

Example 23
Spearman Correlation
Solution

1. State your question: Do the lengths of wings and tails co-vary within a species of bird?
 - a. Is it a good scientific question? Definable, measurable, and controllable
 - b. Identify your population: Wing and tail lengths of birds of the same species
 - c. Identify your variables: Wing and tail lengths
2. State your hypothesis set
 - a. Verbal hypothesis: Wing and tail length within a species of birds tends to co-vary.
 - b. Statistical hypothesis (H_0 , H_A).
 - H_0 : Wing and tail length within a species of birds do not tend to co-vary.
 - H_A : Wing and tail length within a species of birds tend to co-vary.
3. State your significance level: $\alpha=0.05$
4. Select the appropriate test.
 - a. Variable scales
 - i. Variable 1: Ratio
 - o Converted: Ratio \rightarrow Ordinal
 - ii. Variable 2: Ratio
 - o Converted: Ratio \rightarrow Ordinal
 - b. What information is given or available?
 - i. Sample data
 - c. Number of samples: Many (12)
 - d. Are the data paired or unpaired? Unpaired
 - e. What aspect of the variable do you want to compare?
 - i. Correlation
 - f. State the test to be used: Spearman correlation (We are assuming that the assumptions of the Pearson correlation were violated.)
 - i. Are the assumptions of the test met? Yes
 - o Random sample – Assumed
 - o Independent sample – Assumed
5. Conduct your sampling
12 birds were captured and their wings and tails were measured.

Wing length(cm)	Tail length (cm)
10.4	7.4
10.8	7.6
11.1	7.9
10.2	7.2
10.3	7.4
10.2	7.1
10.7	7.4
10.5	7.2
10.8	7.8
11.2	7.7
10.6	7.8
11.4	8.3

6. Graph the data

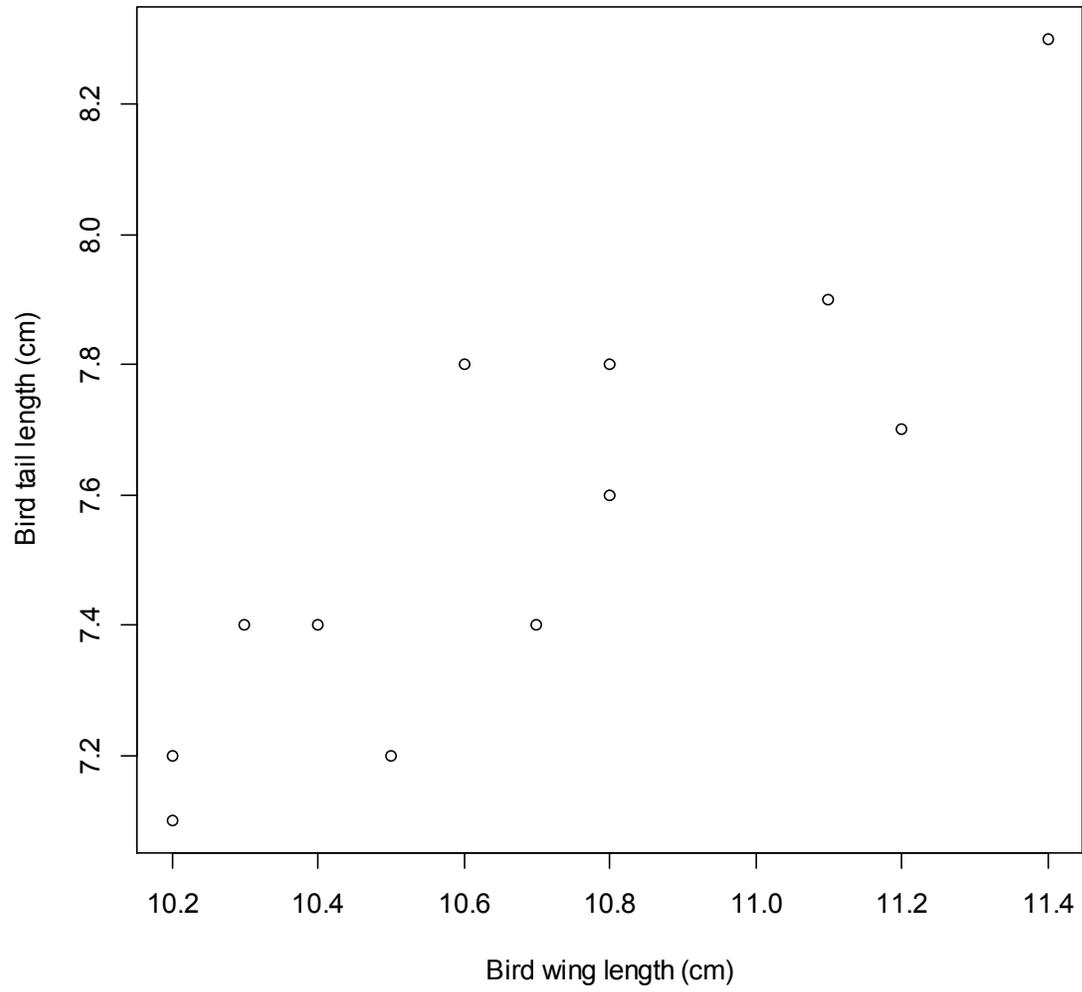


Figure 1. Bird wing length (cm) graphed against bird tail length.

7. Summarize the data
Nothing

- Calculate your test statistic.

Spearman's rank correlation rho

```
data: SBirds$Wing and SBirds$Tail
S = 42.5896, p-value = 0.0004467
alternative hypothesis: true rho is not equal to 0
sample estimates:
  rho
0.8510852
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Warning message:

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In cor.test.default(SBirds$Wing, SBirds$Tail, method = "spearman") :
  Cannot compute exact p-values with ties
```

- Retain or reject your null hypothesis based on your test statistic.
The calculated p-value (0.0004457) is less than the significance level (0.05), so we would reject our null hypothesis and retain our alternate hypothesis.
- Interpret the results in biological terms.
The lengths of wings and tails within a species of bird do co-vary ($r_s = 0.851$, $S=42.590$, $df = 12$, $p<0.001$).