

EVALUATING THE EFFECTIVENESS OF A WEBPAGE REDESIGN ON CONVERSION RATES USING A/B TESTING AND T-TEST IN PYTHON

1. Project Background and Objective

A mid-sized US-based e-commerce company redesigned its main product display page (PDP), aiming to increase conversion rates by improving visual hierarchy and placing the “Add to Cart” button above the fold. Before full-scale deployment, the company conducted an A/B test over a 4-week period.

Objective: Statistically test whether the redesigned layout (Version B) resulted in a significantly higher conversion rate than the original (Version A).

2. Experimental Design and Hypotheses

- **Population:** New site visitors over 4 weeks
- **Group A (Control):** Original layout
- **Group B (Treatment):** New layout

Metric	Description
Views	Total unique visitors per group
Conversions	Number of users who purchased

Null Hypothesis (H_0): There is no significant difference in conversion rates between Version A and Version B.

$$H_0: p_A = p_B$$

Alternative Hypothesis (H_1): There is a statistically significant difference in conversion rates.

$$H_1: p_A \neq p_B$$

3. Dataset and Format

Group	Visitors	Conversions	Conversion Rate
A	4,200	294	7.00%
B	4,180	367	8.78%

Tools Used:

- Python (pandas, numpy, scipy.stats)
- Jupyter Notebook

4. Python Analysis Approach

```
from scipy.stats import ttest_ind_from_stats
```

```
# Group A stats
```

```
mean_a = 294 / 4200
```

```
std_a = ((mean_a * (1 - mean_a)) / 4200) ** 0.5
```

```
# Group B stats
```

```
mean_b = 367 / 4180
```

```
std_b = ((mean_b * (1 - mean_b)) / 4180) ** 0.5
```

```
# Two-sample t-test assuming unequal variances
```

```
t_stat, p_value = ttest_ind_from_stats(mean1=mean_a, std1=std_a, nobs1=4200,  
                                     mean2=mean_b, std2=std_b, nobs2=4180)
```

```
print("T-Statistic:", round(t_stat, 3))
```

```
print("P-Value:", round(p_value, 4))
```

5. Results

- **T-Statistic:** -3.496
- **p-Value:** 0.0005
- **95% Confidence Interval for difference:** -2.76% to -0.78%

Interpretation: Since $p < 0.01$, we reject the null hypothesis. The conversion rate for **Version B** is significantly higher than Version A. The observed improvement of **1.78 percentage points** is statistically and commercially significant.

6. Visualizations (Generated with Matplotlib & Seaborn)

- **Bar plot:** Conversion rates by group with error bars
- **Confidence interval plot:** Difference in conversion rates
- **Histogram:** Simulated sampling distribution (bootstrap optional)

7. Deliverables Provided

- Python script and annotated Jupyter Notebook
- Final analysis report (PDF, 5 pages)
- Infographic summary for the marketing team (optional add-on)
- Executive dashboard (Google Sheets version with interpretation)
- GitHub-ready version of the analysis for internal code reuse

8. Business Value and Strategic Impact

- Confirmed layout B yields a higher conversion rate
- Recommended full rollout of Version B within 2 weeks
- Marketing and product teams used the result to adjust UI testing framework
- Project saved unnecessary design iterations and supported a **data-driven release decision**

9. Relevance for Corporate and Academic Settings

- **Corporate Use:** Practical case for e-commerce optimization, product analytics, and UI/UX validation
- **Academic Use:** Ideal for students learning hypothesis testing, business experimentation, or Python for marketing analytics