

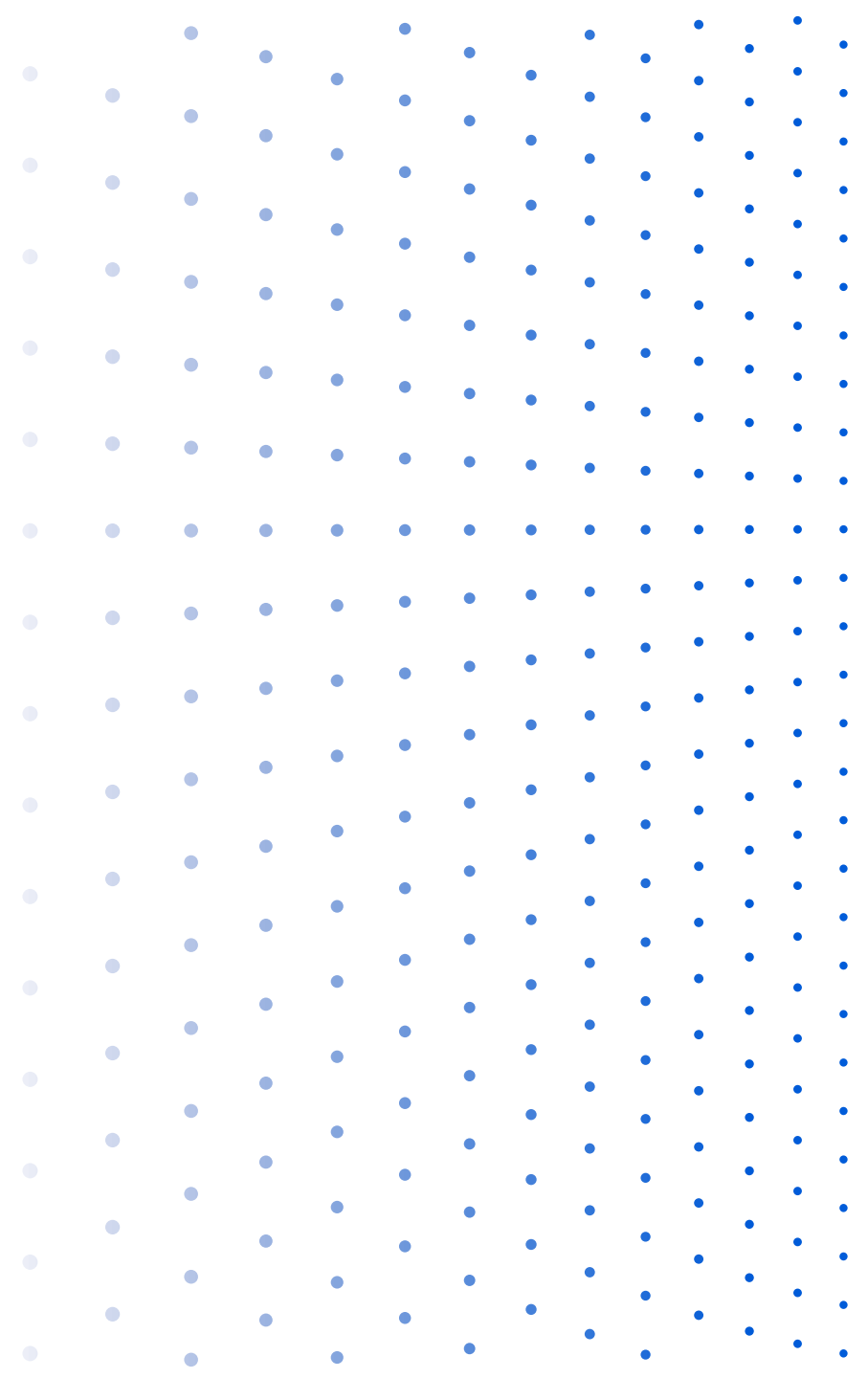


VoltEdge Retail Analytics Case Study

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VOLTEGE
ELECTRIC



VoltEdge Electronics – Business Overview

- VoltEdge Electronics is a fast-growing, U.S.-based retail chain specializing in consumer electronics.
- With over 20 stores nationwide and a growing e-commerce presence, VoltEdge serves a broad customer base—from college students to working professionals—by offering a wide range of products at competitive prices.
- VoltEdge follows a dual strategy:
 - Retailing products from major global brands such as Apple, Sony, Lenovo, Dell, and Samsung.
 - Manufacturing and selling its own branded products under the VoltEdge name, focusing on affordability, functional design, and reliability.
- You have been assigned to analyze VoltEdge's data collected over the last 2 years and give recommendations for their business questions.

