**🧪 Chi-Square Test for Independence: Gender vs Product Preference**

This project explores whether there is a relationship between a customer's **gender** and their **preferred product** (Product A or B) using a statistical method called the **Chi-Square Test for Independence**.

**📌 Objective**

To determine if **product preference depends on gender**. If a significant relationship is found, it can help businesses improve their marketing strategies by targeting the right audience more effectively.

**📁 Dataset Description**

The dataset includes:

* **Gender**: The gender of the customer (Male or Female)
* **Preferred Product**: The product they chose (Product A or Product B)

There are 12 customers in the sample.

**🧪 Method Overview**

1. **Contingency Table**: We summarize how many males and females chose each product.
2. **Expected Frequencies**: We calculate what the counts *should* be if there were no relationship between gender and product preference.
3. **Chi-Square Statistic**: We measure the difference between observed and expected counts.
4. **Degrees of Freedom**: Based on the number of rows and columns in the table.
5. **P-value**: We determine the likelihood that the observed differences are due to chance.
6. **Conclusion**: We decide whether or not to reject the null hypothesis.

**📊 Hypotheses**

* **Null Hypothesis (H₀)**: Gender and product preference are **independent** (no relationship).
* **Alternative Hypothesis (H₁)**: Gender and product preference are **associated** (there is a relationship).

**📉 Significance Level**

We use a standard significance level of **0.05**:

* If the p-value is **less than 0.05**, we reject the null hypothesis.
* If the p-value is **greater than or equal to 0.05**, we fail to reject the null hypothesis.

**✅ Result Interpretation**

* A **low p-value** suggests a significant relationship between gender and product choice.
* A **high p-value** suggests that any difference in choices could be due to random variation.

**📝 Conclusion**

If the results are significant, businesses can:

* Customize marketing strategies based on gender preferences.
* Focus on products that appeal more to specific customer groups.

If not significant, businesses might consider gender-neutral strategies.