The manufacturers of Ramen noodles, a favorite college student staple, are interested in whether the variance of sodium levels in their product has **changed** after they began using different ingredients. With the old ingredients, the sodium levels of Ramen were determined to have a population standard deviation of 110 mg. A random sample of 20 packages made with the new ingredients was analyzed and found to have a sample standard deviation of 139.2 mg. Suppose that the sodium levels are normally distributed. Is there evidence at the $\alpha = 0.10$ level that the variance of the sodium content has changed with the new ingredients?

1. Define the parameter in context and state your hypotheses.

2. State and verify that the appropriate conditions for inference are met.

3. Compute the test statistic for this sample. Label it using the correct symbol.

4. Find the critical values for the test and state the rejection region. Include a sketch that shows the rejection region with the critical values on the horizontal axis and the appropriate areas shaded.

5. What is your decision about the null hypothesis? Provide support for your decision.

6. Summarize the results of your test in context.

7. Suppose that a media research group believes that the average age by which an individual under 25 has seen all 8 Harry Potter films is 14 years old. You want to see if this average is higher for students in your residence hall. You take a random sample of 65 fellow students from your dorm and find that the average age by which they had seen all 8 films is 14.8 years old with a standard deviation of 4.5 years old. Test your hypothesis at the $\alpha = 0.01$ level using the **rejection region** approach.

   (a) Define the **parameter** of interest and state the **hypotheses**.

   (b) Verify that the necessary **assumptions** hold.

   (c) Conduct your test by finding the **test statistic** and using the **rejection region** approach.

   (d) What is your decision about the null hypothesis H_0? Justify your answer with the appropriate **support** from your test results.

   (e) **Summarize** the results of your test in context.

8. Tony Stark is developing a new model of the Iron Man suit. His previous suit model uses an average of 222.4 kilowatts (kW), and he wishes to see if his new model is more efficient (in other words, if the mean energy consumption in kW is less than the previous model). He takes a sample of five randomly selected suits made under the new model and finds that the mean energy consumption is 210.2 kW with a standard deviation of 9.9 kW. He knows that the energy consumption for a given suit follows a normal distribution based on his previous tests. Test Tony's hypothesis at the $\alpha = 0.05$ significance level using the **p-value** approach.

   (a) Define the **parameter** of interest and state the **hypotheses**.

   (b) State and verify the necessary **assumptions**.

   (c) Conduct your test by finding the **test statistic** and using the **p-value** approach.

   (d) Provide **support** for your decision regarding the null hypothesis.

   (e) **Summarize** the results of your test in context.

9. Dunder Mifflin recently expanded its supply to include not just paper, but also copiers. David Wallace, the chief financial officer, claims that the expansion is a smashing success, with the copier production process producing defective parts only 0.7% of the time.

   Michael Scott is not superstitious... but he is a little stitious. He believes that David Wallace's claim is incorrect. He randomly selects 750 copier parts and finds 12 that are defective. Do these data provide evidence at the 10% level that the proportion of defective copier parts is **not** 0.7%?

   (a) Define the **parameter** of interest and state the **hypotheses**.

   (b) Verify that the necessary **assumptions** hold.

   (c) Calculate the appropriate **test** statistic. Show your work.

   (d) Find the **rejection region**. Include a sketch showing where your test statistic falls relative to the RR.

   (e) Use the results of the test to provide **support** for your decision about the null hypothesis.

   (f) **Summarize** the results of your hypothesis test in context.

10. As regional co-manager of Dunder Mifflin, Jim suggests using the p-value approach to double check behind Michael. Find the appropriate p-value (use appropriate probability notation) and provide support for a decision about H_0. Does your conclusion change at all?

An expensive new type of fertilizer is being tested on a plot of land at Schrute Farms to see whether it increases the amount of beets produced. The mean number of pounds of beets produced on this plot with the old fertilizer is 400 pounds. Dwight believes that the mean yield will increase with the new fertilizer.

11. Define the **target parameter** in this scenario.

12. Determine the **null and alternative hypotheses** in this problem.

13. Is this a left-tailed, right-tailed, or two-tailed test?

14. Describe a **Type I error** in context of the problem.

15. What might be a **consequence** of committing a Type I error?

16. Describe a **Type II error** in context of the problem.

17. What might be a **consequence** of committing a Type II error?

18. Which of these types of error might we want to minimize? Justify your answer.