Hypothesis Testing

**Background:**

Bombay hospitality Ltd. operates a franchise model for producing exotic Norwegian dinners throughout New England. The operating cost for a franchise in a week (W) is given by the equation W = $1,000 + $5X, where X represents the number of units produced in a week. Recent feedback from restaurant owners suggests that this cost model may no longer be accurate, as their observed weekly operating costs are higher.

**Objective:**

To investigate the restaurant owners' claim about the increase in weekly operating costs using hypothesis testing.

**Data Provided:**

* The theoretical weekly operating cost model: W = $1,000 + $5X
* Sample of 25 restaurants with a mean weekly cost of Rs. 3,050
* Number of units produced in a week (X) follows a normal distribution with a mean (μ) of 600 units and a standard deviation (σ) of 25 units

**Assignment Tasks:**

**1. State the Hypotheses statement:**

**2. Calculate the Test Statistic:**

Use the following formula to calculate the test statistic (t):

where:

* ˉ*x*ˉ = sample mean weekly cost (Rs. 3,050)
* *μ* = theoretical mean weekly cost according to the cost model (W = $1,000 + $5X for X = 600 units)
* *σ* = 5\*25 units
* *n* = sample size (25 restaurants)

**3. Determine the Critical Value:**

Using the alpha level of 5% (α = 0.05), determine the critical value from the standard normal (Z) distribution table.

**4. Make a Decision:**

Compare the test statistic with the critical value to decide whether to reject the null hypothesis.

**5. Conclusion:**

Based on the decision in step 4, conclude whether there is strong evidence to support the restaurant owners' claim that the weekly operating costs are higher than the model suggests.

**Submission Guidelines:**

* Prepare python file detailing each step of your hypothesis testing process.
* Include calculations for the test statistic and the critical value.
* Provide a clear conclusion based on your analysis.

Thank you for the detailed assignment. I'll help you step-by-step with each part of the hypothesis testing process. Here's an outline of how to proceed:

### 1. State the Hypotheses

- \*\*Null Hypothesis (H₀):\*\* The restaurant owners' actual mean weekly operating costs are the same as the theoretical cost model.

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H\_0: \mu = \mu\_{\text{theoretical}} = 4,000 \, \text{Rs.}

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- \*\*Alternative Hypothesis (H₁):\*\* The actual mean weekly operating costs are higher than the theoretical cost model.

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H\_1: \mu > \mu\_{\text{theoretical}} = 4,000 \, \text{Rs.}

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This is a \*\*one-tailed test\*\* because we're only interested in whether the costs are higher than predicted.

### 2. Calculate the Test Statistic

You’ll calculate the test statistic using the provided formula:

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t = \frac{\bar{x} - \mu}{\frac{\sigma}{\sqrt{n}}}

\]

Where:

- \( \bar{x} = 3,050 \, \text{Rs.} \) (sample mean weekly cost)

- \( \mu = 4,000 \, \text{Rs.} \) (theoretical mean from the model \( W = 1,000 + 5X \))

- \( \sigma = 5 \times 25 = 125 \) (standard deviation of weekly costs)

- \( n = 25 \) (sample size)

The formula becomes:

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t = \frac{3,050 - 4,000}{\frac{125}{\sqrt{25}}} = \frac{-950}{25} = -38

\]

### 3. Determine the Critical Value

For \( \alpha = 0.05 \), and since this is a one-tailed test with 24 degrees of freedom \( (n - 1 = 25 - 1) \), we refer to the t-distribution table.

The critical value for a one-tailed test at \( \alpha = 0.05 \) with 24 degrees of freedom is approximately \*\*1.711\*\*.

### 4. Make a Decision

Since the test statistic \( t = -38 \) is much smaller than the critical value \( t\_{\text{critical}} = 1.711 \), we \*\*reject the null hypothesis\*\*. The calculated value of \( t \) falls far into the rejection region, so there is strong evidence that the mean operating cost is significantly different from the theoretical model.

### 5. Conclusion

Based on this analysis, there is strong evidence to support the restaurant owners' claim that their weekly operating costs are higher than predicted by the theoretical cost model.

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I can also help generate a Python script to show how these calculations would be done programmatically. Would you like me to prepare that for you?