# EXERCISES 14

**1.** The local ice cream shop keeps track of how much ice cream they sell versus the temperature on that day, here are their figures for the last 12 days:

| *Ice Cream Sales vs Temperature* | |
|---|---|
| **Temperature °C** | **Ice Cream Sales** |
| 14.2° | $215 |
| 16.4° | $325 |
| 11.9° | $185 |
| 15.2° | $332 |
| 18.5° | $406 |
| 22.1° | $522 |
| 19.4° | $412 |
| 25.1° | $614 |
| 23.4° | $544 |
| 18.1° | $421 |
| 22.6° | $445 |
| 17.2° | $408 |

Calculate the correlation coefficient. Predict the Ice Cream Sales for Temperature 27°C.

**2.** The following table gives the heights and weights of 10 friends:

| Name | Height (cm) | Weight (kg) |
|---|---|---|
| Albert | 180 | 87 |
| Beth | 176 | 65 |
| Cindy | 144 | 52 |
| David | 195 | 94 |
| Emily | 159 | 87 |
| Frank | 185 | 79 |
| Gary | 166 | 59 |
| Helen | 173 | 64 |
| Ida | 149 | 45 |
| Jeremy | 168 | 77 |

Calculate the correlation coefficient. Estimate the linear regression line.

**3.** The following table gives the math scores and times taken to run 100 m for 10 friends:

| Name | Math score (%) | Time taken to run 100 m (secs) |
|---|---|---|
| Albert | 56 | 11.3 |
| Beth | 29 | 12.9 |
| Cindy | 45 | 11.9 |
| David | 93 | 10.2 |
| Emily | 67 | 11.1 |
| Frank | 38 | 12.5 |
| Gary | 85 | 10.8 |
| Helen | 77 | 10.5 |
| Ida | 56 | 12.0 |
| Jeremy | 71 | 10.9 |

Calculate the correlation coefficient. Estimate the linear regression line.

4. Crickets make their chirping sounds by rapidly sliding one wing over the other. The faster they move their wings, the higher the chirping sound that is produced. Scientists have noticed that crickets move their wings faster in warm temperatures than in cold temperatures. Therefore, by listening to the pitch of the chirp of crickets, it is possible to tell the temperature of the air. The table below gives the recorded pitch (in vibrations per second) of a cricket chirping recorded at 15 different temperatures (in Fahrenheit):

5.

| Chirps/Second | Temperature |
|---|---|
| 20 | 89 |
| 16 | 72 |
| 20 | 93 |
| 18 | 84 |
| 17 | 81 |
| 16 | 75 |
| 15 | 70 |
| 17 | 82 |
| 15 | 69 |
| 16 | 83 |
| 15 | 80 |
| 17 | 83 |
| 16 | 81 |
| 17 | 84 |
| 14 | 76 |

What if someone asked you what the temperature was, but you couldn't use a thermometer?
Could you use the crickets?
If yes: What the temperature of the air if crickets Chirps/Second =10?

6. ***Farr's study of elevation and cholera mortality.*** William Farr (1807–1883) is a titan in the history of epidemiology and public health. He was the first Registrar General of a national vital statistics organization and he innovated many of the methods still used today to collect and analyze population-based health statistics. At the same time, like many of his contemporaries, Farr erroneously believed that epidemics were caused by spontaneous generations and miasmas (bad air) that emanated from the environment; Farr was *not* a contagionist. In 1852, Farr reported on the association between low elevation and cholera. Some of his data are reported below.

| *i* | Mean elevation (feet) | Cholera mortality (per 10,000) |
|---|---|---|
| 1 | 10 | 102 |
| 2 | 30 | 65 |
| 3 | 50 | 34 |
| 4 | 70 | 27 |
| 5 | 90 | 22 |
| 6 | 100 | 17 |
| 7 | 350 | 8 |

Calculate the correlation coefficient. Predict Cholera mortality for mean elevation = 250 feet.

**6.** A professor in the School of Business in a university polled a dozen colleagues about the number of professional meetings professors attended in the past five years (x) and the number of papers submitted by those to refereed journals (y) during the same period. The summary data are given as follows:

$$n = 12, \quad \bar{x} = 4, \quad \bar{y} = 12, \sum_{i=1}^{n} x_i^2 = 232, \sum_{i=1}^{n} x_i y_i = 318$$

Fit a simple linear regression model between x and y by finding out the estimates of intercept and slope. Comment whether attending professional meetings would result in publishing more papers.

**7.** The data were obtained in a study of the relationship between the weight(x ) and chest size(y) of infants at birth. The summary data are given as follows:

$$\text{cov}(x, y) = 21.8507, \quad \text{var}(x) = 9.9955, \quad \text{var}(y) = 77.62, \quad n = 9$$

(a) Calculate r. Interpret it.
(b) Test the null hypothesis that $\rho = 0$ against the alternative that $\rho \neq 0$ at the 0.01 level of significance.

**8.** A study was made on the amount of converted sugar (*y*) in a certain process at various temperatures (*x*). The summary data are given as follows:

$$n = 11, \sum_{i=1}^{n} x_i = 16.5, \sum_{i=1}^{n} y_i = 100.4, \sum_{i=1}^{n} x_i^2 = 25.85,$$

$$\sum_{i=1}^{n} y_i^2 = 923.58, \sum_{i=1}^{n} x_i y_i = 152.59$$

(a) Calculate *r*. Interpret it.
(b) Test the null hypothesis that $\rho = 0$ against the alternative that $\rho \neq 0$ at the 0.05 level of significance.
(c) Estimate the linear regression line. (*y* depends on *x*)
(d) Estimate the mean amount of converted sugar produced when the coded temperature is 1.75.

**9.** A study was made by a retail merchant to determine the relation between weekly advertising cost *(x)* and sales *(y)*. The summary data are given as follows:

$$n = 12, \sum_{i=1}^{n} x_i = 410, \sum_{i=1}^{n} y_i = 5\ 445, \sum_{i=1}^{n} x_i^2 = 15\ 650,$$

$$\sum_{i=1}^{n} y_i^2 = 2\ 512\ 625, \sum_{i=1}^{n} x_i y_i = 191\ 325$$

(a) Calculate *r*. Interpret it.
(b) Test the null hypothesis that $\rho = 0$ against the alternative that $\rho \neq 0$ at the 0.02 level of significance.
(c) Estimate the linear regression line. (*y* depends on *x*)
(d) Estimate the weekly sales when advertising costs are $35.