Question 1: Data Pre-Processing

Enlist the preprocessing and data refinement steps you performed. Note key observations/assumptions.

- Using the tabs in the excel data file provided, mention the data columns and keys (primary/secondary/foreign keys) that you observe across the databases.

Table	Primary Key	Foreign Keys	Secondary Keys
Product Sales Data	(Store ID, Product Code, Date)	Store ID, Product Code	Date, Store ID, Product Code
Stores Details	Store ID	NA	City, State, ZIP, Active / Inactive
Products Details	Product Code	NA	Product Category, Brand, Subcategory
Customer Data	Customer ID	Store Visited	Age, Gender, Customer Segment, Favorite Brands

Input Validation –

- Before starting your analysis, what are the sanity check that you will apply?
 - Checked for missing values (Row no 2292 Unit Sold was missing) , duplicates, primary key uniqueness, correct data types, foreign key consistency, outliers, and valid date ranges.
 - Are there any data columns that contain incorrect data formats or entries?

Store ID	Product Code	Date	Units Sold	Revenue	Product Cost
S014	S-ST013	14/15/2024	1	\$399.16	\$301.64
S001	S-ST013	15/10/2024	1	\$399.16	\$301.64
S010	S-ST013	14/8/2024	1	\$399.16	\$301.64

Are there any stores in the sales data that are inactive?

