4.1 節

4.1 a $\bar{x} = \frac{\sum x_i}{n} = \frac{52+25+15+0+104+44+60+30+33+81+40+5}{12} = \frac{489}{12} = 40.75$

Ordered data: 0, 5, 15, 25, 30, 33, 40, 44, 52, 60, 81, 104; Median = (33 + 40)/2 = 36.5

Mode = all

4.2 a $\bar{x} = \frac{\sum x_i}{n} = \frac{5.5+7.2+1.6+22.0+8.7+2.8+5.3+3.4+12.5+18.6+8.3+6.6}{12} = \frac{102.5}{12} = 8.54$

Ordered data: 1.6, 2.8, 3.4, 5.3, 5.5, 6.6, 7.2, 8.3, 8.7, 12.5, 18.6, 22.0; Median = 6.9

Mode = all

b The mean number of miles jogged is 8.54. Half the sample jogged more than 6.9 miles and half jogged less.

4.3 a $\bar{x} = \frac{\sum x_i}{n} = \frac{14+8+3+2+6+4+9+13+10+12+7+4+9+13+15+8+11+12+4+0}{20}$

$= \frac{164}{20} = 8.2$

Ordered data: 0, 2, 3, 4, 4, 4, 6, 7, 8, 8, 9, 9, 10, 11, 12, 12, 13, 13, 14, 15; Median = 8.5

Mode = 4

b The mean number of days to submit grades is 8.2, the median is 8.5, and the mode is 4.

4.2 節

4.12 $\bar{x} = \frac{\sum x_i}{n} = \frac{4+5+3+6+5+6+5+6}{8} = \frac{40}{8} = 5$

$$s^2 = \frac{\sum (x_i - \bar{x})^2}{n-1} = \frac{[(4-5)^2 + (5-5)^2 + \ldots + (6-5)^2}{8-1} = \frac{8}{7} = 1.14$$

4.13 $\bar{x} = \frac{\sum x_i}{n} = \frac{0+(-5)+(-3)+6+4+(-4)+1+(-5)+0+3}{10} = \frac{-3}{10} = -.30$

$$s^2 = \frac{\sum (x_i - \bar{x})^2}{n-1} = \frac{[(0-(-.3))^2 + ((-5)-(-.3))^2 + \ldots + (3-(-.3))^2}{10-1} = \frac{136.1}{9} = 15.12$$

$$s = \sqrt{s^2} = \sqrt{15.12} = 3.89$$

4.16

a. About 68%

b. About 95%

c. About 99.7%

4.18

a at least 75%

b at least 88.9%

4.3 節

4.23 First quartile: $L_{25} = (15+1)\frac{25}{100}$ = (16)(.25) = 4; the fourth number is 3.

Second quartile: $L_{50} = (15+1)\frac{50}{100}$ = (16)(.5) = 8; the eighth number is 5.

Third quartile: $L_{75} = (15+1)\frac{75}{100}$ = (16)(.75) = 12; the twelfth number is 7.

4.25 20th percentile: $L_{20} = (10+1)\frac{20}{100}$ = (11)(.20) = 2.2; the 20th percentile is 43 + .2(51–43) = 44.6.

40th percentile: $L_{40} = (10+1)\frac{40}{100}$ = (11)(.40) = 4.4; the 40th percentile is 52 +.4(60–52) = 55.2.

4.26 First quartile: $L_{25} = (13+1)\frac{25}{100}$ = (14)(.25) = 3.5; the first quartile is 13.05.

Second quartile: $L_{50} = (13+1)\frac{50}{100}$ = (14)(.5) = 7; the second quartile is 14.7.

Third quartile: $L_{75} = (13+1)\frac{75}{100}$ = (14)(.75) = 10.5; the third quartile is 15.6.

4.27 Interquartile range = 15.6 –13.05 = 2.55

4.28 First quartile = 5.75, third quartile = 15; interquartile range = 15 – 5.75 = 9.25

4.4 節

4.33a.

	x_i	y_i	x_i^2	y_i^2	$x_i y_i$
	20	14	400	196	280
	40	16	1600	256	640
	60	18	3600	324	1080
	50	17	2500	289	850
	50	18	2500	324	900
	55	18	3025	324	990
	60	18	3600	324	1080
	70	20	4900	400	1400
Total	405	139	22,125	2,437	7,220

$$\sum_{i=1}^{n} x_i = 405 \qquad \sum_{i=1}^{n} y_i = 139 \qquad \sum_{i=1}^{n} x_i^2 = 22{,}125 \quad \sum_{i=1}^{n} y_i^2 = 2{,}437 \quad \sum_{i=1}^{n} x_i y_i = 7{,}220$$

