

## Class Exercise

### 1. Teabag Biodiversity

A recent study found that a single teabag can contain traces of up to 400 different kinds of insect DNA, reflecting the biodiversity of the fields where the tea leaves are grown. A food safety researcher believes that for certain popular brands, the true average number of insect DNA types per teabag is actually less than 400.

To investigate this claim, the researcher randomly samples 30 teabags from a major tea manufacturer. DNA barcoding of each teabag reveals an average of  $\bar{x} = 390$  distinct insect DNA types, with a sample standard deviation of 28.

- At the 2.5% level of significance, is there sufficient evidence to support the claim that the average number of insect DNA types per teabag is lower than 400? State the hypotheses clearly, conduct the test, report the estimated  $P$ -value, and write a conclusion in the context of the problem.
- Construct and interpret an appropriate confidence bound for the true mean number of insect DNA types in teabags produced by this manufacturer. Explain how this bound can be used to support the conclusion obtained in part (a).

### 2. Life Spans

A random sample of 100 recorded deaths in the US during the past year showed an average life span of 71.8 years. Assuming a normal population and a population standard deviation of 8.9 years, does this seem to indicate that the mean life span today is greater than 70 years?

- Use 0.05 level of significance.
- 0.01 level of significance.
- What is the  $p$ -value of this test. What is your final conclusion?

### 3. Punctuation Cushioning

Because ending an Internet comment with a punctuation mark can sometimes seem too abrupt or aggressive, many users have begun adopting “punctuation cushioning”: inserting a space before a full stop, question mark, or exclamation mark to soften the tone. A linguist believes that more than 15% of online commenters now use punctuation cushioning regularly.

A random sample of 250 Internet comments revealed that 48 used punctuation cushioning.

- Does this sample provide evidence to support the linguist’s claim? Use  $\alpha = 0.05$  level of significance. Include a conclusion in the context of the problem and report the  $P$ -value.

- b. Construct and interpret an appropriate confidence bound for the true proportion of online comments that use punctuation cushioning. Explain how this confidence bound could be used to support the conclusion in part (a).
- c. State the Type I and Type II errors in the context of this problem.