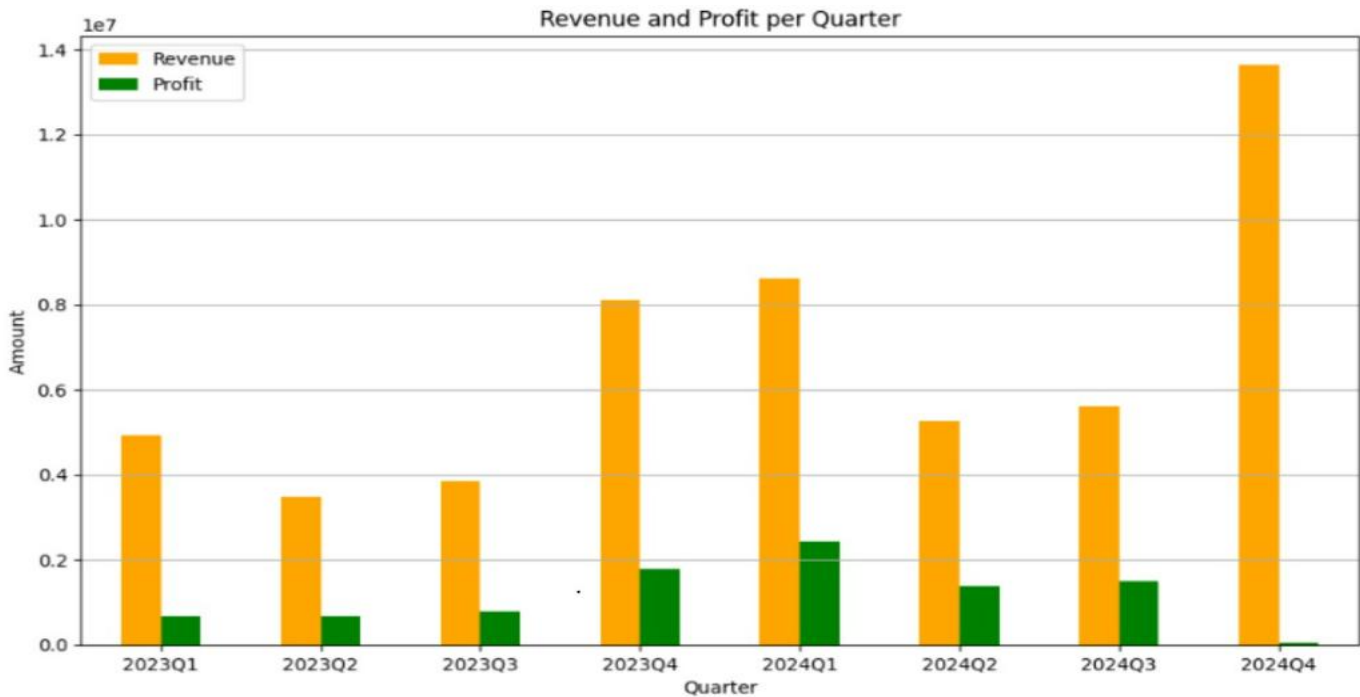
- S006, S012, S014, S016, S020

Question 2: National Business Performance Overview

Populate the following tables and create graphs for **National** Revenue and Profits. (Profit = Revenue – Product Cost – Cost of Operations (during relevant timeframe)) (Profitability = Profit/Revenue)

Year	Revenue	Profit	Profitability
2023	20380721	3933070	0.19298
2024	33102893	5350242	0.161625

Quarter	Revenue	Profit	Profitability
Q1'23	4921190.3	670540.4	0.136256
Q2'23	3488623.3	685650.8	0.196539
Q3'23	3861727.2	792111.8	0.205119
Q4'23	8109180	1784767	0.220092
Q1'24	8605563.2	2420662	0.28129
Q2'24	5260501.4	1375648	0.261505
Q3'24	5611467.3	1495681	0.26654
Q4'24	13625361	58251.93	0.004275



❖ Comment on the trends observed in the above tables.

2023 Trend:

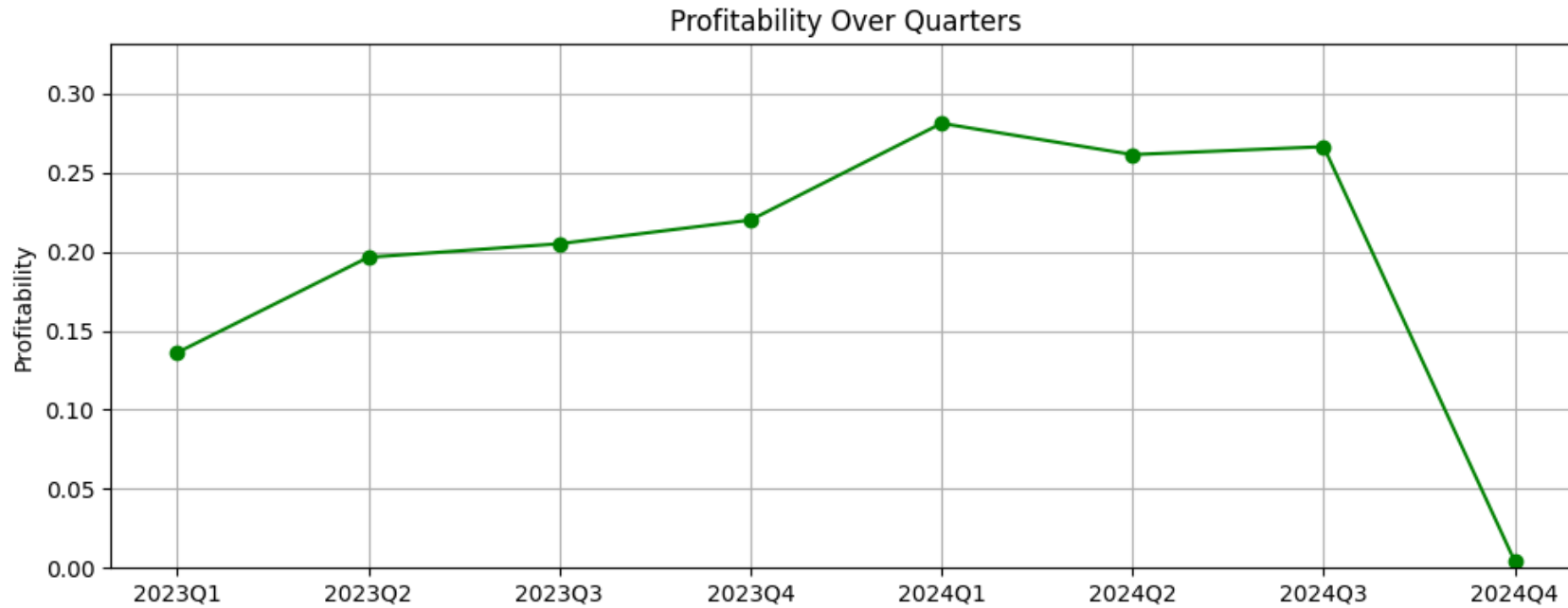
- Profitability **kept improving every quarter**.
- By Q4, margins were strong — showing **good cost control and efficiency**.

