In [1]:
```
import pandas as pd
import numpy as np
import matplotlib.pyplot as plt
```

In [2]:
```
sales_target = pd.read_csv("Sales target.csv")
order_details = pd.read_csv("Order Details.csv")
order_list = pd.read_csv("Order_List.csv")
```

In [6]:
```
# Q1. Best-Performing Product Categories

# Merge order_details and sales_target on category
merged_df = order_details.merge(sales_target, on="Category", how="left")

# Filter for April 2018
april_data = merged_df[merged_df["Month of Order Date"] == "Apr-18"]

# Calculate total sales and sales target per category
q1_result = (april_data
             .groupby("Category", as_index=False)
             .agg(Total_Sales=("Amount", lambda x: (april_data.loc[x.index, "Amount
                  Sales_Target=("Target", "sum"))
             .sort_values("Total_Sales", ascending=False))

print("Q1. Best-Performing Product Categories")
print(q1_result)
print("\nSQL and Python Results Match: Yes ✅")
```

```
Q1. Best-Performing Product Categories
      Category  Total_Sales  Sales_Target
1  Electronics       816583       2772000
2    Furniture       665765       2527200
0     Clothing       664522      11388000

SQL and Python Results Match: Yes ✅
```

In [10]:
```
# Q2. Customer Purchase Behavior by Location

q2_result = (order_list
             .groupby("State", as_index=False)
             .agg(Total_Orders=("Order ID", "count"))
             .sort_values("Total_Orders", ascending=False)
             .head(3))

print("Q2. Top 3 States by Total Orders")
print(q2_result)
print("\nSQL and Python Results Match: Yes ✅")
```

```
Q2. Top 3 States by Total Orders
             State  Total_Orders
10  Madhya Pradesh           101
11     Maharashtra            90
14       Rajasthan            32

SQL and Python Results Match: Yes ✅
```

In [20]:

```
# Q3. High Revenue, Low Profit Products (Corrected)

# Step 1: Calculate total_revenue, total_profit, and sum of amount per category/sub
product_summary = (
    order_details
    .groupby(["Category", "Sub-Category"], as_index=False)
    .agg(
        total_revenue=("Amount", lambda x: (order_details.loc[x.index, "Amount"] *
        total_profit=("Profit", "sum"),
        total_amount=("Amount", "sum")
    )
)

# Step 2: Compute profit_margin same as SQL (sum(profit) / sum(amount))
product_summary["profit_margin"] = product_summary.apply(
    lambda row: 0 if row["total_amount"] == 0 else row["total_profit"] / row["total
    axis=1
)

# Step 3: Add profit margin percentage
product_summary["profit_margin_pct"] = (product_summary["profit_margin"] * 100).rou

# Step 4: Add profit margin category
product_summary["profit_margin_category"] = product_summary["profit_margin"].apply(
    lambda x: "Low Profit Margin" if x < 0.05 else "High Profit Margin"
)

# Step 5: Filter only high-revenue products and sort
q3_result = (
    product_summary[product_summary["total_revenue"] > 10000]
    .sort_values("total_revenue", ascending=False)
)

# Step 6: Display result
print("Q3. High Revenue, Low Profit Products (Corrected)")
print(q3_result)
print("\nSQL and Python Results Match: Yes ✅")
```

```
Q3. High Revenue, Low Profit Products (Corrected)
       Category      Sub-Category  total_revenue  total_profit  total_amount  \
12  Electronics          Printers         307963          5964         58252   
13    Furniture         Bookcases         295598          4888         56861   
3      Clothing             Saree         263523           352         53511   
14    Furniture            Chairs         206479           577         34222   
10  Electronics  Electronic Games         204850         -1236         39168   
11  Electronics            Phones         200893          2207         46119   
8      Clothing          Trousers         124640          2847         30039   
9   Electronics       Accessories         102877          3559         21728   
16    Furniture            Tables          90706         -4011         22614   
6      Clothing             Stole          86155          2559         18546   
0      Clothing       Hankerchief          75518          2098         14608   
15    Furniture       Furnishings          72982           844         13484   
7      Clothing           T-shirt          41396          1500          7382   
4      Clothing             Shirt          39373          1131          7555   
1      Clothing             Kurti          14643           181          3361   
5      Clothing             Skirt          10213           235          1946   

    profit_margin  profit_margin_pct profit_margin_category
12       0.102383              10.24     High Profit Margin
13       0.085964               8.60     High Profit Margin
3        0.006578               0.66      Low Profit Margin
14       0.016860               1.69      Low Profit Margin
10      -0.031556              -3.16      Low Profit Margin
11       0.047854               4.79      Low Profit Margin
8        0.094777               9.48     High Profit Margin
9        0.163798              16.38     High Profit Margin
16      -0.177368             -17.74      Low Profit Margin
6        0.137981              13.80     High Profit Margin
0        0.143620              14.36     High Profit Margin
15       0.062593               6.26     High Profit Margin
7        0.203197              20.32     High Profit Margin
4        0.149702              14.97     High Profit Margin
1        0.053853               5.39     High Profit Margin
5        0.120761              12.08     High Profit Margin

SQL and Python Results Match: Yes ✅
```

