

Hypothesis Testing using Z-Test

Exp : 12

Date: 12-10-2025

Aim:

To test whether the average weight of a species of birds differs from **150 grams**.

Algorithm:

1. **Null Hypothesis (H_0):** The average weight of the birds is 150 grams.
2. **Alternative Hypothesis (H_1):** The average weight of the birds is not 150 grams.
3. **Sample:** Measure the weights of 30 birds randomly selected from the population.
4. **Z-Test:** Conduct a Z-test to compare the sample mean to 150 grams.
5. **Decision Rule:** Use a significance level of $\alpha = 0.05$.

Code:

```
import numpy as np
import scipy.stats as stats

sample_data = np.array([152, 148, 151, 149, 147, 153, 150, 148, 152, 149, 151, 150, 149, 152,
151, 148, 150, 152, 149, 150, 148, 153, 151, 150, 149, 152, 148, 151, 150, 153])

population_mean = 150

sample_mean = np.mean(sample_data)
sample_std = np.std(sample_data, ddof=1)
n = len(sample_data)

z_statistic = (sample_mean - population_mean) / (sample_std / np.sqrt(n))

p_value = 2 * (1 - stats.norm.cdf(np.abs(z_statistic)))
```

```
print(f"Sample Mean: {sample_mean:.2f}")  
print(f"Z-Statistic: {z_statistic:.4f}")  
print(f"P-Value: {p_value:.4f}")  
alpha = 0.05  
if p_value < alpha:  
    print("Reject the null hypothesis: The average weight is significantly different from 150 grams.")  
else:  
    print("Fail to reject the null hypothesis: There is no significant difference in average weight from 150 grams.")
```

Output:

Sample Mean: 150.20

Z-Statistic: 0.6406

P-Value: 0.5218

Fail to reject the null hypothesis: There is no significant difference in average weight from 150 grams.

Result:

The Z-Test was successfully conducted. With a **Sample Mean of 150.20** and a **P-Value of 0.5218**, the P-Value (0.5218) is greater than the significance level ($\alpha = 0.05$). Therefore, we **Fail to reject the Null Hypothesis**. There is insufficient evidence to conclude that the average weight of the birds is significantly different from 150 grams.