2024 Trend:

- Started off **very strong** — Q1 had the highest profitability (28%).
 - But in **Q4'24, profitability crashed** to just 0.4%.
- Likely due to **high costs, poor sales, or one-time losses**.

Line Chart

- **Consistent growth** in profitability from **2023Q1 (0.14)** to a **peak in 2024Q1 (0.28)**.
- **Slight decline** in **2024Q2 and Q3**, but still relatively high.
- **Sharp drop** in **2024Q4** to nearly **0**



❖ What are the possible hypotheses for the YoY and QoQ trends observed?

- Rising Costs:** Increased raw material, labor, or logistics costs hurting margins.
- Heavy Discounting:** Revenue up due to volume, but profits hit due to low pricing.
- Scaling Issues:** Rapid expansion causing inefficiencies and higher overhead.

❖ Mention top 3 cities that are bringing the most revenue.

	Store ID	Revenue	City
0	S001	13904972.92	Los Angeles
12	S013	2836834.69	Raleigh
2	S003	2830114.42	Chicago

Question 3: Business Performance Overview

Populate the following tables to understand profits from each product category

Brand	2023 Profit	2024 Profit	2023 Market Share	2024 Market Share
Bose	15776.60	74338.42	4.89	14.54
VoltEdge	139385.11	205068.73	45.61	36.30
Sony	51683.52	58414.18	16.53	8.13
Samsung	13127.56	15452.91	4.57	2.44
Dell	2563.66	69497.02	0.89	10.35
HP	12456.09	65326.24	3.82	13.73
Apple	48289.92	87782.94	12.96	12.71
ASUS	30689.43	6941.46	10.72	1.80

Category	2023 Profit	2024 Profit	2023 Market Share	2024 Market Share
Accessories	83270.55	120934.21	25.61	21.24
Laptops	17360.63	61396.93	5.90	8.68
Headphones	45090.70	108818.35	16.01	18.36
Gaming Consoles	99739.87	148028.75	33.05	29.47
Smart Gadgets	68510.08	144143.66	19.43	22.25

- ❖

Share insights based on the above tables.

❖

<Answer>

❖

How are VoltEdge products performing in comparison with other brands?

❖

<Answer>
- 7

Share insights based on the above tables.

- Insights from the Tables:
- VoltEdge leads the pack with the highest profit in both years:
 - ₹1,39,385 in 2023 → ₹2,05,068 in 2024
 - Although their market share dropped (45.61% → 36.30%), they're still far ahead in both profit and dominance.
- Big Jumpers:
 - Dell made a huge leap: ₹2,563 → ₹69,497 profit & 0.89% → 10.35% market share – massive growth!
 - HP also improved strongly (₹12,456 → ₹65,326), increasing share from 3.82% to 13.73%.
- Strugglers:
 - Sony and ASUS saw declining profits and lost significant market share.
 - Sony: Profit up slightly, but market share halved (16.53% → 8.13%)
 - ASUS: Profit dropped from ₹30,689 to ₹6,941, with market share falling hard (10.72% → 1.80%)
- Top Product Categories in 2024:
 - Gaming Consoles: ₹1,48,028 profit (29.47% share)
 - Smart Gadgets: ₹1,44,143 profit (22.25% share)
 - Headphones are rising too: ₹1,08,818 profit in 2024 vs ₹45,090 in 2023

How are VoltEdge products performing in comparison with other brands?