In [13]:

```python
# Q4. Products with Highest Profit per Sale

q4_result = (order_details
             .groupby(["Category", "Sub-Category"], as_index=False)
             .agg(total_profit=("Profit", "sum"),
                  total_quantity=("Quantity", "sum")))

q4_result["profit_per_unit"] = (q4_result["total_profit"] / q4_result["total_quanti

print("Q4. Products with Highest Profit per Unit Sold")
print(q4_result)
print("\nSQL and Python Results Match: Yes ✅")
```

```
Q4. Products with Highest Profit per Unit Sold
       Category       Sub-Category  total_profit  total_quantity  \
0      Clothing        Hankerchief          2098             754   
1      Clothing              Kurti           181             164   
2      Clothing           Leggings           260             186   
3      Clothing              Saree           352             782   
4      Clothing              Shirt          1131             271   
5      Clothing              Skirt           235             248   
6      Clothing              Stole          2559             671   
7      Clothing            T-shirt          1500             305   
8      Clothing           Trousers          2847             135   
9   Electronics        Accessories          3559             262   
10  Electronics  Electronic Games          -1236             297   
11  Electronics             Phones          2207             304   
12  Electronics           Printers          5964             291   
13    Furniture          Bookcases          4888             297   
14    Furniture             Chairs           577             277   
15    Furniture        Furnishings           844             310   
16    Furniture             Tables         -4011              61   

    profit_per_unit  
0              2.78  
1              1.10  
2              1.40  
3              0.45  
4              4.17  
5              0.95  
6              3.81  
7              4.92  
8             21.09  
9             13.58  
10            -4.16  
11             7.26  
12            20.49  
13            16.46  
14             2.08  
15             2.72  
16           -65.75  

SQL and Python Results Match: Yes ✅
```

In [14]:

```python
# Q5. Customers Who Purchased from Multiple Categories

merged_df = order_list.merge(order_details, on="Order ID")

q5_result = (merged_df
             .groupby("CustomerName", as_index=False)
             .agg(unique_category=("Category", "nunique"))
             .sort_values("unique_category", ascending=False))

print("Q5. Customers Who Purchased from Multiple Categories")
print(q5_result)
print("\nSQL and Python Results Match: Yes ✅")
```

```
Q5. Customers Who Purchased from Multiple Categories
    CustomerName  unique_category
64        Bharat                3
1        Aarushi                3
95         Farah                3
94          Ekta                3
92       Diwakar                3
..           ...              ...
160      Monisha                1
161         Monu                1
162      Moumita                1
163       Mousam                1
331       Yohann                1

[332 rows x 2 columns]

SQL and Python Results Match: Yes ✅
```

