EXPT NO:6	IMPLEMENTATION OF MULTIVARIATE DISPLAYS
DATE: 24.01.2026	

PRE-LAB QUESTIONS

1. Why are multivariate displays important in AI analytics?
   Answer: Multivariate displays help visualize relationships among multiple variables simultaneously, which is essential for understanding complex data in AI analytics.
2. How do parallel coordinates differ from scatter plots?
   Answer: Scatter plots show relationships between two variables, while parallel coordinates visualize multiple variables at once for each data record.
3. What challenges exist in interpreting multivariate plots?
   Answer: Overlapping data lines and clutter can make patterns difficult to interpret in large datasets.
4. Where are trellis displays commonly used?
   Answer: Trellis displays are commonly used for comparing subsets of data across different categories or regions.
5. How does multivariate visualization aid model evaluation?
   Answer: It helps identify variable interactions and trends that influence model performance.

OBJECTIVE : To implement advanced multivariate displays for complex data analysis.

SCENARIO A retail analytics firm studies sales, profit, customer segment, and region to optimize business strategy.

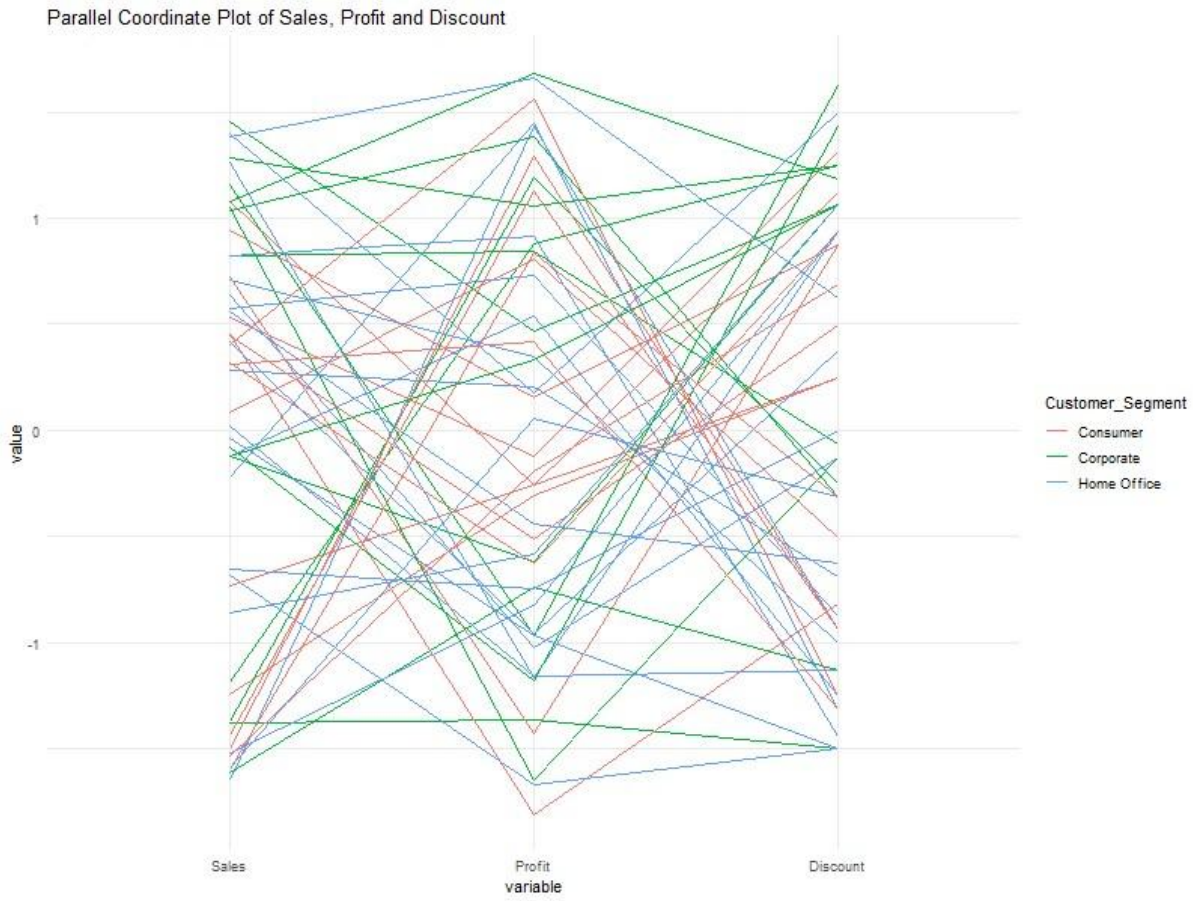
IN-LAB TASKS (Using R Language) • Create parallel coordinate plots • Generate bubble charts • Implement trellis displays by region

