Theory Section

* 1. Define: Correlation vs. Covariance

**✅ Covariance**

* **Definition:**  
  A measure of how two variables change *together*.
* **Interpretation:**
  + **Positive** covariance → variables tend to move in the **same direction**
  + **Negative** covariance → variables tend to move in **opposite directions**
  + Value is **not standardized**, so hard to interpret magnitude directly

### ✅ ****Correlation****

* **Definition:**  
  A **standardized** measure of the strength and direction of the relationship between two variables.
* **Interpretation:**
  + Ranges from **–1 to +1**
    - +1 → perfect positive relationship
    - –1 → perfect negative relationship
    - 0 → no linear relationship
  + Easier to compare across different datasets

### 🔁 ****Key Difference:****

* **Covariance** tells you **direction** of the relationship.
* **Correlation** tells you **direction + strength**, on a **standard scale**.

* 1. Null and Alternative Hypothesis

### ✅ ****Null Hypothesis (H₀)****

* **Definition:**  
  The null hypothesis is a **default or initial assumption** that there is **no effect**, **no difference**, or **no relationship** between variables.
* **Purpose:**  
  It represents what we assume to be true unless we have enough evidence to reject it.

### ✅ ****Alternative Hypothesis (H₁ or Hₐ)****

* **Definition:**  
  The alternative hypothesis is what you propose **if** you reject the null. It suggests that there **is** an effect, a difference, or a relationship.
* **Purpose:**  
  It's what you're trying to find evidence **for**.

* 1. p-value and significance level

**✅ p-value (Probability Value)**

* **Definition:**  
  The **p-value** is the **probability** of observing your sample data — or something more extreme — **if the null hypothesis is true**.
* **Interpretation:**
  + A **small p-value** (e.g., 0.01) means the observed result is **unlikely** under the null hypothesis.
  + A **large p-value** (e.g., 0.40) suggests the data is **consistent** with the null hypothesis.
* **Usage:**  
  It helps you decide whether to **reject** or **fail to reject** the null hypothesis.

**✅ Significance Level (α)**

* **Definition:**  
  The **significance level** is a **threshold** set by the researcher before testing, representing how much risk of a false positive (Type I error) you're willing to accept.
* **Common Values:**
  + **α = 0.05** (most common)
  + α = 0.01 (stricter)
  + α = 0.10 (more lenient)
* **Interpretation:**
  + If **p-value ≤ α** → Reject the null hypothesis (**statistically significant**)
  + If **p-value > α** → Fail to reject the null (**not statistically significant**)