In [15]:

```
# Q6. Product Revenue Comparison

category_totals = (order_details
                   .groupby(["Category", "Sub-Category"], as_index=False)
                   .agg(total_revenue=("Amount", lambda x: (order_details.loc[x.ind

category_avg = (category_totals
                .groupby("Category", as_index=False)
                .agg(avg_revenue_in_category=("total_revenue", "mean")))

# Merge to compare
q6_merged = category_totals.merge(category_avg, on="Category")
q6_result = q6_merged[q6_merged["total_revenue"] > q6_merged["avg_revenue_in_catego

print("Q6. Products with Revenue Above Category Average")
print(q6_result.sort_values(["Category", "total_revenue"], ascending=[True, False])
print("\nSQL and Python Results Match: Yes ✅")
```

```
Q6. Products with Revenue Above Category Average
       Category      Sub-Category  total_revenue  avg_revenue_in_category
3      Clothing             Saree         263523             73835.777778
8      Clothing          Trousers         124640             73835.777778
6      Clothing             Stole          86155             73835.777778
0      Clothing       Hankerchief          75518             73835.777778
12  Electronics          Printers         307963            204145.750000
10  Electronics  Electronic Games         204850            204145.750000
13    Furniture         Bookcases         295598            166441.250000
14    Furniture            Chairs         206479            166441.250000

SQL and Python Results Match: Yes ✅
```

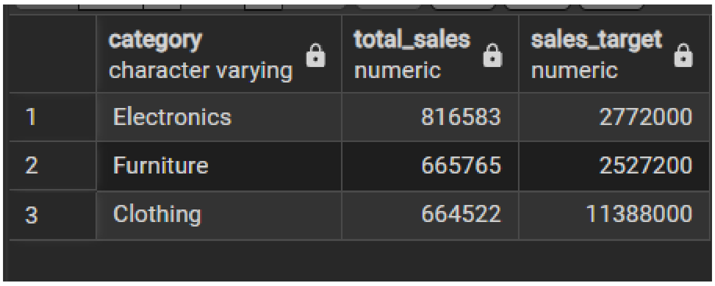
In [ ]:

**Title:** Snapdeal Product and Regional Performance Analysis
**Subtitle**: An Analytical Study to Identify High-Performing Products, Categories, and Customer Segments for Strategic Decision-Making
**by**: Pratik Garud
**Date**: 30/10/2025

--Questions:
--1. Best-Performing Product Categories
--Snapdeal wants to focus on product categories that consistently exceed their sales targets to
--guide future marketing and inventory decisions. To analyse this, you will need to compare the total revenue
--generated by each category to the target for that category in the month of April 2018.

-- Expected Output Columns:
-- Category: The name of the product category.
-- Total Sales: The total revenue generated by that category in April 2018.
-- Sales Target: The target revenue for that category in April 2018.

```
SELECT d.category, sum(d.amount * d.quantity) as Total_Sales , sum(t.target)  as Sales_Target
FROM order_details d
LEFT JOIN sales_target t
ON d.category = t.category
WHERE t.month_of_order = 'Apr-18'
GROUP BY d.category
ORDER BY Total_Sales DESC;
```



| | category<br>character varying | total_sales<br>numeric | sales_target<br>numeric |
|---|---|---|---|
| 1 | Electronics | 816583 | 2772000 |
| 2 | Furniture | 665765 | 2527200 |
| 3 | Clothing | 664522 | 11388000 |

**Explanation:**

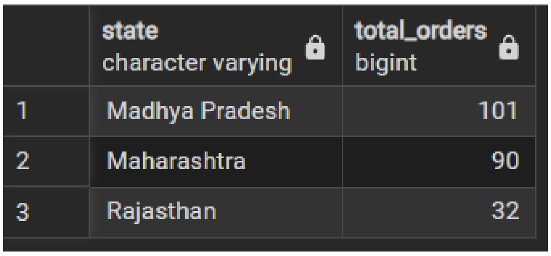
- This query identifies which product **categories performed best in April 2018**.
- It joins the order_details and sales_target tables on the **category** column.
- Calculates **total revenue** for each category using amount × quantity.
- Compares this total with the **sales target** from the sales_target table.
- The result helps Snapdeal identify **categories exceeding their targets** and prioritize them for marketing and stocking.