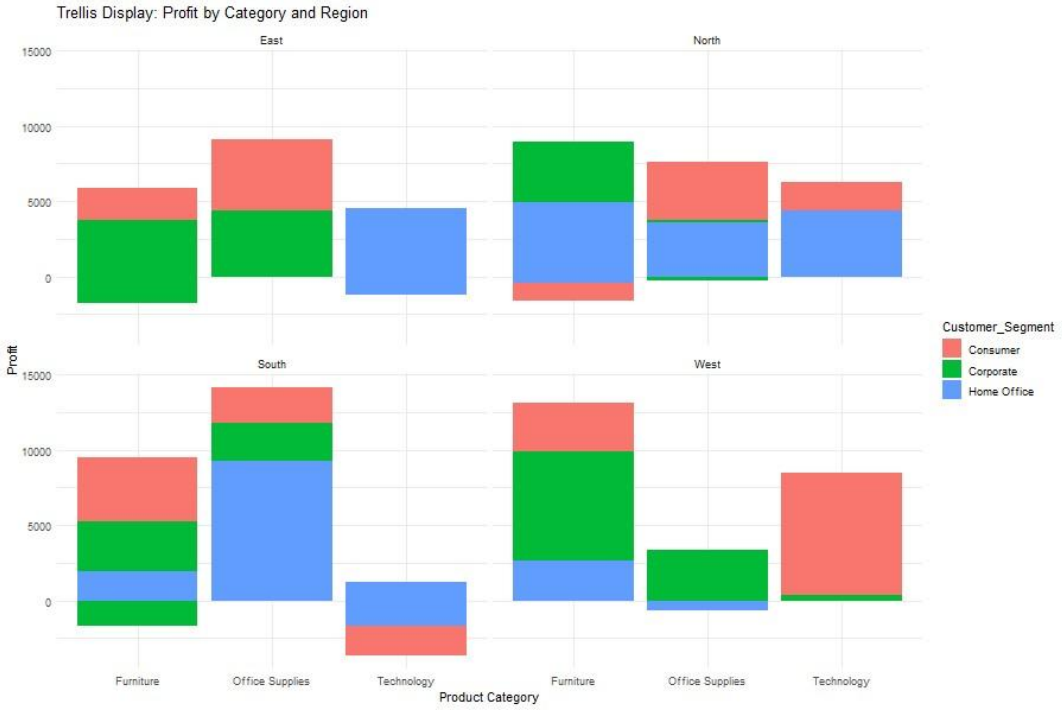
Code:

