

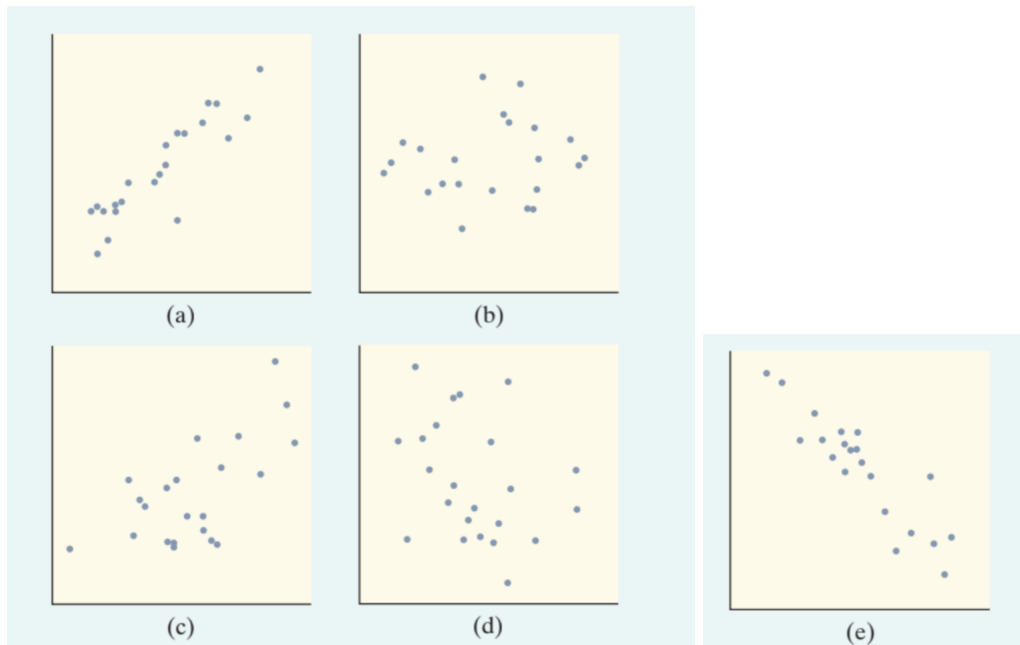
**AP STATISTICS  
PROBLEM SET 05**

DUE DATE: SEPTEMBER 20, 2023

**Question 1.** Finish the 15 MCQ on AP Classroom

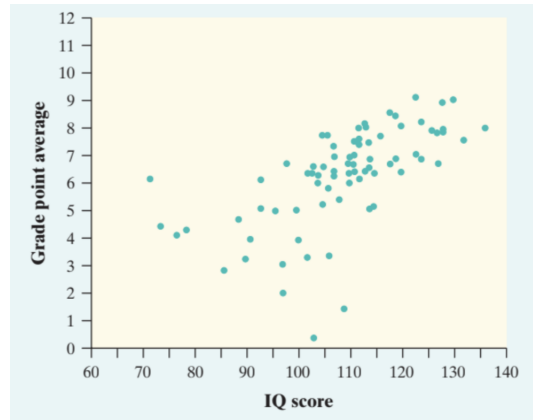
**Question 2** (Starnes, §3.1.15). Match each of the following scatterplots to the  $r$  below that best describes it. (Some  $r$ 's will be left over.)

$r = -0.9, \quad r = -0.7, \quad r = -0.3, \quad r = 0$   
 $r = 0.3, \quad r = 0.7, \quad r = 0.9$



**Question 3** (Starnes, §3.1.3). Do students with higher IQ test scores tend to do better in school?

The figure below shows a scatterplot of IQ and school grade point average (GPA) for all 78 seventh-grade students in a rural midwestern school. GPA was recorded on a 12-point scale with  $A+ = 12$ ,  $A = 11$ ,  $A- = 10$ ,  $B+ = 9$ ,  $\dots$ ,  $D- = 1$ , and  $F = 0$ .



Comment on the form and strength of the relationship shown in the scatterplot between GPA and IQ Score, according to this survey.

**Question 4.** Recall that **the** regression line (the least squares regression line) of  $Y$  on  $X$  is given by the equation

$$y = a + bx$$

where  $b = \frac{\text{cov}(X, Y)}{\text{var}(X)}$  and  $a = \mu_Y - b\mu_X$ .

Recalling from class that we have the following results:

$$(1) \ r(X, Y) = \frac{\text{cov}(X, Y)}{\sigma_X \sigma_Y}$$

$$(2) \ \text{cov}(X, Y) = \text{cov}(Y, X)$$

$$(3) \ \text{and } \text{Var}(X) = \sigma_X^2$$

Prove the following formulas must also be true:

$$(a) \ r(X, Y) = r(Y, X)$$

$$(b) \ \text{Slope of the regression line is } b = r \frac{\sigma_Y}{\sigma_X}$$

**Question 5.** Suppose we have **the** regression line of  $Y$  on  $X$  given by the equation

$$y = a + bx$$

and then we find **the** regression of  $X$  on  $Y$  which is given by the equation

$$x = c + dy$$

Using **Question 4** part (b), prove that

$$bd = r^2.$$

**Question 6.** Consider  $n$  pairs of numbers with  $\mu_X = 2$ ,  $\mu_Y = 4$  and  $\sigma_X = 3$  and  $\sigma_Y = 5$ . Given that  $r = 0.6$ , find the equation of the least squares regression line.

**Question 7.** You and a friend want to examine the relationship between GPA of first year college students and their senior year SAT scores.

- (a) Your friend proposes the following regression model for predictions:

$$GPA = 0.25 + 0.002234 * (\text{SAT score})$$

Correct the formatting of the equation.

- (b) You find that the  $r$ -value for the equation your friend proposed is  $r = 0.754$ . What percentage of variation in GPA can be accounted for by the variation of SAT scores by the linear regression model?
- (c) Your SAT score was a 1580. What is the predicted first year GPA according to the model?
- (d) Your first year GPA was a 2.9. Calculate the residual.