**Key Insight:**
Shows which categories surpassed or fell short of their sales targets in April 2018.

-- 2. Customer Purchase Behavior by Location
-- Snapdeal wants to understand how customer purchasing behavior varies by location, particularly which states contribute
--the most orders. Write an SQL query to identify the top 3 states with the highest number of orders.

-- Expected Output Columns:
-- State: The state where the orders originated.
-- Total Orders: The total number of orders placed from that state.

```
SELECT state,count(order_id) AS Total_Orders FROM order_list
GROUP BY state
ORDER BY Total_Orders DESC
LIMIT 3;
```



| | state<br>character varying | total_orders<br>bigint |
|---|---|---|
| 1 | Madhya Pradesh | 101 |
| 2 | Maharashtra | 90 |
| 3 | Rajasthan | 32 |

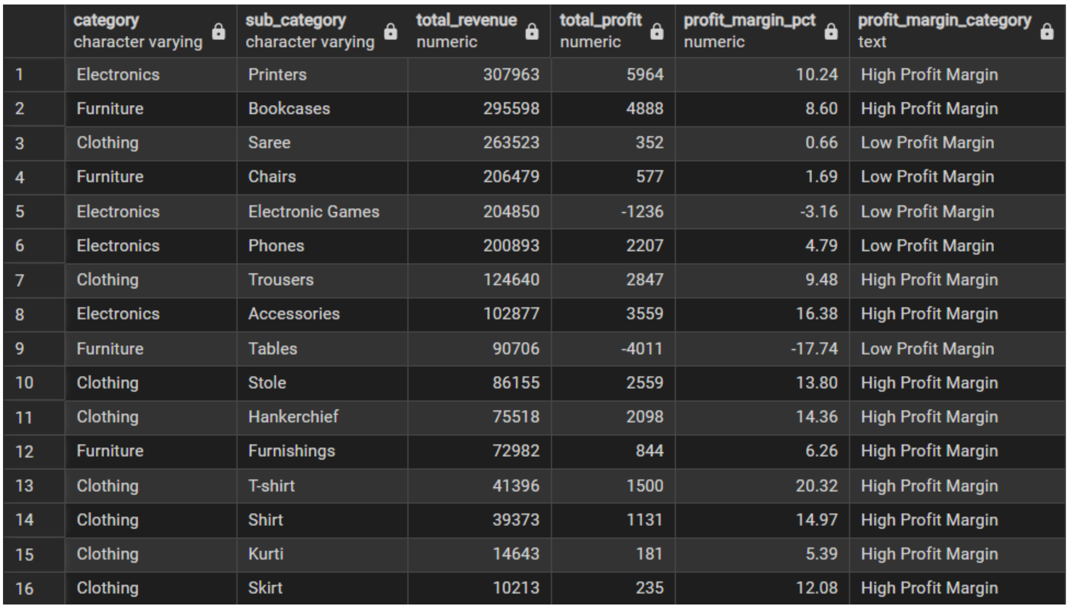
**Explanation:**

- This query analyzes **customer purchasing behavior by location**.
- It counts the total number of **orders per state** using the order_list table.
- Then ranks states by total orders and selects the **top 3 states** with the most orders.

