

Association and Correlation

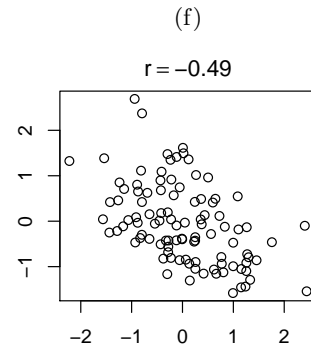
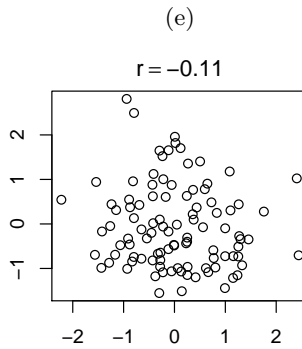
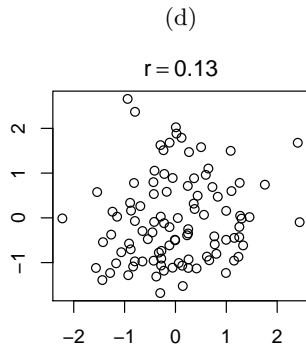
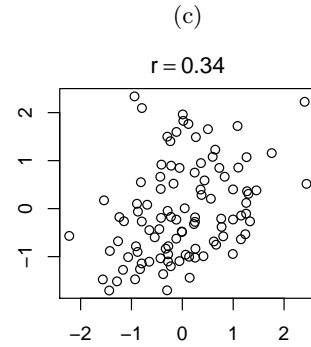
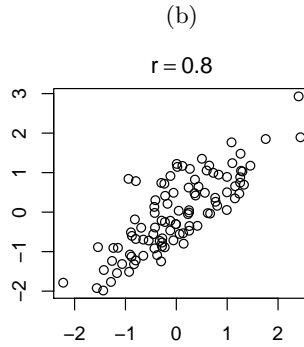
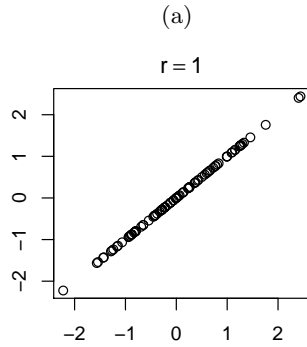
1. Let us consider a test of children's ability to write French text correctly from dictation. For simplicity we may assume that the spoken French is standardized by using a tape recorder, that the scoring has been made uniform, and that the scorers can decipher all the handwritings involved. Let

y = the score on this dictation test,

x = the weight of the child.

What is the relation between y and x ?

2. Consider two variables, x and y . In the scenarios below, we have collected $n = 100$ measurements of (x, y) pairs. There is a scatterplot of the 100 points, along with the computed correlation between the two variables. Is there an apparent association between the two variables? Is the relationship positive or negative? Weak or strong?



Causation

3. Consider a general x and y . How might one confirm the three requirements for causation?

(a) Consistency?

(b) Responsiveness?

(c) A mechanism?

Lurking Variables

In each of the following situations, a lurking variable can explain a strong association between two variables (some of these are taken from the Wikipedia article “Correlation does not imply causation”). Give an example of a potential lurking variable.

4. Sleeping with one’s shoes on is strongly correlated with waking up with a headache.
5. During the industrial revolution in the United States (1750–1850), there was a strong positive association between the amount of scotch whisky imported into New York and the number of ministers there as well.
6. As ice cream sales increase, the rate of drowning deaths increases sharply.
7. There is a positive association between high school seniors’ GPAs and their SAT scores.
8. Since the 1950s, both the atmospheric carbon dioxide level and obesity levels have increased sharply.
9. An article in the May 13, 1999 issue of *Nature* found that young children who sleep with the light on are much more likely to develop myopia in later life. Explain why this does not imply that sleeping with the light on causes myopia.