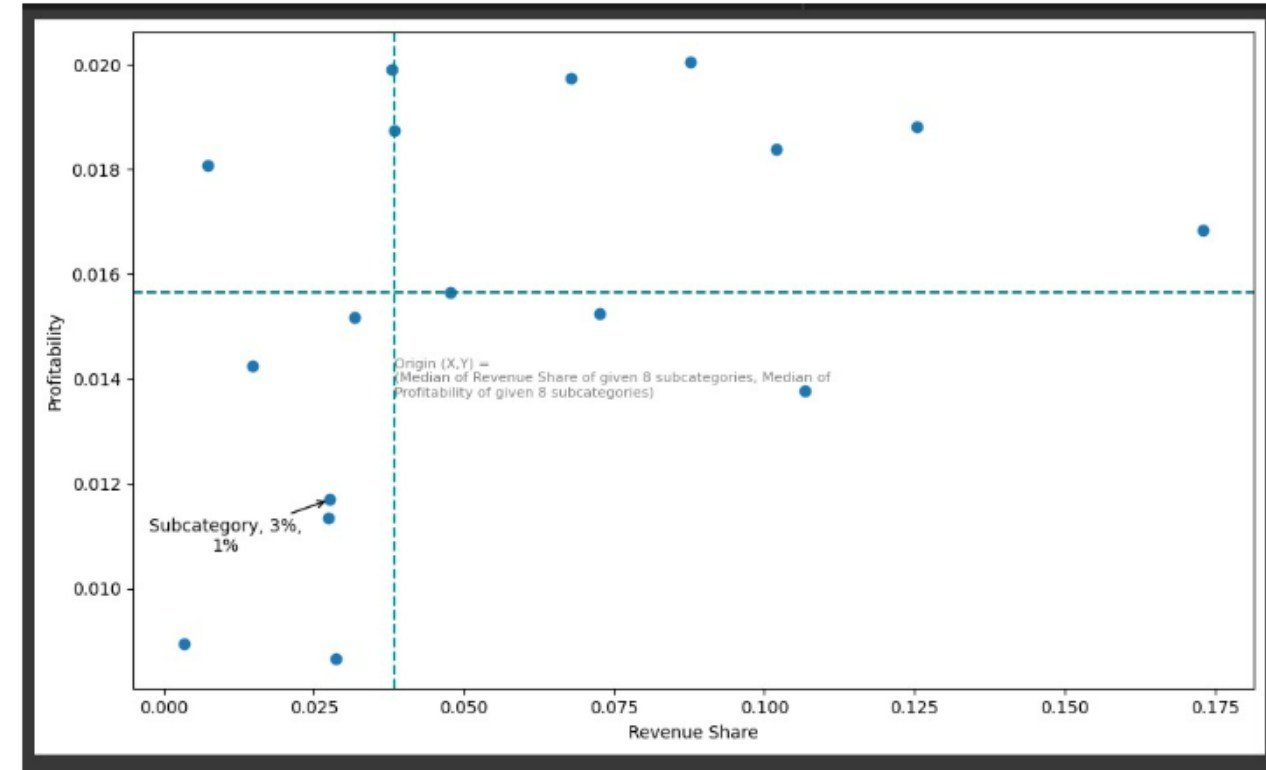
- Still the market leader in both profit and share, but its market share dropped by 9.31% (from 45.61% to 36.30%).
- Despite the dip, no other brand comes close in absolute profits – VoltEdge's 2024 profit is more than 2x Sony + Apple combined.
- Other brands like HP and Dell are catching up in terms of growth rate, but not volume.
- Suggests VoltEdge is maturing, while others are playing catch-up with rapid gains.

Question 4: Subcategory Deep dives

Populate the following table and plot the subcategory of products on the scatter plot

Revenue Share to be calculated with respect to all 17 subcategories.

