Example 1 Heights of Mothers, Fathers, and Daughters

Table 10-4 includes a random sample of heights of mothers, fathers, and their daughters (based on data from the National Health and Nutrition Examination). Find the multiple regression equation in which the response (y) variable is the height of a daughter and the predictor (x) variables are the height of the mother and height of the father.

Solution

Using Minitab with the sample data in Table 10-4, we obtain the results shown in the display.

Table 10-4 Heights (in inches) of Mothers, Fathers, and Their Daughters

Height of Mother	Height of Father	Height of Daughter
63	64	58.6
67	65	64.7
64	67	65.3
60	72	61.0
65	72	65.4
67	72	67.4
59	67	60.9
60	71	63.1
58	66	60.0
72	75	71.1
63	69	62.2
67	70	67.2
62	69	63.4
69	62	68.4
63	66	62.2
64	76	64.7
63	69	59.6
64	68	61.0
60	66	64.0
65	68	65.4

MINITAB

```
The regression equation is
Daughter = 7.5 + 0.707 Mother + 0.164 Father

Predictor      Coef  SE Coef      T      P
Constant       7.45    10.88   0.69  0.503
Mother       0.7072   0.1289   5.49  0.000
Father       0.1636   0.1266   1.29  0.213

S = 1.93990   R-Sq = 67.5%   R-Sq(adj) = 63.7%

Analysis of Variance
Source           DF       SS      MS      F      P
Regression        2  132.997  66.499  17.67  0.000
Residual Error   17   63.975   3.763
Total            19  196.972
```

From the display, we see that the multiple regression equation is

$$\text{Daughter} = 7.5 + 0.707\ \text{Mother} + 0.164\ \text{Father}$$

Using our notation presented earlier in this section, we could write this equation as

$$\hat{y} = 7.5 + 0.707x_1 + 0.164x_2$$

where $\hat{y}$ is the predicted height of a daughter, x_1 is the height of the mother, and x_2 is the height of the father.