Finding Relationships Among Variables

BUS 230: Business Research and Communication

Goals

- Specific goals:
  - Re-familiarize ourselves with basic statistics ideas: sampling distributions, hypothesis tests, p-values.
  - Be able to distinguish different types of data and prescribe appropriate statistical methods.
  - Conduct a number of hypothesis tests using methods appropriate for questions involving only one or two variables.
- Learning objectives:
  - LO2: Interpret data using statistical analysis.
  - LO2.3: Formulate conclusions and recommendations based upon statistical results.

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What to Look For

- For each test, remember the following:
  - In plain English, be able to describe the purpose of the test.
  - Know whether the test is a parametric test or a non-parametric test.
  - Know the null and alternative hypotheses.
- When choosing a test to answer a research question, ask yourself:
  1. What is your research question?
  2. How many variables do you have?
  3. What is your scale of measurement?
  4. Are you looking for differences or other relationship?
  5. If you are looking for differences, are your observations independent or paired?
  6. Do the hypotheses (or the result of the hypothesis test) answer your research question?

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Correlation

- A **correlation** exists between two variables when one of them is related to the other in some way, such that there is **co-movement**.
- The **Pearson linear correlation coefficient** is a measure of the strength of the linear relationship between two variables.
  - Parametric test!
  - Null hypothesis: there is zero linear correlation between two variables.
  - Alternative hypothesis: there is a linear correlation (either positive or negative) between two variables.
- Spearman's Rank Test
  - Non-parametric test.
  - Behind the scenes - replaces actual data with their *rank*, computes the Pearson using ranks.
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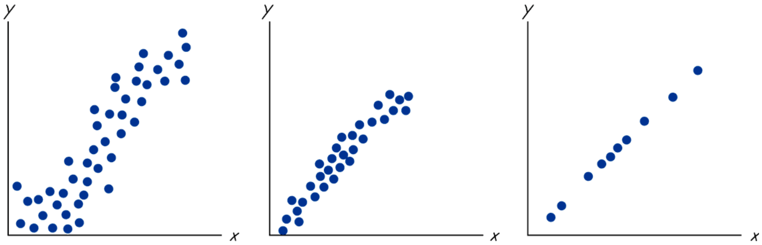
Positive linear correlation



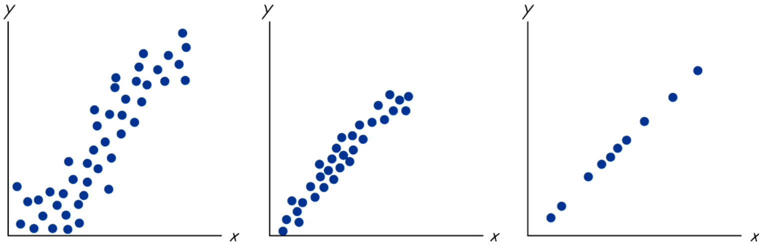
(a) Positive correlation between x and y

(b) Strong positive correlation between x and y

(c) Perfect positive correlation between x and y

- Positive correlation: two variables move in the same direction.
- Stronger the correlation: closer the correlation coefficient is to 1.
- Perfect positive correlation: $\rho = 1$

Positive linear correlation



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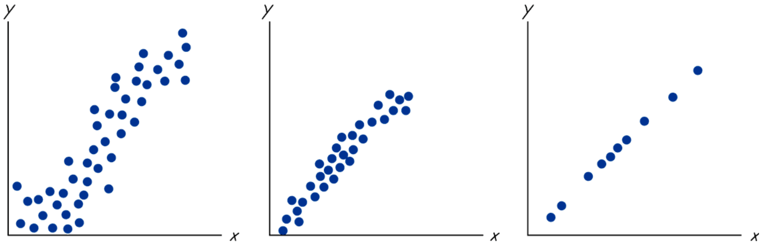