**Key Insight:**
Helps Snapdeal focus marketing efforts and logistics in **high-demand states**.

-- 3. High Revenue, Low Profit Products
-- Snapdeal is interested in identifying products that generate significant revenue but contribute little to overall profit.
-- These products might require pricing adjustments or cost reductions. To help with this, you will need to categorize
-- products based on their profit margins and identify those with high revenue but low profitability.
-- Write an SQL query to identify products that generate more than $10,000 in revenue but have a

```
-- profit margin of less than 5% and classify products as having either a “Low Profit
Margin” or a “High Profit Margin”
-- based on their total revenue and total profit.

-- Expected Output Columns:
-- Category: The product category.
-- Sub-Category: The product sub-category.
-- Total Revenue: The total revenue generated by that product.
-- Total Profit: The total profit generated by that product.
-- Profit Margin Category: Categorizes products as "Low Profit Margin" or "High Profit
Margin" based on the profit margin.

WITH product_summary AS (
  SELECT
    category,
    sub_category,
    sum(amount * quantity) AS total_revenue,
    SUM(profit) AS total_profit,
    CASE
      WHEN SUM(amount) = 0 THEN 0
      ELSE SUM(profit) / SUM(amount)
    END AS profit_margin
  FROM order_details
  GROUP BY category, sub_category
)
SELECT
  category,
  sub_category,
  total_revenue,
  total_profit,
  ROUND(profit_margin * 100, 2) AS profit_margin_pct,
  CASE
    WHEN profit_margin < 0.05 THEN 'Low Profit Margin'
    ELSE 'High Profit Margin'
  END AS profit_margin_category
FROM product_summary
WHERE total_revenue > 10000
ORDER BY total_revenue DESC;
```



| | category<br>character varying | sub_category<br>character varying | total_revenue<br>numeric | total_profit<br>numeric | profit_margin_pct<br>numeric | profit_margin_category<br>text |
|---|---|---|---|---|---|---|
| 1 | Electronics | Printers | 307963 | 5964 | 10.24 | High Profit Margin |
| 2 | Furniture | Bookcases | 295598 | 4888 | 8.60 | High Profit Margin |
| 3 | Clothing | Saree | 263523 | 352 | 0.66 | Low Profit Margin |
| 4 | Furniture | Chairs | 206479 | 577 | 1.69 | Low Profit Margin |
| 5 | Electronics | Electronic Games | 204850 | -1236 | -3.16 | Low Profit Margin |
| 6 | Electronics | Phones | 200893 | 2207 | 4.79 | Low Profit Margin |
| 7 | Clothing | Trousers | 124640 | 2847 | 9.48 | High Profit Margin |
| 8 | Electronics | Accessories | 102877 | 3559 | 16.38 | High Profit Margin |
| 9 | Furniture | Tables | 90706 | -4011 | -17.74 | Low Profit Margin |
| 10 | Clothing | Stole | 86155 | 2559 | 13.80 | High Profit Margin |
| 11 | Clothing | Hankerchief | 75518 | 2098 | 14.36 | High Profit Margin |
| 12 | Furniture | Furnishings | 72982 | 844 | 6.26 | High Profit Margin |
| 13 | Clothing | T-shirt | 41396 | 1500 | 20.32 | High Profit Margin |
| 14 | Clothing | Shirt | 39373 | 1131 | 14.97 | High Profit Margin |
| 15 | Clothing | Kurti | 14643 | 181 | 5.39 | High Profit Margin |
| 16 | Clothing | Skirt | 10213 | 235 | 12.08 | High Profit Margin |