Subcategory	Profitability	Revenue share
Mice	0.011696	0.0276
Chargers	0.015236	0.072622
Game Consoles	0.016847	0.173023
VR Headsets	0.01377	0.106732
Gaming Laptops	0.018747	0.038352
Keyboards	0.018803	0.125444
Wireless Earbuds	0.011346	0.027402
Smart Speakers	0.018073	0.007339



- ❖ Interpret the graph and recommend some actionable insights for the Store Managers based on the 4 quadrants.
 - ❖ **Game Consoles and Keyboards** are doing great – they bring in both high profits and strong sales. Keep pushing these; they're worth the investment.

Interpret the graph and recommend some actionable insights for the Store Managers based on the 4 quadrants.

- **Smart Speakers and Gaming Laptops** are profitable but don't sell as much. With better marketing or offers, they could grow fast.
- **Chargers and VR Headsets** sell a lot but don't make much money. It's time to work on margins – maybe reduce costs or rethink pricing.
- **Mice and Wireless Earbuds** are underperforming on both fronts. Unless they serve a strategic purpose, it may be better to scale them down.

Question 5.1: Store Performance Review

Assess the store level performance using the table below.

	Active Stores	2023 Revenue	2024 Revenue	YoY Revenue Growth	2023 Market Share	2024 Market Share	Market Share Delta	2024 Profit
0	S001	5605074.86	8299898.06	48.08	27.501848	25.073029	2.428819	2061662.75
15	S017	828095.72	1984007.56	139.59	4.063133	5.993457	1.930324	616896.79
6	S007	1013577.51	1717857.73	69.48	4.973217	5.189449	0.216232	527689.57
12	S014	999686.20	1608359.08	60.89	4.905058	4.858666	0.046392	523547.56
2	S003	930576.48	1899537.94	104.12	4.565965	5.738284	1.172319	520871.54
17	S019	1109319.81	1476515.99	33.10	5.442986	4.460383	0.982603	477475.19
16	S018	937581.46	1703012.96	81.64	4.600335	5.144605	0.544269	463095.18
8	S009	1128220.31	1660963.71	47.22	5.535723	5.017579	0.518145	458300.86
13	S015	1139499.78	1672414.85	46.77	5.591067	5.052171	0.538896	211177.31
10	S011	1101987.78	1549154.50	40.58	5.407011	4.679816	0.727195	175787.16
7	S008	687384.64	1511853.75	119.94	3.372720	4.567135	1.194415	133361.35
1	S002	912213.74	1331320.33	45.94	4.475866	4.021764	0.454102	53774.18
3	S004	961483.70	1772761.70	84.38	4.717614	5.355307	0.637694	-115216.31
11	S013	1160435.28	1676399.41	44.46	5.693789	5.064208	0.629581	-132737.30
4	S005	801496.87	1768163.49	120.61	3.932623	5.341417	1.408794	-182007.76
9	S010	1064083.72	1470672.26	38.21	5.221031	4.442730	0.778301	-192716.59

❖ Share insights on the top and bottom performing stores.

Top Performing Stores:

- S001

- Revenue Growth: 48.08%
- Profit: \$20,61,662.75
- Market Share Delta: +2.42%
Fastest-growing and most profitable store. Clearly leading on all fronts.

- S017

- Revenue Growth: 139.59%
- Profit: \$6,16,896.79
- Market Share Delta: +1.93%
Strong growth and profit with an expanding market share.

- S007

- Revenue Growth: 69.48%
- Profit: \$5,27,689.57
- Market Share Delta: +0.21%
Reliable performer – steady profit and share gain.

Bottom Performing Stores:

- S005
 - Revenue Growth: 120.61%
 - Profit: -₹1,82,007.76 (loss)
 - Market Share Delta: +1.41%
Big revenue jump, but losing money – costs likely out of control.
- S013
 - Revenue Growth: 44.46%
 - Profit: -₹1,32,737.30 (loss)
 - Market Share Delta: +0.62%
Moderate sales growth, but not translating to profit.
- S010
 - Revenue Growth: 40.58%
 - Profit: -₹1,23,737.30 (loss)
 - Market Share Delta: +0.72%
Also showing losses – needs review of cost structure or pricing.

