Section 11.2 #29

Simple linear regression results:
Dependent Variable: ACCURACY
Independent Variable: DISTANCE
ACCURACY = 250.14203 - 0.62944314 DISTANCE
Sample size: 40
R (correlation coefficient) = -0.906395
R-sq = 0.82155189
Estimate of error standard deviation: 2.2363921

Parameter estimates:

Parameter	Estimate	Std. Err.	Alternative	DF	T-Stat	P-value
Intercept	250.14203	14.231014	≠ 0	38	17.577245	<0.0001
Slope	-0.62944314	0.047588628	≠ 0	38	-13.226755	<0.0001

Analysis of variance table for regression model:

Source	DF	SS	MS	F-stat	P-value
Model	1	874.98891	874.98891	174.94706	<0.0001
Error	38	190.05509	5.0014497		
Total	39	1065.044			

Section 11.2 #32

Simple linear regression results:
Dependent Variable: SweetIndex
Independent Variable: Pectin
SweetIndex = 6.2520679 - 0.0023106259 Pectin
Sample size: 24
R (correlation coefficient) = -0.47814583
R-sq = 0.22862343
Estimate of error standard deviation: 0.21499804

Parameter estimates:

Parameter	Estimate	Std. Err.	Alternative	DF	T-Stat	P-value
Intercept	6.2520679	0.23662195	≠ 0	22	26.422181	<0.0001
Slope	-0.0023106259	0.00090488032	≠ 0	22	-2.5535154	0.0181

Analysis of variance table for regression model:

Source	DF	SS	MS	F-stat	P-value
Model	1	0.30140189	0.30140189	6.5204411	0.0181
Error	22	1.0169314	0.046224156		
Total	23	1.3183333			

Section 11.3 #47

Simple linear regression results:
Dependent Variable: Rain
Independent Variable: Temp
Rain = 295.25331 - 16.364215 Temp
Sample size: 11
R (correlation coefficient) = -0.91861699
R-sq = 0.84385717
Estimate of error standard deviation: 17.511119

Parameter estimates:

Parameter	Estimate	Std. Err.	Alternative	DF	T-Stat	P-value
Intercept	295.25331	22.40963	≠ 0	9	13.175287	<0.0001
Slope	-16.364215	2.3463915	≠ 0	9	-6.9742049	<0.0001

Analysis of variance table for regression model:

Source	DF	SS	MS	F-stat	P-value
Model	1	14914.792	14914.792	48.639534	<0.0001
Error	9	2759.7536	306.63928		
Total	10	17674.545			

Section 11.3 #50

Simple linear regression results:
Dependent Variable: SweetIndex
Independent Variable: Pectin
SweetIndex = 6.2520679 - 0.0023106259 Pectin
Sample size: 24
R (correlation coefficient) = -0.47814583
R-sq = 0.22862343
Estimate of error standard deviation: 0.21499804

Parameter estimates:

Parameter	Estimate	Std. Err.	Alternative	DF	T-Stat	P-value
Intercept	6.2520679	0.23662195	≠ 0	22	26.422181	<0.0001
Slope	-0.0023106259	0.00090488032	≠ 0	22	-2.5535154	0.0181

Analysis of variance table for regression model:

Source	DF	SS	MS	F-stat	P-value
Model	1	0.30140189	0.30140189	6.5204411	0.0181
Error	22	1.0169314	0.046224156		
Total	23	1.3183333			

section 11.4 # 59

Simple linear regression results:
Dependent Variable: Y
Independent Variable: X
Y = 1.9545455 + 0.36363636 X
Sample size: 6
R (correlation coefficient) = 0.29918304
R-sq = 0.08951049
Estimate of error standard deviation: 1.5703213

Parameter estimates:

Parameter	Estimate	Std. Err.	Alternative	DF	T-Stat	P-value
Intercept	1.9545455	2.0364702	≠ 0	4	0.95977122	0.3915
Slope	0.36363636	0.57987958	≠ 0	4	0.62708944	0.5646

