

$$5.3. \quad (1) \quad \begin{bmatrix} Y_1 \\ Y_2 \\ Y_3 \\ Y_4 \end{bmatrix} - \begin{bmatrix} \hat{Y}_1 \\ \hat{Y}_2 \\ \hat{Y}_3 \\ \hat{Y}_4 \end{bmatrix} = \begin{bmatrix} e_1 \\ e_2 \\ e_3 \\ e_4 \end{bmatrix}$$

$$(2) \quad \begin{bmatrix} X_1 & X_2 & X_3 & X_4 \end{bmatrix} \begin{bmatrix} e_1 \\ e_2 \\ e_3 \\ e_4 \end{bmatrix} = \begin{bmatrix} 0 \end{bmatrix}$$

$$5.4. \quad (1) \quad 503.77 \quad (2) \quad \begin{bmatrix} 5 & 0 \\ 0 & 160 \end{bmatrix} \quad (3) \quad \begin{bmatrix} 49.7 \\ -39.2 \end{bmatrix}$$

$$5.12. \quad \begin{bmatrix} .2 & 0 \\ 0 & .00625 \end{bmatrix}$$

$$6.1. \quad \text{a.} \quad \mathbf{X} = \begin{bmatrix} 1 & X_{11} & X_{11}X_{12} \\ 1 & X_{21} & X_{21}X_{22} \\ 1 & X_{31} & X_{31}X_{32} \\ 1 & X_{41} & X_{41}X_{42} \end{bmatrix} \quad \beta = \begin{bmatrix} \beta_0 \\ \beta_1 \\ \beta_2 \end{bmatrix}$$

$$\text{b.} \quad \mathbf{X} = \begin{bmatrix} 1 & X_{11} & X_{12} \\ 1 & X_{21} & X_{22} \\ 1 & X_{31} & X_{32} \\ 1 & X_{41} & X_{42} \end{bmatrix} \quad \beta = \begin{bmatrix} \beta_0 \\ \beta_1 \\ \beta_2 \end{bmatrix}$$

6.5. a.

$$\begin{matrix} Y \\ X_1 \\ X_2 \end{matrix} \begin{bmatrix} 1.000 & .892 & .395 \\ & 1.000 & .000 \\ & & 1.000 \end{bmatrix}$$

b. $b_0 = 37.650, b_1 = 4.425, b_2 = 4.375, \hat{Y} = 37.650 + 4.425X_1 + 4.375X_2$

c&d.

$i:$	1	2	3	4	5	6	7	8
$e_i:$	-.10	.15	-3.10	3.15	-.95	-1.70	-1.95	1.30
Expected Val.:	-.208	.208	-3.452	2.661	-.629	-1.533	-2.052	1.533
$i:$	9	10	11	12	13	14	15	16
$e_i:$	1.20	-1.55	4.20	2.45	-2.65	-4.40	3.35	.60
Expected Val.:	1.066	-1.066	4.764	2.052	-2.661	-4.764	3.452	.629

e. $SSR^* = 72.41, SSE = 94.30, X_{BP}^2 = (72.41/2) \div (94.30/16)^2 = 1.04, \chi^2(.99; 2) = 9.21$. If $X_{BP}^2 \leq 9.21$ conclude error variance constant, otherwise error variance not constant. Conclude error variance constant.

f. $H_0: E\{Y\} = \beta_0 + \beta_1X_1 + \beta_2X_2, H_a: E\{Y\} \neq \beta_0 + \beta_1X_1 + \beta_2X_2$. $MSLF = 7.46, MSPE = 7.125, F^* = 7.46/7.125 = 1.047, F(.99; 5, 8) = 6.63$. If $F^* \leq 6.63$ conclude H_0 , otherwise H_a . Conclude H_0 .

6.6. a. $H_0: \beta_1 = \beta_2 = 0$, H_a : not all $\beta_k = 0$ ($k = 1, 2$). $MSR = 936.350$, $MSE = 7.254$, $F^* = 936.350/7.254 = 129.083$, $F(.99; 2, 13) = 6.70$. If $F^* \leq 6.70$ conclude H_0 , otherwise H_a . Conclude H_a .

b. P -value = 0+

c. $s\{b_1\} = .301$, $s\{b_2\} = .673$, $B = t(.9975; 13) = 3.372$
 $4.425 \pm 3.372(.301)$ $3.410 \leq \beta_1 \leq 5.440$
 $4.375 \pm 3.372(.673)$ $2.106 \leq \beta_2 \leq 6.644$

6.8. a. $\hat{Y}_h = 77.275$, $s\{\hat{Y}_h\} = 1.127$, $t(.995; 13) = 3.012$, $77.275 \pm 3.012(1.127)$,
 $73.880 \leq E\{Y_h\} \leq 80.670$

b. $s\{\text{pred}\} = 2.919$, $77.275 \pm 3.012(2.919)$, $68.483 \leq Y_{h(\text{new})} \leq 86.067$

