

Assignment 1 of Quantitative Methods (I)

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To: Professor S.M. Lin

Subject: (Assignment 1) Two-way ANOVA Report for [LFH](#) Company

1. Describe the question

LFH Company has over 20 back-office employees across three locations: North, Central, and South. They work daily with computers to issue various documents, including sales, receipts, and accounting vouchers. The number of these documents issued provides an opportunity to analyze their workload. This analysis aims to investigate whether LFH employees' workload (measured by the number of documents processed) varies by region (North, Central, and South) and time period (2024_H1, 2024_H2, and 2025_H1).

2. Describe the variables and [data](#)

Dataset: LFH_data.csv, covering the period from 2024/01/01 to 2025/06/30. It contains 69 records with the following variables:

Variable	Description
Employee_ID	Unique identifier of employee
Period	Time period: 2024_H1, 2024_H2, 2025_H1
Location	Region: North, Central, South
Total_Units	Number of documents processed (workload measure)

3. Hypothesis

I apply a two-way ANOVA with the following hypotheses:

- $H_0(\text{Region})$: There is no significant difference in workload across regions.
- $H_0(\text{Period})$: There is no significant difference in workload across periods.
- $H_0(\text{Interaction})$: There is no significant interaction effect between region and period.

4. Descriptive Statistics

Location	Period	Mean	Std Dev	N
Central	2024_H1	2793.50	2056.82	6
Central	2024_H2	2936.83	1834.21	6
Central	2025_H1	2341.14	1450.03	7

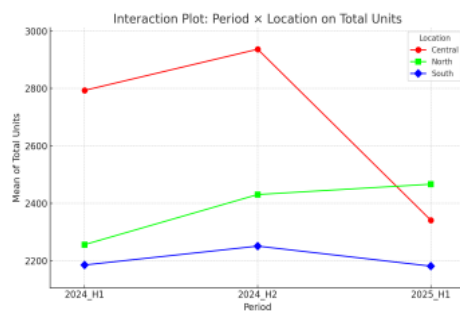
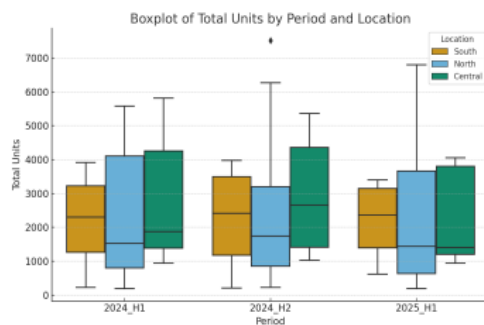
North	2024_H1	2256.00	1976.07	12
North	2024_H2	2430.50	2326.68	12
North	2025_H1	2466.57	2351.93	14
South	2024_H1	2185.00	1615.71	4
South	2024_H2	2250.75	1720.29	4
South	2025_H1	2181.00	1288.69	4

5. ANOVA Result

Source	df	F-value	p-value
Location	2	0.219	0.804
Period	2	0.042	0.959
Location × Period	4	0.077	0.989

Visualization

The following boxplot and interaction plot provide a visual representation of the data distribution and interaction.



6. Conclusions

The two-way ANOVA results show that:

- Region effect: Not significant ($p = 0.804$).
- Period effect: Not significant ($p = 0.959$).
- Interaction effect: Not significant ($p = 0.989$).

Conclusion: There are no statistically significant differences in workload among different regions, different periods, or their interaction. The workload distribution is fairly consistent across the LFH company's staff.