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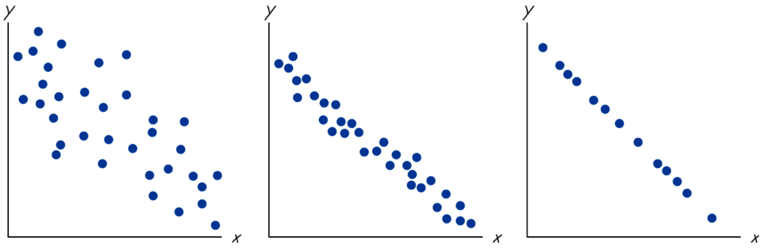
Negative linear correlation



(d) Negative correlation between x and y

(e) Strong negative correlation between x and y

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- Negative correlation: two variables move in opposite directions.
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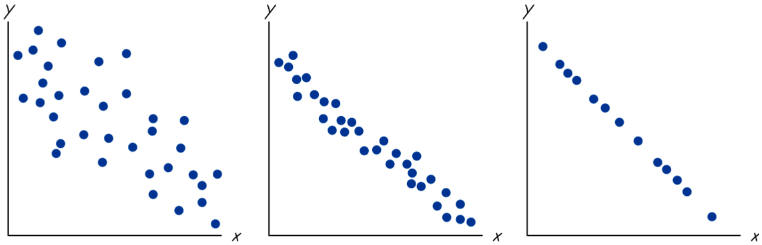
Negative linear correlation



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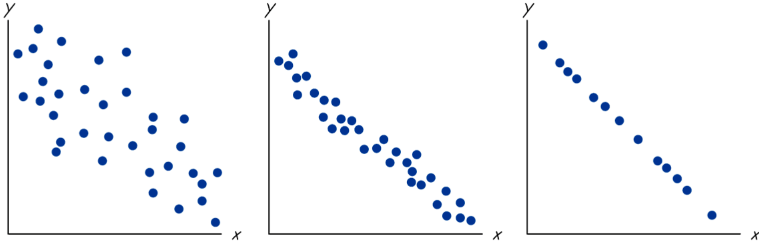

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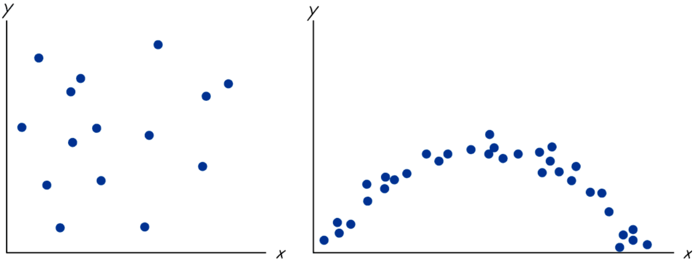
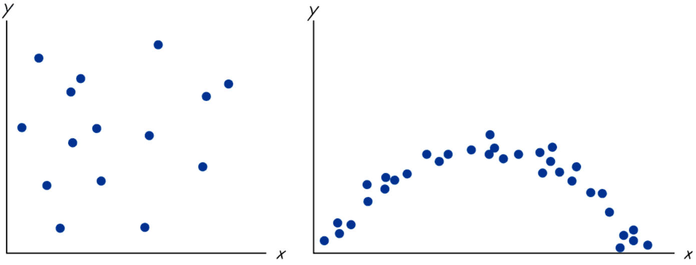


(g) No correlation between x and y

(h) Nonlinear relationship between x and y

- Panel (g): no relationship at all.
- Panel (h): strong relationship, but not a *linear* relationship.
  - Cannot use regular correlation to detect this.

No linear correlation



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Chi-Squared Test for Independence

- Used to determine if two categorical variables (eg: nominal) are related.
- Example: Suppose a hotel manager surveys guest who indicate they will not return:

	Reason for Not Returning		
Reason for Stay	Price	Location	Amenities
Personal/Vacation	48	47	10
Business	20	47	27

- Data in the table are always frequencies that fall into individual categories.
- Could use this table to test if two variables are independent.

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Test of independence

- **Null hypothesis**: there is no relationship between the row variable and the column variable (independent)
- **Alternative hypothesis**: There is a relationship between the row variable and the column variable (dependent).
- Test statistic:

$$\chi^2 = \sum \frac{(O-E)^2}{E}$$

- O: observed frequency in a cell from the contingency table.
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