**Project Overview:**I designed and implemented an A/B test for Urban Wear to optimize email sign-ups on their pre-launch page. The test evaluated whether changing the **submit button color** from blue (control) to green (treatment) would lead to a higher conversion rate. My goal was to provide actionable, data-driven recommendations to help maximize sign-ups before the full website launch.

### **Steps I Took:**

1. **Data Exploration and Cleaning:**
   * Loaded and explored pretest and test datasets, checking for missing values and formatting inconsistencies.
   * Converted date columns for proper time-series analysis and ensured data integrity through initial validation.
2. **Segmentation of Data:**
   * Split the dataset into control (blue button) and treatment (green button) groups.
   * Verified balanced group assignment and corrected any data imbalance using **stratified sampling**.
3. **Calculating Conversion Rates:**
   * Computed the conversion rate for both groups as: Conversion Rate=Number of Sign-upsTotal Visitors\text{Conversion Rate} = \frac{\text{Number of Sign-ups}}{\text{Total Visitors}}Conversion Rate=Total VisitorsNumber of Sign-ups​
4. **Statistical Hypothesis Testing:**
   * Formulated hypotheses:
     + **Null Hypothesis (H₀):** No significant difference in conversion rates between control and treatment.
     + **Alternative Hypothesis (H₁):** The green button has a higher conversion rate than the blue button.
   * Performed a **Z-test for proportions** using Python’s statsmodels to assess statistical significance.
5. **Visualization and Business Recommendations:**
   * Created conversion rate plots and summary tables using Seaborn and Matplotlib.
   * Presented findings to the product team, emphasizing actionable insights and confidence intervals.

### **Results:**

* The treatment group (green button) had a **higher conversion rate** compared to the control group, with a **statistically significant p-value (< 0.05)**.
* Based on the results, I recommended deploying the green button, which is projected to increase email sign-ups and improve pre-launch engagement.

### **Challenges I Overcame:**

* **Data Imbalance:** The initial dataset had unequal group sizes, which I addressed using stratified sampling to ensure fair comparisons.
* **Handling Missing Data:** Some sign-up records were incomplete, so I used imputation techniques and conducted sensitivity analysis to validate that the missing data didn’t affect the final outcome.
* **Multiple Metrics:** Balancing the immediate goal (email sign-ups) with potential long-term business outcomes was a key consideration when providing recommendations.

### **Key Takeaways:**

This project demonstrated my ability to design and execute experiments, clean and analyze data, apply statistical methods, and provide business-driven recommendations. It reinforced the importance of careful experimental design and stakeholder communication when driving business decisions.

### **Tools & Technologies:**

* **Data Analysis & Cleaning:** Python (Pandas, NumPy)
* **Statistical Testing:** SciPy, Statsmodels
* **Visualization:** Seaborn, Matplotlib
* **Hypothesis Testing:** Z-test for proportions, confidence intervals