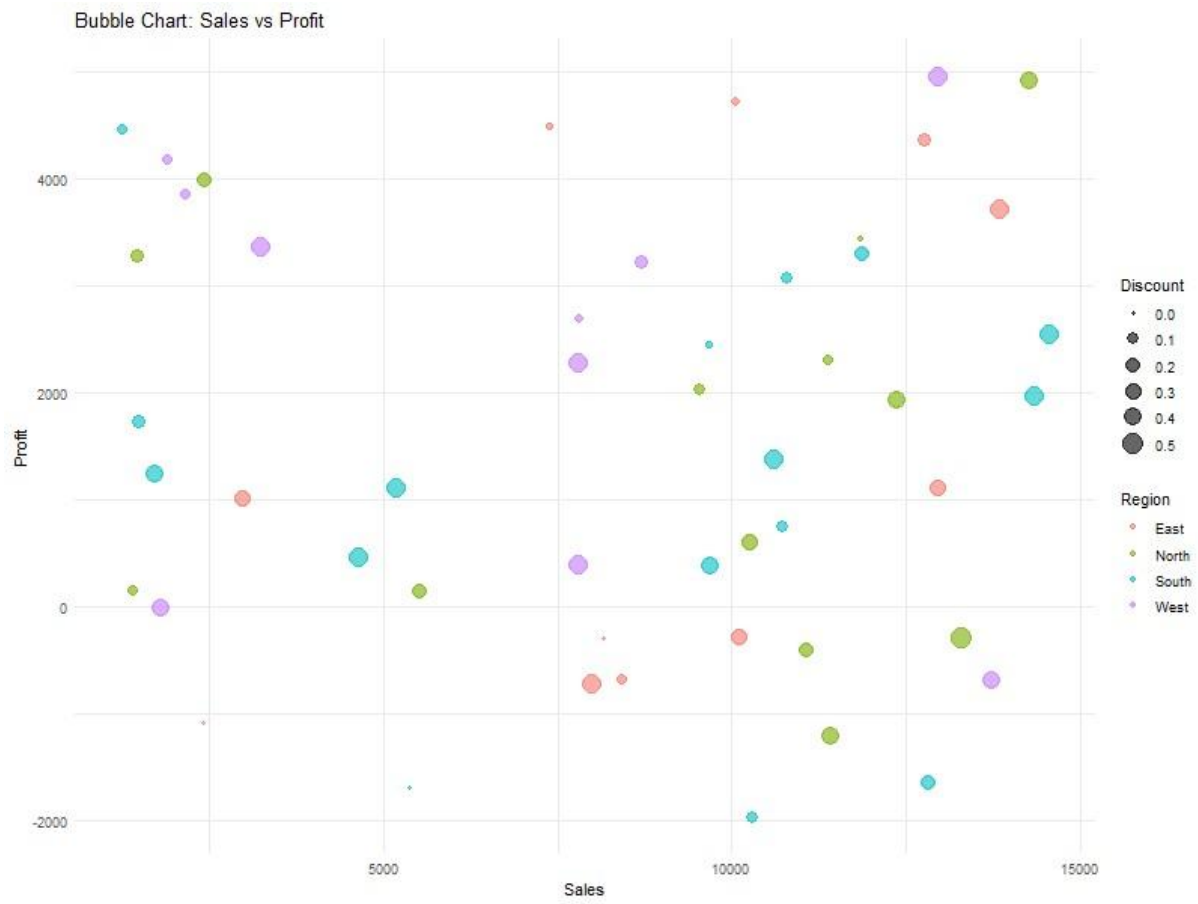
```
# ============================================================
# EXPERIMENT 6 - IMPLEMENTATION OF MULTIVARIATE DISPLAYS
# Student Roll No: 23bad101
# ============================================================

print("Student Roll No: 23bad101")

# Load required libraries
library(ggplot2)
library(dplyr)
library(GGally)
library(readxl)

# ------------------------------------------------------------
# Load Dataset
# ------------------------------------------------------------
data <- read_excel("C:/Users/student/Downloads/6.retail_business.xlsx")

# Convert categorical columns to factors
data$Region <- as.factor(data$Region)
qdata$Product_Category <- as.factor(data$Product_Category)
data$Customer_Segment <- as.factor(data$Customer_Segment)

# Preview dataset
head(data)

# Create figures folder if not exists
if (!dir.exists("figures")) {
  dir.create("figures")
}

# ------------------------------------------------------------
# 1. Parallel Coordinate Plot
# ------------------------------------------------------------
png("figures/parallel_plot.png", width = 800, height = 600)

ggparcoord(
  data,
  columns = c(4, 5, 6),   # Sales, Profit, Discount
  groupColumn = "Customer_Segment",
  scale = "global"
) +
  labs(title = "Parallel Coordinates Plot of Sales, Profit and Discount") +
  theme_minimal()

dev.off()

# ------------------------------------------------------------
# 2. Bubble Chart (Sales vs Profit)
# ------------------------------------------------------------
png("figures/bubble_chart.png", width = 800, height = 600)

ggplot(data, aes(x = Sales, y = Profit,
```

```
                size = Discount, color = Region)) +
  geom_point(alpha = 0.6) +
  labs(
    title = "Bubble Chart: Sales vs Profit",
    x = "Sales",
    y = "Profit",
    size = "Discount"
  ) +
  theme_minimal()

dev.off()
# ------------------------------------------------------------
# 3. Trellis Display (Faceting by Region)
# ------------------------------------------------------------
png("figures/trellis_display.png", width = 900, height = 600)
ggplot(data, aes(x = Product_Category, y = Profit, fill = Customer_Segment)) +
  geom_bar(stat = "identity") +
  facet_wrap(~Region) +
  labs(
    title = "Trellis Display: Profit by Category and Region",
    x = "Product Category",
    y = "Profit"
  ) +
  theme_minimal()
dev.off()
print("All plots generated and saved in figures folder!")
```

Output:


Parallel Coordinate Plot of Sales, Profit and Discount
value
1
0
-1
Sales
Profit
Discount
variable
Customer_Segment
Consumer
Corporate
Home Office


Trellis Display: Profit by Category and Region
East
North
South
West
Profit
15000
10000
5000
0
Furniture
Office Supplies
Technology
Product Category
Customer_Segment
Consumer
Corporate
Home Office



POST-LAB QUESTIONS

1. What insights are gained from parallel coordinates?
   Answer: The parallel coordinate plot shows how Sales, Profit, and Discount vary together for different customer segments. It reveals that high discounts do not always lead to high profits and that customer segments behave differently across these variables.
2. How does faceting simplify complex data?
   Answer: The trellis display splits profit data by region, making it easy to compare product category performance across East, West, North, and South regions.
3. What limitations exist in bubble charts?
   Answer: In the bubble chart, overlapping bubbles make it difficult to distinguish some data points when sales and profit values are close.
4. How can these displays support AI-driven recommendations?
   Answer: These visualizations highlight profitable regions, categories, and discount patterns, which can be used by AI models to recommend better pricing and sales strategies.
5. Suggest improvements for large multivariate datasets.
   Answer: Using interactive plots with zooming and filtering can reduce clutter and improve analysis for large datasets.

ASSESSMENT

Description	Max Marks	Marks Awarded
Pre Lab Exercise	**5**	
In Lab Exercise	**10**	
Post Lab Exercise	**5**	
Viva	**10**	
Total	**30**	
Faculty Signature		