_{12} = \frac{s_{12}}{s_1 s_2} \Rightarrow s_{12} = r_{12}s_1 s_2 = .80(10)(7) = 56$

Therefore, $\mathbf{S} = \begin{bmatrix}100 & 56\\ 56 & 49\end{bmatrix} \Rightarrow |\mathbf{S}| = 1{,}764$

(b) $s_{12} = .20(9)(6) = 10.8$

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Therefore, $\mathbf{S} = \begin{bmatrix} 81 & 10.8 \\ 10.8 & 36 \end{bmatrix} \Rightarrow |\mathbf{S}| = 2{,}799.36$

The fact that the generalized variance is larger for (b) might seem surprising, since the variances for both variables are larger for (a). However, the fact that the variables are highly correlated in (a) means that much of the variance in either variable is accounted for by, or shared with, the other variable. This fact reduces the generalized variance for (a) considerably.

5. **A** cannot be a variance-covariance matrix, since the determinant is -113, and the determinant of a covariance matrix represents the generalized variance.

6. SPSS output for this problem is:

A

6 8 7 6

8 9 2 3

7 2 5 2

6 3 2 1

AINV

.80000000 -1.50000000 -2.00000000 3.70000000

-1.50000000 2.75000000 3.50000000 -6.25000000

-2.00000000 3.50000000 5.00000000 -8.50000000

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3.70000000 -6.25000000 -8.50000000 14.55000000

7. When the SPSS MATRIX program is run the following output is obtained:

A

6 2 4

2 3 1

4 1 5

DETA

32.00000000

AINV

.4375000000 -.1875000000 -.3125000000

-.1875000000 .4375000000 .0625000000

-.3125000000 .0625000000 .4375000000

8. $\mathbf{AB} = \mathbf{BA} = \begin{bmatrix} 2 & 3 \\ 3 & 6 \end{bmatrix}$ A matrix multiplied by an identity matrix is unchanged.

9. (a) The SPSS output is:

S

4 3 1

3 9 2

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1 2 1

DETS

14

(b) The determinant represents the variation in the set of 3 variables after we account for the associations among the variables.

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