Chi-Square test

**Association between Device Type and Customer Satisfaction**

**Background:**

Mizzare Corporation has collected data on customer satisfaction levels for two types of smart home devices: Smart Thermostats and Smart Lights. They want to determine if there's a significant association between the type of device purchased and the customer's satisfaction level.

**Data Provided:**

The data is summarized in a contingency table showing the counts of customers in each satisfaction level for both types of devices:

| **Satisfaction** | **Smart Thermostat** | **Smart Light** | **Total** |
| --- | --- | --- | --- |
| Very Satisfied | 50 | 70 | 120 |
| Satisfied | 80 | 100 | 180 |
| Neutral | 60 | 90 | 150 |
| Unsatisfied | 30 | 50 | 80 |
| Very Unsatisfied | 20 | 50 | 70 |
| **Total** | 240 | 360 | 600 |

**Objective:**

To use the Chi-Square test for independence to determine if there's a significant association between the type of smart home device purchased (Smart Thermostats vs. Smart Lights) and the customer satisfaction level.

**Assignment Tasks:**

**1. State the Hypotheses:**

**2. Compute the Chi-Square Statistic:**

**3. Determine the Critical Value:**

Using the significance level (alpha) of 0.05 and the degrees of freedom (which is the number of categories minus 1)

**4. Make a Decision:**

Compare the Chi-Square statistic with the critical value to decide whether to reject the null hypothesis.

**Submission Guidelines:**

* Provide a detailed report of your analysis, including each step outlined in the assignment tasks in a python file.
* Include all calculations, the Chi-Square statistic, the critical value, and your conclusion.

**ANALYSIS SUMMARY**

**Hypotheses :**

Null Hypothesis (H0): There's no significant association between device type and customer satisfaction.

Alternative Hypothesis (HA): There's a significant association between device type and customer satisfaction.

**Chi-Square Statistic:** : 12.011

**Degrees of Freedeom :**4

**Critical Value :** 9.488 (with alpha = 0.05)

**Decision :** Since the Chi-Square statistic (12.011) is greater than the critical value (9.488), we reject the null hypothesis. This indicates there's a significant association between device type and customer satisfaction level.

**ANALYSIS OVERVIEW**

- \*\*Objective\*\*: Determine if there's a significant association between the type of smart home device (Smart Thermostat vs. Smart Light) and customer satisfaction level.

- \*\*Methodology\*\*: Chi-Square test for independence.

**TASK 1: STATE THE HYPOTHESES**

- \*\*Null Hypothesis (H0)\*\*: There is no significant association between the type of device and customer satisfaction.

- \*\*Alternative Hypothesis (HA)\*\*: There is a significant association between the type of device and customer satisfaction.

This step outlines the hypotheses to be tested.

**TASK 2: COMPUTE THE CHI-SQUARE STATISTIC**

- The code creates a contingency table showing counts of customer satisfaction levels for two types of devices: Smart Thermostat and Smart Light.

- \*\*Observed Counts\*\*:

- Smart Thermostat: [50, 80, 60, 30, 20]

- Smart Light: [70, 100, 90, 50, 50]

- \*\*Chi-Square Calculation\*\*: The `chi2\_contingency` function calculates the Chi-Square statistic, degrees of freedom (dof), expected counts, and p-value. The observed counts are provided as an array.

- \*\*Results\*\*:

- Chi-Square Statistic: 12.011

- P-Value: 0.017

- Degrees of Freedom: 4

The Chi-Square statistic and p-value are key metrics for assessing the association between the variables.

**TASK 3: DETERMINE THE CRITICAL VALUE**

- Using a significance level (alpha) of 0.05 and the degrees of freedom (dof = (number of rows - 1) \* (number of columns - 1)), the code calculates the critical value using the Chi-Square distribution's percent-point function (`stats.chi2.ppf`).

- \*\*Critical Value\*\*: 9.488

The critical value represents the threshold for determining statistical significance at a given alpha level.

**TASK 4: MAKE A DECISION**

- The code compares the Chi-Square statistic with the critical value to decide whether to reject the null hypothesis.

- If the Chi-Square statistic is greater than the critical value, reject the null hypothesis, indicating a significant association between the variables.

- \*\*Decision\*\*:

- Since the Chi-Square statistic (12.011) is greater than the critical value (9.488), the code rejects the null hypothesis, indicating a significant association between device type and customer satisfaction.

**CONCLUSION**

The analysis suggests that there's a significant association between the type of smart home device and customer satisfaction. Thus, the company might want to explore why these differences exist and how to leverage this information to improve customer satisfaction for both types of devices.

This detailed report summarizes the hypothesis testing, calculations, and conclusion derived from the Chi-Square test for independence.