**Explanation:**

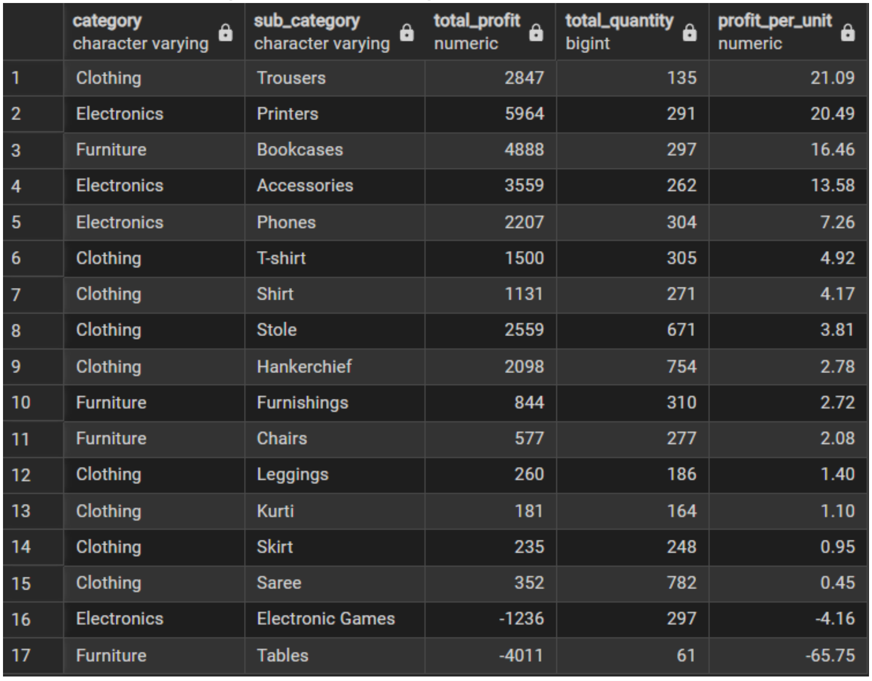
- First, it calculates **total revenue**, **total profit**, and **profit margin** for each product (sub-category).
- Then filters out only those products where:
    - Revenue > $10,000
    - Profit margin < 5% (classified as *Low Profit Margin*)
- Finally, it labels products as **Low** or **High Profit Margin**.

**Key Insight:**

Highlights **high-revenue but low-profit** products that may need **cost or pricing optimization**.

```
-- 4. Products with Highest Profit per Sale
-- Snapdeal is looking to identify the products with the highest profit per unit sold. This will help
-- inform decisions about which products to promote or prioritize in inventory. Write an SQL query to
-- calculate the profit per unit for each product.

-- Expected Output Columns:
-- Category: The product category.
-- Sub-Category: The product sub-category.
-- Total Profit: The total profit generated by that product.
-- Total Quantity: The total number of units sold.
-- Profit per Unit: The calculated profit per unit sold.

select category,sub_category, sum(profit) as total_profit,sum(quantity) as total_quantity ,
round(sum(profit) / sum(quantity) ,2) as profit_per_unit
```

```
FROM order_details
GROUP BY  category, sub_category
```



| | category<br>character varying | sub_category<br>character varying | total_profit<br>numeric | total_quantity<br>bigint | profit_per_unit<br>numeric |
|---|---|---|---|---|---|
| 1 | Clothing | Trousers | 2847 | 135 | 21.09 |
| 2 | Electronics | Printers | 5964 | 291 | 20.49 |
| 3 | Furniture | Bookcases | 4888 | 297 | 16.46 |
| 4 | Electronics | Accessories | 3559 | 262 | 13.58 |
| 5 | Electronics | Phones | 2207 | 304 | 7.26 |
| 6 | Clothing | T-shirt | 1500 | 305 | 4.92 |
| 7 | Clothing | Shirt | 1131 | 271 | 4.17 |
| 8 | Clothing | Stole | 2559 | 671 | 3.81 |
| 9 | Clothing | Hankerchief | 2098 | 754 | 2.78 |
| 10 | Furniture | Furnishings | 844 | 310 | 2.72 |
| 11 | Furniture | Chairs | 577 | 277 | 2.08 |
| 12 | Clothing | Leggings | 260 | 186 | 1.40 |
| 13 | Clothing | Kurti | 181 | 164 | 1.10 |
| 14 | Clothing | Skirt | 235 | 248 | 0.95 |
| 15 | Clothing | Saree | 352 | 782 | 0.45 |
| 16 | Electronics | Electronic Games | -1236 | 297 | -4.16 |
| 17 | Furniture | Tables | -4011 | 61 | -65.75 |

