9.2-7 $8.449 < \chi^2_{0.05}(4) = 9.488$ do not reject the null hypothesis;
$0.05 < p$ -value $< 0.10; p$ -value $= 0.076$

9.2-11 $23.78 > 21.03$, reject hypothesis of independence.

9.2-12 $q = 8.792 > 7.378 = \chi^2_{0.025}(2)$, reject H_0. ($p-$ value $= 0.012$.)

9.3-2

Source	SS	DF	MS	F	p-value
Treatment	388.2805	3	129.4268	4.9078	0.0188
Error	316.4597	12	26.3716		
Total	704.7402	15			

$F = 4.9078 > 3.49 = F_{0.05}(3, 12)$. Reject H_0.

9.3-5

(a)

Source	SS	DF	MS	F	p-value
Treatment	31.112	2	15.556	22.33	0.000
Error	29.261	42	0.697		
Total	60.372	44			

(b) The respective means are $23.114, 22.556$, and 21.120, with the eggs of the shortest lengths in the nests of the smallest bird.

9.3-9

(a) $F \geq 4.07$.

Source	SS	DF	MS	F	p-value
Treatment	3214.9	3	1071.6	4.1059	0.0489
Error	2088.0	8	261.0		
Total	5302.9	11			

(b) $F = 4.1059 > 4.07$. Reject H_0

(c) $F = 4.1059 < 5.42$, do not reject H_0.

(d) $0.025 < p$ -value < 0.05, p -value ≈ 0.05

9.3-10

(a)

$$t = \frac{92.143 - 103.009}{\sqrt{\frac{6(69.139)+6(57.669)}{12}\left(\frac{1}{7}+\frac{1}{7}\right)}} = -2.55 < -2.179, \text{ reject } H_0$$

F and the t tests give the same results since $t^2 = F$

(b) $F = \frac{86.3336}{114.8889} = 0.7515 < 3.55$, do not reject H_0.

9.4-2

					$\mu + \alpha_i$
	6	3	7	8	6
	10	7	11	12	10
	8	5	9	10	8
$\mu + \beta_j$	8	5	9	10	$\mu = 8$

$\alpha_1 = -2, \alpha_2 = 2, \alpha_3 = 0$ and $\beta_1 = 0, \beta_2 = -3, \beta_3 = 1, \beta_4 = 2$

9.4-3

(a) $7.624 > 4.46$, reject H_A.

(b) $15.539 > 3.84$, reject H_B.

9.4-4

$$\begin{aligned}
&\sum_{i=1}^{a}\sum_{j=1}^{b}\left(\overline{X}_{i}, -\overline{X}_{..}\right)\left(X_{ij} - \overline{X}_{i.} - \overline{X}_{.j} + \overline{X}_{..}\right) \\
&= \sum_{i=1}^{a}\left(\overline{X}_{i.} - \overline{X}_{..}\right)\sum_{j=1}^{b}\left[\left(X_{ij} - \overline{X}_{i.}\right) - \left(\overline{X}_{.j} - \overline{X}_{..}\right)\right] \\
&= \sum_{i=1}^{a}\left(\overline{X}_{i.} - \overline{X}_{..}\right)\left\{\sum_{j=1}^{b}\left(X_{ij} - \overline{X}_{i.}\right) - \sum_{j=1}^{b}\left(\overline{X}_{.j} - \overline{X}_{..}\right)\right\} \\
&= \sum_{i=1}^{a}\left(\overline{X}_{i.} - \overline{X}_{..}\right)(0 - 0) = 0
\end{aligned}$$

$\sum_{i=1}^{a}\sum_{j=1}^{b}\left(\overline{X}_{.j} - \overline{X}_{..}\right)\left(X_{ij} - \overline{X}_{i.} - \overline{X}_{.j} + \overline{X}_{..}\right) = 0$,, similarly;

$$\sum_{i=1}^{a}\sum_{j=1}^{b}\left(\overline{X}_{i.} - \overline{X}_{..}\right)\left(\overline{X}_{.j} - \overline{X}_{..}\right) = \left\{\sum_{i=1}^{a}\left(\overline{X}_{i.} - \overline{X}_{..}\right)\right\}\left\{\sum_{j=1}^{b}\left(\overline{X}_{.j} - \overline{X}_{..}\right)\right\} = (0)(0) = 0$$

.

9.4-6

					$\mu+\alpha_i$
	6	7	7	12	8
	10	3	11	8	8
	8	5	9	10	8
$\mu+\beta_j$	8	5	9	10	$\mu=8$

So $\alpha_1=\alpha_2=\alpha_3=0$ and $\beta_1=0, \beta_2=-3, \beta_3=1, \beta_4=2$ as in Exercise $9.4-2$. However, $\gamma_{11}=-2$ because $8+0+0+(-2)=6$. Similarly we obtain the other γ_{ij} s :

$$\begin{array}{rrrr} -2 & 2 & -2 & 2 \\ 2 & -2 & 2 & -2 \\ 0 & 0 & 0 & 0 \end{array}$$

9.4-7

(a) $1.727<2.36$, do not reject H_{AB}.

(b) $2.238<3.26$, do not reject H_A.

(c) $2.063<2.87$, do not reject H_B.

9.4-8

					$\mu+\alpha_i$
	6	7	7	12	8
	10	3	11	8	8
	8	5	9	10	8
$\mu+\beta_j$	8	5	9	10	$\mu=8$

(a) $F=0.892<F_{0.05}(1,24)=4.26$, do not reject H_{AB}.

(b) $F=4.307>F_{0.05}(1,24)=4.26$, reject H_A.

(c) $F=5.167>F_{0.05}(1,24)=4.26$, reject H_B.