

EXPERIMENT NO : 14

Hypothetical using ANOVA-Test

Aim:

To test whether there is a significant difference in the **mean growth rates** of plants under three different treatments (A, B, and C) using the **One-Way ANOVA** method.

Algorithm:

- Import required libraries: numpy, scipy.stats, and statsmodels.
- Generate three random samples (growth rates) for treatments A, B, and C.
- Perform **One-way ANOVA** using stats.f_oneway().
- Compare the obtained p-value with significance level $\alpha = 0.05$.
- If significant, perform **Tukey's HSD post-hoc test** to find which groups differ.

Code:

```

[]: import numpy as np
import scipy.stats as stats
from statsmodels.stats.multicomp import pairwise_tukeyhsd

np.random.seed(42)
n_plants = 25

# Generate sample data
growth_A = np.random.normal(loc=10, scale=2, size=n_plants)
growth_B = np.random.normal(loc=12, scale=3, size=n_plants)
growth_C = np.random.normal(loc=15, scale=2.5, size=n_plants)

# Combine all data
all_data = np.concatenate([growth_A, growth_B, growth_C])
treatment_labels = ['A'] * n_plants + ['B'] * n_plants + ['C'] * n_plants

# Perform one-way ANOVA
f_statistic, p_value = stats.f_oneway(growth_A, growth_B, growth_C)

# Print results
print("Treatment A Mean Growth:", np.mean(growth_A))
print("Treatment B Mean Growth:", np.mean(growth_B))
print("Treatment C Mean Growth:", np.mean(growth_C))
print()
print(f"F-Statistic: {f_statistic:.4f}")
print(f"P-Value: {p_value:.4f}")

alpha = 0.05

if p_value < alpha:
    print("Reject the null hypothesis: There is a significant difference in mean growth rates among the three treatments.")

    # Perform Tukey's HSD post-hoc test
    tukey_results = pairwise_tukeyhsd(all_data, treatment_labels, alpha=0.05)
    print("\nTukey's HSD Post-hoc Test:")
    print(tukey_results)
else:
    print("Fail to reject the null hypothesis: There is no significant difference in mean growth rates among the three treatments.")

```

Result:

The p-value (< 0.05) indicates that there is a **significant difference** in the mean growth rates among treatments A, B, and C.

Tukey's HSD test confirms that **each treatment differs significantly** from the others