Analysis of variance table for regression model:

Source	DF	SS	MS	F-stat	P-value
Model	1	0.96969697	0.96969697	0.39324117	0.5646
Error	4	9.8636364	2.4659091		
Total	5	10.833333			

section 11.4 # 65

Simple linear regression results:
Dependent Variable: ACCURACY
Independent Variable: DISTANCE
ACCURACY = 250.14203 - 0.62944314 DISTANCE
Sample size: 40
R (correlation coefficient) = -0.906395
R-sq = 0.82155189
Estimate of error standard deviation: 2.2363921

Parameter estimates:

Parameter	Estimate	Std. Err.	Alternative	DF	T-Stat	P-value
Intercept	250.14203	14.231014	≠ 0	38	17.577245	<0.0001
Slope	-0.62944314	0.047588628	≠ 0	38	-13.226755	<0.0001

Analysis of variance table for regression model:

Source	DF	SS	MS	F-stat	P-value
Model	1	874.98891	874.98891	174.94706	<0.0001
Error	38	190.05509	5.0014497		
Total	39	1065.044			

section 11.4 #72

Simple linear regression results:
Dependent Variable: ACTIVITY
Independent Variable: EMPATHY
ACTIVITY = -0.39248596 + 0.036179775 EMPATHY
Sample size: 16
R (correlation coefficient) = 0.62747664
R-sq = 0.39372693
Estimate of error standard deviation: 0.16008418

Parameter estimates:

Parameter	Estimate	Std. Err.	Alternative	DF	T-Stat	P-value
Intercept	-0.39248596	0.21965538	≠ 0	14	-1.7868261	0.0956
Slope	0.036179775	0.011998817	≠ 0	14	3.0152785	0.0093

Analysis of variance table for regression model:

Source	DF	SS	MS	F-stat	P-value
Model	1	0.23299775	0.23299775	9.0919047	0.0093
Error	14	0.35877725	0.025626946		
Total	15	0.591775			

section 11.5 #97

Simple linear regression results:
Dependent Variable: LACTATE
Independent Variable: RECOVERY
LACTATE = 2.9696003 + 0.12666557 RECOVERY
Sample size: 16
R (correlation coefficient) = 0.57018269
R-sq = 0.3251083
Estimate of error standard deviation: 0.95072226

Parameter estimates:

Parameter	Estimate	Std. Err.	Alternative	DF	T-Stat	P-value
Intercept	2.9696003	0.78958706	≠ 0	14	3.7609536	0.0021
Slope	0.12666557	0.048775034	≠ 0	14	2.5969345	0.0211

Analysis of variance table for regression model:

Source	DF	SS	MS	F-stat	P-value
Model	1	6.0957806	6.0957806	6.7440689	0.0211
Error	14	12.654219	0.90387282		
Total	15	18.75			

section 11.6 #118

From Exercises 11.34 and 11.74, $\bar{x} = 5.5$, $SS_{xx} = 756$

Simple linear regression results:
Dependent Variable: RECALL
Independent Variable: POSITION
RECALL = 0.57044312 + 0.026421958 POSITION
Sample size: 144
R (correlation coefficient) = 0.23325607
R-sq = 0.054408393
Estimate of error standard deviation: 0.25415612

Parameter estimates:

Parameter	Estimate	Std. Err.	Alternative	DF	T-Stat	P-value
Intercept	0.57044312	0.055074917	≠ 0	142	10.357585	<0.0001
Slope	0.026421958	0.0092435687	≠ 0	142	2.8584152	0.0049

Analysis of variance table for regression model:

Source	DF	SS	MS	F-stat	P-value
Model	1	0.5277786	0.5277786	8.1705376	0.0049
Error	142	9.1725374	0.064595334		
Total	143	9.700316			

section 11.6 #119

$\bar{x}$ =22.869565, SS_{xx} =6906.6087

Simple linear regression results:
Dependent Variable: MASS
Independent Variable: TIME
MASS = 5.2206954 - 0.1140228 TIME
Sample size: 23
R (correlation coefficient) = -0.92376344
R-sq = 0.85333889
Estimate of error standard deviation: 0.8572573

Parameter estimates:

Parameter	Estimate	Std. Err.	Alternative	DF	T-Stat	P-value
Intercept	5.2206954	0.29597769	≠ 0	21	17.638814	<0.0001
Slope	-0.1140228	0.010315226	≠ 0	21	-11.053834	<0.0001

Analysis of variance table for regression model:

Source	DF	SS	MS	F-stat	P-value
Model	1	89.794195	89.794195	122.18725	<0.0001
Error	21	15.432692	0.73489008		
Total	22	105.22689			

12.6 NW MINITAB was used to fit the model $y = \beta_0 + \beta_1 x_1 + \beta_2 x_2 + \varepsilon$ to $n = 20$ data points, and the printout on p. 669 was obtained.

a. What are the sample estimates of β_0, β_1, and β_2?

b. What is the least squares prediction equation?

c. Find SSE, MSE, and s. Interpret the standard deviation in the context of the problem.

d. Test H_0: $\beta_1 = 0$ against H_a: $\beta_1 \neq 0$. Use $\alpha = .05$.

e. Use a 95% confidence interval to estimate β_2.

f. Find R^2 and R_a^2 and interpret these values.

g. Use the two formulas given in this section to calculate the test statistic for the null hypothesis H_0: $\beta_1 = \beta_2 = 0$.

MINITAB output for Exercise 12.6

```
The regression equation is
Y = 506.35 - 941.9 X1 - 429.1 X2


Predictor      Coef  SE Coef      T      P
Constant    506.346   45.17  11.21  0.000
X1         -941.900  275.08  -3.42  0.003
X2         -429.060  379.83  -1.13  0.274


S = 94.251     R-Sq = 45.9%     R-Sq(adj) = 39.6%


Analysis of Variance

Source           DF      SS      MS     F      P
Regression        2  128329   64165  7.22  0.005
Residual Error   17  151016    8883
Total            19  279345
```

Compare your results with the test statistic shown on the printout.

h. Find the observed significance level of the test you conducted in part **g.** Interpret the value.

section 12.3 # 23

Multiple linear regression results:
Dependent Variable: ARSENIC
Independent Variable(s): LATITUDE, LONGITUDE, DEPTH-FT
ARSENIC = -86867.913 + -2218.7568 LATITUDE + 1542.1627 LONGITUDE + -0.34962436 DEPTH-FT

Parameter estimates:

Parameter	Estimate	Std. Err.	Alternative	DF	T-Stat	P-value
Intercept	-86867.913	31224.267	≠ 0	323	-2.7820641	0.0057
LATITUDE	-2218.7568	526.81651	≠ 0	323	-4.211631	<0.0001
LONGITUDE	1542.1627	373.07207	≠ 0	323	4.1336857	<0.0001
DEPTH-FT	-0.34962436	0.15661719	≠ 0	323	-2.2323498	0.0263

Analysis of variance table for multiple regression model:

Source	DF	SS	MS	F-stat	P-value
Model	3	505770.42	168590.14	15.798641	<0.0001
Error	323	3446791.2	10671.18		
Total	326	3952561.6			

Summary of fit:
Root MSE: 103.3014
R-squared: 0.128
R-squared (adjusted): 0.1199

section 12.3 # 27

Multiple linear regression results:
Dependent Variable: HEATRATE
Independent Variable(s): RPM, INLET-TEMP, EXH-TEMP, CPRATIO, AIRFLOW
HEATRATE = 13614.461 + 0.088785907 RPM + -9.2008732 INLET-TEMP + 14.393853 EXH-TEMP + 0.35190426 CPRATIO + -0.84795834 AIRFLOW