6.25. Fit $Y'_i = \beta_0 + \beta_1 X_{i1} + \beta_3 X_{i3} + \varepsilon_i$, where $Y'_i = Y_i - 4X_{i2}$

7.3. a. $SSR(X_1) = 1,566.45$, $SSR(X_2|X_1) = 306.25$, $SSE(X_1, X_2) = 94.30$, $df: 1, 1, 13$.

b. $H_0: \beta_2 = 0$, $H_a: \beta_2 \neq 0$. $SSR(X_2|X_1) = 306.25$, $SSE(X_1, X_2) = 94.30$, $F^* = (306.25/1) \div (94.30/13) = 42.219$, $F(.99; 1, 13) = 9.07$. If $F^* \leq 9.07$ conclude H_0 , otherwise H_a . Conclude H_a . P -value = 0+.

7.12. $R^2_{Y_1} = .796$, $R^2_{Y_2} = .156$, $R^2_{12} = 0$, $R^2_{Y_1|2} = .943$, $R^2_{Y_2|1} = .765$, $R^2 = .952$

7.24. a. $\hat{Y} = 50.775 + 4.425X_1$

c. Yes, $SSR(X_1) = 1,566.45$, $SSR(X_1|X_2) = 1,566.45$

d. $r_{12} = 0$

7.30. a. $\hat{Y} = 68.625 + 4.375X_2$

$i:$	1	2	3	4	5	6
$e_i:$	-13.3750	-13.1250	-16.3750	-10.1250	-5.3750	-6.1250
$i:$	7	8	9	10	11	12
$e_i:$	-6.3750	-3.1250	5.6250	2.8750	8.6250	6.8750
$i:$	13	14	15	16		
$e_i:$	10.6250	8.8750	16.6250	13.8750		

b. $\hat{X}_1 = 7$

$i:$	1	2	3	4	5	6	7	8
$e_i:$	-3	-3	-3	-3	-1	-1	-1	-1
$i:$	9	10	11	12	13	14	15	16
$e_i:$	1	1	1	1	3	3	3	3

c. $r = .971 = r_{Y_1|2}$

8.24. b. $\hat{Y} = -126.905 + 2.7759X_1 + 76.0215X_2 - 1.10748X_1X_2,$

$H_0 : \beta_2 = \beta_3 = 0, H_a : \text{not both } \beta_2 = 0 \text{ and } \beta_3 = 0. SSR(X_2, X_1X_2 | X_1) = 566.15, SSE(X_1, X_2, X_1X_2) = 909.105, F^* = (369.85/2) \div (909.105/60) = 12.2049, F(.95; 2, 60) = 3.15041. \text{ If } F^* \leq 3.15041 \text{ conclude } H_0, \text{ otherwise } H_a. \text{ Conclude } H_a.$

c. $\hat{Y} = -126.9052 + 2.7759X_1$ for noncorner lots
 $\hat{Y} = -50.8836 + 1.6684X_1$ for corner lots

9.10. b.

$$\begin{matrix} X_1 \\ X_2 \\ X_3 \\ X_4 \end{matrix} \begin{bmatrix} 1 & .102 & .181 & .327 \\ & 1 & .519 & .397 \\ & & 1 & .782 \\ & & & 1 \end{bmatrix}$$

c. $\hat{Y} = -124.3820 + .2957X_1 + .0483X_2 + 1.3060X_3 + .5198X_4$

9.11. a.

Subset	$R_{a,p}^2$
X_1, X_3, X_4	.9560
X_1, X_2, X_3, X_4	.9555
X_1, X_3	.9269
X_1, X_2, X_3	.9247

9.18. a. X_1, X_3, X_4

10.9 a&g

$i:$	1	2	3	4	5	6
$t_i:$	-.041	.061	-1.361	1.386	-.367	-.665
$D_i:$	.0002	.0004	.1804	.1863	.0077	.0245
$i:$	7	8	9	10	11	12
$t_i:$	-.767	.505	.465	-.604	1.823	.978
$D_i:$	.0323	.0144	.0122	.0204	.1498	.0510
$i:$	13	14	15	16		
$t_i:$	-1.140	-2.103	1.490	.246		
$D_i:$	.1318	.3634	.2107	.0068		

$t(.9969; 12) = 3.31. \text{ If } |t_i| \leq 3.31 \text{ conclude no outliers, otherwise outliers. Conclude no outliers.}$

c. $2p/n = 2(3)/16 = .375, \text{ no}$

d. $X'_{\text{new}} = [1 \ 10 \ 3]$

$$(X'X)^{-1} = \begin{bmatrix} 1.2375 & -.0875 & -.1875 \\ & .0125 & 0 \\ & 0 & .0625 \end{bmatrix}$$

$h_{\text{new,new}} = .175, \text{ no extrapolation}$

e.

	DFFITs	DFBETAS			D
		b_0	b_1	b_2	
Case 14:	-1.174	.839	-.808	-.602	.3634

f. .68%