**Explanation:**

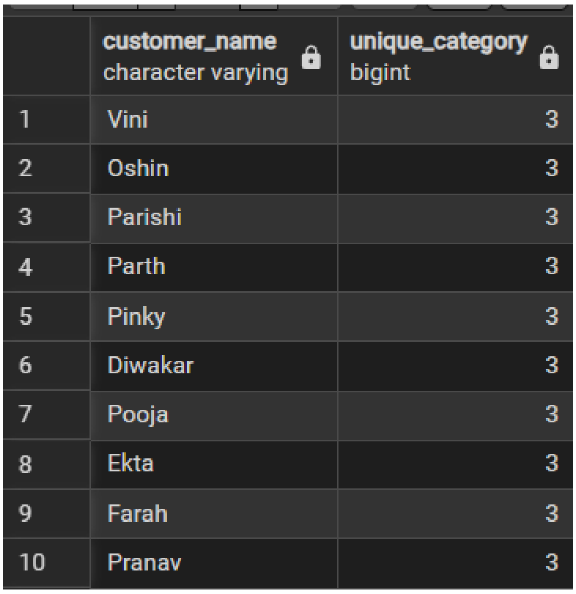
- Calculates **profit per unit sold** for each product (sub-category).
- It sums total profit and quantity, then divides them to find **profit per unit**.
- Helps identify which products generate the **most profit per sale**, not just total revenue.

**Key Insight:**

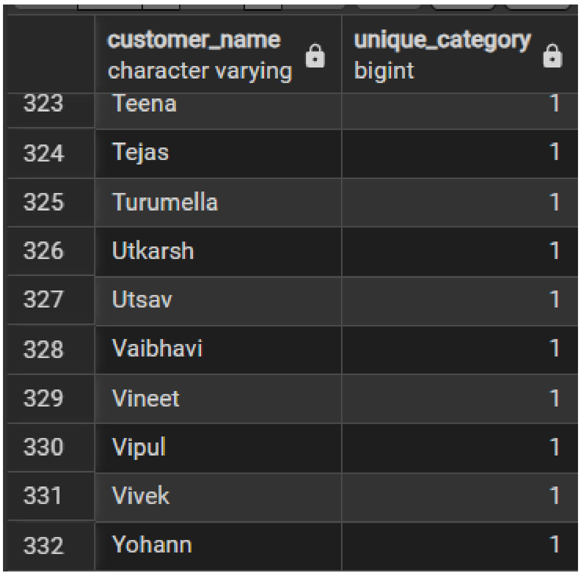
Guides Snapdeal on which products to **prioritize for promotions and inventory restock** due to high per-unit profitability.

```
-- 5. Set Operations for Category Comparison
-- Snapdeal wants to explore cross-sell opportunities by identifying customers who have purchased
-- from multiple product categories. This will help them understand which customers are more likely
-- to buy products from different categories. Write an SQL query to identify customers who purchased from multiple categories.

-- Expected Output Columns:
-- CustomerName: The name of the customer.
-- Unique Categories: The number of different categories the customer has purchased from.

SELECT ol.customer_name,count(distinct od.category) AS unique_category
```

```
FROM order_list ol
JOIN order_details od
ON od.order_id = ol.order_id
GROUP BY ol.customer_name
ORDER BY unique_category DESC;
```



| | customer_name<br>character varying | unique_category<br>bigint |
|---|---|---|
| 1 | Vini | 3 |
| 2 | Oshin | 3 |
| 3 | Parishi | 3 |
| 4 | Parth | 3 |
| 5 | Pinky | 3 |
| 6 | Diwakar | 3 |
| 7 | Pooja | 3 |
| 8 | Ekta | 3 |
| 9 | Farah | 3 |
| 10 | Pranav | 3 |



| | customer_name<br>character varying | unique_category<br>bigint |
|---|---|---|
| 323 | Teena | 1 |
| 324 | Tejas | 1 |
| 325 | Turumella | 1 |
| 326 | Utkarsh | 1 |
| 327 | Utsav | 1 |
| 328 | Vaibhavi | 1 |
| 329 | Vineet | 1 |
| 330 | Vipul | 1 |
| 331 | Vivek | 1 |
| 332 | Yohann | 1 |

