

1.19. **Grade point average.** The director of admissions of a small college selected 120 students at random from the new freshman class in a study to determine whether a student's grade point average (GPA) at the end of the freshman year ( $Y$ ) can be predicted from the ACT test score ( $X$ ). The results of the study follow. Assume that first-order regression model (1.1) is appropriate.

$i$ :	1	2	3	...	118	119	120
$X_i$ :	21	14	28	...	28	16	28
$Y_i$ :	3.897	3.885	3.778	...	3.914	1.860	2.948

- Obtain the least squares estimates of  $\beta_0$  and  $\beta_1$ , and state the estimated regression function.
- Plot the estimated regression function and the data. Does the estimated regression function appear to fit the data well?
- Obtain a point estimate of the mean freshman GPA for students with ACT test score  $X = 30$ .
- What is the point estimate of the change in the mean response when the entrance test score increases by one point?

\*1.20. **Copier maintenance.** The Tri-City Office Equipment Corporation sells an imported copier on a franchise basis and performs preventive maintenance and repair service on this copier. The data below have been collected from 45 recent calls on users to perform routine preventive maintenance service; for each call,  $X$  is the number of copiers serviced and  $Y$  is the total number of minutes spent by the service person. Assume that first-order regression model (1.1) is appropriate.

$i$ :	1	2	3	...	43	44	45
$X_i$ :	2	4	3	...	2	4	5
$Y_i$ :	20	60	46	...	27	61	77

- Obtain the estimated regression function.
- Plot the estimated regression function and the data. How well does the estimated regression function fit the data?
- Interpret  $b_0$  in your estimated regression function. Does  $b_0$  provide any relevant information here? Explain.
- Obtain a point estimate of the mean service time when  $X = 5$  copiers are serviced.

\*1.21. **Airfreight breakage.** A substance used in biological and medical research is shipped by airfreight to users in cartons of 1,000 ampules. The data below, involving 10 shipments, were collected on the number of times the carton was transferred from one aircraft to another over the shipment route ( $X$ ) and the number of ampules found to be broken upon arrival ( $Y$ ). Assume that first-order regression model (1.1) is appropriate.

$i$ :	1	2	3	4	5	6	7	8	9	10
$X_i$ :	1	0	2	0	3	1	0	1	2	0
$Y_i$ :	16	9	17	12	22	13	8	15	19	11

- Obtain the estimated regression function. Plot the estimated regression function and the data. Does a linear regression function appear to give a good fit here?
- Obtain a point estimate of the expected number of broken ampules when  $X = 1$  transfer is made.