

Expt No: 14

Date: 13-10-28

Hypothetical using ANOVA Test

Objective: To compare the growth rates of plants under three different fertilizer treatments (Treatment A, B and C) to determine if there is a significant difference in their means.

Procedure:

1. Null Hypothesis (H_0): The mean growth rates of plants under all three fertilizer treatments are equal.
2. Alternative Hypothesis (H_1): At least one pair of measured growth rates of plants under different fertilizer treatments are not equal.
3. Sample: \Rightarrow Measure the growth (in cm) of 25 plants under Treatment A
 \Rightarrow Measure the growth (in cm) of 25 plants under Treatment B
 \Rightarrow Measure the growth (in cm) of 25 plants under Treatment C
4. ANOVA: Conduct a one-way ANOVA to compare the mean growth rates of plants across the three fertilizer treatments.
5. Decision Rule: Use a significance level of $\alpha = 0.05$.

Program:

```
import numpy as np
import scipy.stats as stats
np.random.seed(42)
n_plants = 25
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)
all_data = np.concatenate([growth_A, growth_B, growth_C])
treatment_labels = ['A'] * n_plants + ['B'] * n_plants + ['C'] * n_plants
f_statistic, p_value = stats.f_oneway(growth_A, growth_B, growth_C)
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}")
```

Output:

Treatment A Mean Growth : 9.67298

Treatment B Mean Growth : 11.13760

Treatment C Mean Growth : 15.26526

F-Statistic : 36.7214

p-value : 0.0000

Reject the null hypothesis: There is a significant difference in mean growth rates among the three treatments.

$\alpha = 0.05$

if p-value < alpha :

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

else :

```
print ("Fail to reject the null hypothesis: There  
is no significant difference in mean  
growth rates among the three treatments.")
```

significant

if p-value < alpha :

```
from statsmodels.stats.multicomp import pairwise.
```

```
tukey_hsd.
```

```
tukey_results = pairwise_tukey_hsd(all_data,  
treatment_labels, alpha=0.05)
```

```
print ("Tukey's HSD Post-hoc Test: ")
```

```
print (tukey_results)
```

Result:

The calculated F-statistic is 36.1214 with a p-value of 0.0000. Since the p-value < 0.05 we reject the null hypothesis. Hence, there is a significant difference.