$$s_{xy} = \frac{1}{n-1}\left[\sum_{i=1}^{n} x_i y_i - \frac{\sum_{i=1}^{n} x_i \sum_{i=1}^{n} y_i}{n}\right] = \frac{1}{8-1}\left[7{,}220 - \frac{(405)(139)}{8}\right] = 26.16$$

$$s_x^2 = \frac{1}{n-1}\left[\sum_{i=1}^{n} x_i^2 - \frac{\left(\sum_{i=1}^{n} x_i\right)^2}{n}\right] = \frac{1}{8-1}\left[22{,}125 - \frac{(405)^2}{8}\right] = 231.7$$

$$s_x = \sqrt{s_x^2} = \sqrt{231.7} = 15.22$$

$$s_y^2 = \frac{1}{n-1}\left[\sum_{i=1}^{n} y_i^2 - \frac{\left(\sum_{i=1}^{n} y_i\right)^2}{n}\right] = \frac{1}{8-1}\left[2{,}437 - \frac{(139)^2}{8}\right] = 3.13$$

$$s_y = \sqrt{s_y^2} = \sqrt{3.13} = 1.77$$

$$r = \frac{s_{xy}}{s_x s_y} = \frac{26.16}{\sqrt{(15.22)(1.77)}} = ..9711$$

$$R^2 = r^2 = .9711^2 = .9430$$

The covariance is 26.16, the coefficient of correlation is .9711 and the coefficient of determination is .9430.

94.30% of the variation in expenses is explained by the variation in total sales.

b. $$b_1 = \frac{s_{xy}}{s_x^2} = \frac{26.16}{231.7} = .113$$

$$\bar{x} = \frac{\sum x_i}{n} = \frac{405}{8} = 50.63$$

$$\bar{y} = \frac{\sum y_i}{n} = \frac{139}{8} = 17.38$$

$$b_0 = \bar{y} - b_1\bar{x} = 17.38 - (.113)(50.63) = 11.66$$

The least squares line is

$$\hat{y} = 11.66 + .113x$$

The estimated variable cost is .113 and the estimated fixed cost is 11.66.

4.34

	x_i	y_i	x_i^2	y_i^2	$x_i y_i$
	40	77	1,600	5,929	3,080
	42	63	1,764	3,969	2,646
	37	79	1,369	6,241	2,923
	47	86	2,209	7,396	4,041
	25	51	625	2,601	1,276
	44	78	1,936	6,084	3,432
	41	83	1,681	6,889	3,403
	48	90	2,304	8,100	4,320
	35	65	1,225	4,225	2,275
	28	47	784	2,209	1,316
Total	387	719	15,497	53,643	28,712

$$\sum_{i=1}^{n} x_i = 387 \qquad \sum_{i=1}^{n} y_i = 719 \qquad \sum_{i=1}^{n} x_i^2 = 15{,}497 \quad \sum_{i=1}^{n} y_i^2 = 53{,}643 \quad \sum_{i=1}^{n} x_i y_i = 28{,}712$$

a $$s_{xy} = \frac{1}{n-1}\left[\sum_{i=1}^{n} x_i y_i - \frac{\sum_{i=1}^{n} x_i \sum_{i=1}^{n} y_i}{n}\right] = \frac{1}{10-1}\left[28{,}712 - \frac{(387)(719)}{10}\right] = 98.52$$

$$s_x^2 = \frac{1}{n-1}\left[\sum_{i=1}^{n} x_i^2 - \frac{\left(\sum_{i=1}^{n} x_i\right)^2}{n}\right] = \frac{1}{10-1}\left[15{,}497 - \frac{(387)^2}{10}\right] = 57.79$$

$$s_y^2 = \frac{1}{n-1}\left[\sum_{i=1}^{n} y_i^2 - \frac{\left(\sum_{i=1}^{n} y_i\right)^2}{n}\right] = \frac{1}{10-1}\left[53{,}643 - \frac{(719)^2}{10}\right] = 216.32$$

b $$r = \frac{s_{xy}}{s_x s_y} = \frac{98.52}{\sqrt{(57.79)(216.32)}} = .8811$$

c $R^2 = r^2 = .8811^2 = .7763$

d $$b_1 = \frac{s_{xy}}{s_x^2} = \frac{98.52}{57.79} = 1.705$$

$$\bar{x} = \frac{\sum x_i}{n} = \frac{387}{10} = 38.7$$

$$\bar{y} = \frac{\sum y_i}{n} = \frac{719}{10} = 71.9$$

$$b_0 = \bar{y} - b_1\bar{x} = 71.9 - (1.705)(38.7) = 5.917$$

The least squares line is

$$\hat{y} = 5.917 + 1.705x$$

e. There is a strong positive linear relationship between marks and study time. For each additional hour of study time marks increased on average by 1.705.