

HW7-Solution

1. Outdoor temperature influences natural gas consumption for the purpose of heating a house. The usual measure of the need for heating is the number of heating degree days for heating degree days. a particular day is the number of degrees the average temperature for that day is below 65°F, where the average temperature for a day is the mean of the high and low temperatures for that day. An average temperature of 20°F, for example, corresponds to 45 heating degree days. A homeowner interested in switching to solar heating panels collects the following data on her natural gas use for the months October through June, where is heating degree days x y per day for the month and is gas consumption per day in hundreds of cubic feet.

Month	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun
x	15.6	26.8	37.8	36.4	35.5	18.6	15.3	7.9	0
y	5.2	6.1	8.7	8.5	8.8	4.9	4.5	2.5	1.1

- a. Calculate the correlation coefficient and interpret its value; draw a scatterplot of the data.

Month	x	y	xy	x ²	y ²
Oct	15.6	5.2	81.12	243.36	27.04
Nov	26.8	6.1	163.48	718.24	37.21
Dec	37.8	8.7	328.86	1428.84	75.69
Jan	36.4	8.5	309.4	1324.96	72.25
Feb	35.5	8.8	312.4	1260.25	77.44
Mar	18.6	4.9	91.14	345.96	24.01
Apr	15.3	4.5	68.85	234.09	20.25
May	7.9	2.5	19.75	62.41	6.25
Jun	0	1.1	0	0	1.21
SUM	193.9	50.3	1375	5618.11	341.35

$$\begin{aligned}
 r &= \frac{n(\sum xy) - (\sum x)(\sum y)}{\sqrt{[n(\sum x^2) - (\sum x)^2][n(\sum y^2) - (\sum y)^2]}} \\
 &= \frac{9(1375) - (193.9)(50.3)}{\sqrt{[9(5618.11) - (193.9)^2][9(341.35) - (50.3)^2]}} \\
 r &= 0.989
 \end{aligned}$$

- b. Calculate the least squares regression line $y = b_0 + b_1x$ of gas consumption y on heating degree days x . Draw the regression line on the scatterplot.

$$m = \frac{n(\sum xy) - (\sum x)(\sum y)}{n(\sum x^2) - (\sum x)^2} = \frac{9(1375) - (0.989)(50.3)}{9(5618.11) - (193.9)^2} = 0.202$$

$$b = \frac{(\sum y) - m(\sum x)}{n} = \frac{(50.3) - (0.202)(193.9)}{9} = 1.24$$

$$y = mx + b = 0.202x + 1.24$$

