

## 4.4: Properties of $r$

### Learning Objectives

- State the range of values for Pearson's correlation
- State the values that represent perfect linear relationships
- State the relationship between the correlation of  $Y$  with  $X$  and the correlation of  $X$  with  $Y$
- State the effect of linear transformations on Pearson's correlation

A basic property of Pearson's  $r$  is that its possible range is from  $-1$  to  $1$ . A correlation of  $-1$  means a perfect negative linear relationship, a correlation of  $0$  means no linear relationship, and a correlation of  $1$  means a perfect positive linear relationship.

Pearson's correlation is symmetric in the sense that the correlation of  $X$  with  $Y$  is the same as the correlation of  $Y$  with  $X$ . For example, the correlation of Weight with Height is the same as the correlation of Height with Weight.

A critical property of Pearson's  $r$  is that it is unaffected by linear transformations. This means that multiplying a variable by a constant and/or adding a constant does not change the correlation of that variable with other variables. For instance, the correlation of Weight and Height does not depend on whether Height is measured in inches, feet, or even miles. Similarly, adding five points to every student's test score would not change the correlation of the test score with other variables such as GPA.

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