Parameter estimates:

Parameter	Estimate	Std. Err.	Alternative	DF	T-Stat	P-value
Intercept	13614.461	870.01294	≠ 0	61	15.648573	<0.0001
RPM	0.088785907	0.013912265	≠ 0	61	6.381844	<0.0001
INLET-TEMP	-9.2008732	1.4991957	≠ 0	61	-6.1372062	<0.0001
EXH-TEMP	14.393853	3.46095	≠ 0	61	4.1589311	0.0001
CPRATIO	0.35190426	29.55568	≠ 0	61	0.011906485	0.9905
AIRFLOW	-0.84795834	0.44211432	≠ 0	61	-1.9179617	0.0598

Analysis of variance table for multiple regression model:

Source	DF	SS	MS	F-stat	P-value
Model	5	1.5505527e8	31011055	147.30446	<0.0001
Error	61	12841935	210523.53		
Total	66	1.6789721e8			

Summary of fit:
Root MSE: 458.82843
R-squared: 0.9235
R-squared (adjusted): 0.9172

section 12.4 # 37

MIMITAB output for Exercise 12.37

```
Predicted Values for New Observations

New
Obs      Fit  SE Fit         95% CI               95% PI
  1  12632.5   237.3  (12157.9, 13107.1)  (11599.6, 13665.5)


Values of Predictors for New Observations

New
Obs    RPM  INLET-TEMP  EXH-TEMP  CPRATIO  AIRFLOW
  1   7500        1000       525     13.5     10.0
```

section 12.4 # 38

Multiple linear regression results:
Dependent Variable: Precip
Independent Variable(s): Altitude, Latitude, Distance
Precip = -102.35743 + 0.0040905182 Altitude + 3.4510798 Latitude + -0.14285778 Distance

Parameter estimates:

Parameter	Estimate	Std. Err.	Alternative	DF	T-Stat	P-value
Intercept	-102.35743	29.205482	≠ 0	26	-3.5047335	0.0017
Altitude	0.0040905182	0.001218311	≠ 0	26	3.3575321	0.0024
Latitude	3.4510798	0.79486312	≠ 0	26	4.3417283	0.0002
Distance	-0.14285778	0.036340056	≠ 0	26	-3.9311381	0.0006

Analysis of variance table for multiple regression model:

Source	DF	SS	MS	F-stat	P-value
Model	3	4809.356	1603.1187	13.015993	<0.0001
Error	26	3202.2976	123.16529		
Total	29	8011.6536			

Summary of fit:
Root MSE: 11.097986
R-squared: 0.6003
R-squared (adjusted): 0.5542

section 12.4 #40

Multiple linear regression results:
Dependent Variable: ManHours
Independent Variable(s): Capacity, Pressure, Boiler, Drum
ManHours = -3783.4329 + 0.0087490107 Capacity + 1.9264772 Pressure + 3444.2546 Boiler + 2093.3536 Drum

Parameter estimates:

Parameter	Estimate	Std. Err.	Alternative	DF	T-Stat	P-value
Intercept	-3783.4329	1205.49	≠ 0	31	-3.1385022	0.0037
Capacity	0.0087490107	0.00090346789	≠ 0	31	9.6838092	<0.0001
Pressure	1.9264772	0.64890691	≠ 0	31	2.9688036	0.0057
Boiler	3444.2546	911.72829	≠ 0	31	3.7777205	0.0007
Drum	2093.3536	305.63368	≠ 0	31	6.849224	<0.0001

Analysis of variance table for multiple regression model:

Source	DF	SS	MS	F-stat	P-value
Model	4	2.3085485e8	57713714	72.11376	<0.0001
Error	31	24809761	800314.86		
Total	35	2.5566461e8			

Summary of fit:
Root MSE: 894.60319
R-squared: 0.903
R-squared (adjusted): 0.8904