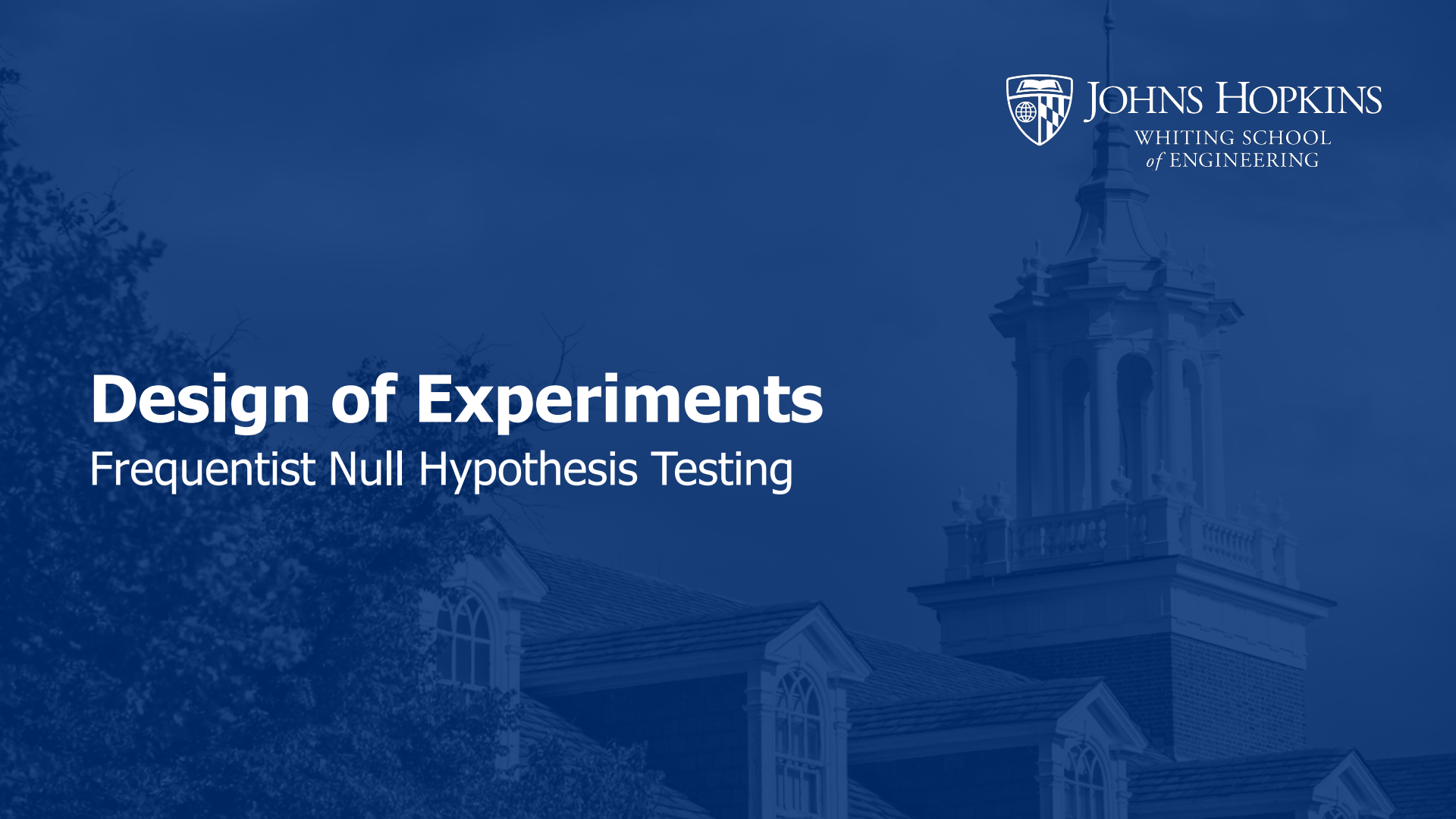

Design of Experiments

Frequentist Null Hypothesis Testing

Review: Hypothesis Testing Framework

1. **State the Hypotheses**:
   - **Null Hypothesis (H_0)**: The default assumption (e.g., there is no effect or difference).
   - **Alternative Hypothesis (H_1)**: What you're trying to prove (e.g., there is an effect or difference).
2. **Choose the Significance Level**:
   - Typically $\alpha=0.05$. This is the threshold for deciding whether to reject the null hypothesis.
3. **Calculate the Test Statistic**:
   - Based on the test you're using (e.g., Z, t, F, $\chi 2$).

Review: Hypothesis Testing Framework

4. Find the p-value:
- The p-value tells you the probability of observing the data, or something more extreme, assuming the null hypothesis is true.

5. Make a Decision:
- **Reject H_0** if the p-value is less than α, otherwise **fail to reject H_0**.

Review: Common Hypothesis Tests

T-test

- A **T-test** is used when the population variance is **unknown** and the sample size is small ($n<30$). The test statistic follows a **t-distribution**, which adjusts for small sample sizes by accounting for additional uncertainty.
- One-Sample
- Independent Two-Sample
- Paired T-Test

Z-test

- A **Z-test** is used when the population variance is known and the sample size is large (typically $n\geq30$). The test statistic follows a **standard normal distribution** (the **Z-distribution**)
- One-Sample
- Two-Sample