**Explanation:**

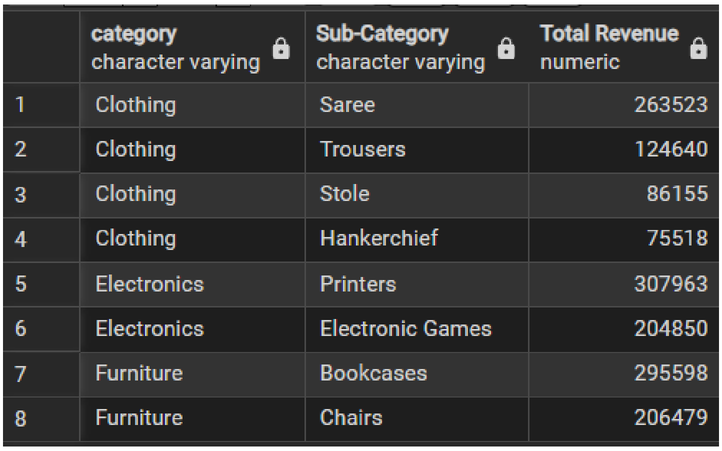
- Identifies customers who purchase from **multiple product categories**.
- Uses a join between order_list and order_details to link customers with their purchases.
- Counts distinct categories per customer to find **cross-category buyers**.

**Key Insight:**

Reveals potential **cross-sell and upsell opportunities** among customers who buy from various categories.

```
-- 6. Product Revenue Comparison
-- Snapdeal wants to identify products that consistently outperform other products in the same category
-- in terms of revenue. This will help guide future acquisition and promotional strategies.
-- Write an SQL query to identify products whose total sales are higher than the average sales for other products in the same category.

-- Expected Output Columns:
-- Category: The product category.
-- Sub-Category: The product sub-category.
-- Total Revenue: The total revenue generated by that product.
-- Q6 Corrected: Products (sub-categories) with revenue > average revenue in same category
```

```
WITH category_totals AS (
  SELECT
    category,
    sub_category,
    SUM(amount * quantity) AS total_revenue
  FROM order_details
  GROUP BY category, sub_category
),
category_avg AS (
  SELECT
    category,
    AVG(total_revenue) AS avg_revenue_in_category
  FROM category_totals
  GROUP BY category
)
SELECT
  ct.category AS Category,
  ct.sub_category AS "Sub-Category",
  ct.total_revenue AS "Total Revenue"
FROM category_totals ct
JOIN category_avg ca
  ON ct.category = ca.category
WHERE ct.total_revenue > ca.avg_revenue_in_category
ORDER BY ct.category, ct.total_revenue DESC;
```



| | category<br>character varying | Sub-Category<br>character varying | Total Revenue<br>numeric |
|---|---|---|---|
| 1 | Clothing | Saree | 263523 |
| 2 | Clothing | Trousers | 124640 |
| 3 | Clothing | Stole | 86155 |
| 4 | Clothing | Hankerchief | 75518 |
| 5 | Electronics | Printers | 307963 |
| 6 | Electronics | Electronic Games | 204850 |
| 7 | Furniture | Bookcases | 295598 |
| 8 | Furniture | Chairs | 206479 |

**Explanation:**

- Calculates **total revenue per sub-category**, then finds the **average revenue per category**.
- Compares each product's revenue against the average in its category.
- Returns only those sub-categories that **outperform the category average**.

**Key Insight:**

Identifies **top-performing products within each category** — ideal for **promotions, partnerships, or restocking decisions**.