

**Aim:**

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

**Procedure:**

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  $\alpha = 0.05$ .

In [38]:

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

# Define the sample data (hypothetical weights in grams)
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(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.")
```

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.

In []:

**Result:**

The calculated sample mean is approximately **150 grams**, equal to the hypothesized population mean.

The computed **Z-statistic** is close to **0**, and the **p-value** is around **1.0000**. Since the p-value is greater than the significance level (0.05), we **fail to reject the null hypothesis**.

Hence, there is **no significant difference** between the sample mean and the population mean of 150 grams.