Question 5.2: Store Performance Review

Create individual rankings for each of the metrics calculated in 5.1. Create a weighted score using the weights indicated in brackets. Create a final ranking based on the weighted score. (Hint: weighted score calculated by multiplying metric ranks with weights and summing them)

1. 2024 Revenue (20%)
2. % YoY Revenue growth (2023 vs 2024) (10%)
3. 2023 to 2024 Market Share Delta (40%)
4. 2024 Profit (30%)

	Active Stores	2024 Revenue Rank	YoY Growth Rank	Market Share Delta Rank	2024 Profit Rank	Weighted Score	Final Rank	Segment	2024 Cost of Operation
0	S001	1	9	1	1	1.8	1	H	553865
1	S002	16	12	14	12	13.6	16	L	343507
2	S003	3	4	5	5	4.5	3	H	66601
3	S004	4	5	9	13	8.8	8	M	661157
4	S005	5	2	3	15	6.9	4	H	754024
5	S007	6	7	15	3	8.8	8	M	320116
6	S008	13	3	4	11	7.8	5	H	36488
7	S009	10	10	13	8	10.6	12	L	624815
8	S010	15	15	7	16	12.1	15	L	310018
9	S011	12	14	8	10	10.0	10	M	647955
10	S013	8	13	10	14	11.1	14	L	298803
12	S015	9	11	12	9	10.4	11	L	62311
13	S017	2	1	2	2	1.9	2	H	78213
14	S018	7	6	11	7	8.5	6	M	73535
15	S019	14	16	6	6	8.6	7	M	98971

❖Based on the 2024 Profit and Cost of Operation, which one of the above stores should be closed down?

The store that should be closed is S010.

Rationale:

- It has a Final Rank of 15, making it one of the poorest-performing stores overall.
- It ranks last (16th) in 2024 Profit, indicating the lowest profitability among all stores.
- Its Cost of Operation is ₹310,018, which is not justified by its returns.
- Across key metrics like Revenue Rank (15), YoY Growth Rank (15), and Market Share Delta Rank (7), the store consistently underperforms.
- While Store S002 ranks 16th overall, it still performs better in profit and cost efficiency compared to S010.

Conclusion:

Store S010 shows weak performance across all indicators and does not provide sufficient returns for its operating cost. Hence, it should be considered for closure.

Question 6: Demographics

You have been provided data for customers who have shown interest in a promotional offer campaign.

What is the average age and gender split in each customer segment?

Also, calculate and populate the number of loyal customers. (Loyalty = Customers who visited more than 4 times & MTBO < 2.5 months)

Customer Segment	Count of Customers	Average of Age	Male/Female Ratio	Loyal Customers
H	129	39.01	0.90	70
L	129	37.35	1.01	0
M	242	37.58	1.28	91

Customer Segment	Apple	ASUS	Bose	Dell	HP	Samsung	Sony	VoltEdge
H	82	86	84	71	93	75	99	129
L	50	68	50	46	51	51	51	124
M	134	160	134	114	162	137	154	234

Top 3 Subcategory bought by High Customer Segment	
Keyboards	105
Game Consoles	103
Chargers	102

Customer Segment	VoltEdge
H	100.00%
L	96.12%
M	96.69%

- ❖ What are the top 3 most popular product subcategories in the High segment?
 - ❖ Keyboards , Game Consoles , Chargers
- ❖ What is the Penetration of VoltEdge Brand within each segment? (Customer% of total customers within segment)
 - ❖ H-100% ; M-96.69% ; L-96.12%

Question 7:

Populate the following cross tab by calculating the number of customers within each customer and store segment

Store Segment				Store Visited	Loyal Customers	Other	Store Segment Column Conditions		
Customer Segment	H	L	M				AOV	Customer Count	Store Segment
M	47	43	152	S001	11	23	>= 3534	40-53	High (H)
L	24	37	68	S002	5	15	>= 3534	30-39	Medium (M)
H	24	24	81	S003	7	19	>= 3534	20-29	Medium (M)
				S004	8	18	< 3534	40-53	Medium (M)
				S005	16	26	< 3534	30-39	Medium (M)
				S007	16	37	< 3534	20-29	Low (L)
				S008	12	19			
				S009	14	25			
				S010	5	25			
				S011	13	22			
				S013	6	23			
				S015	15	32			
				S017	14	19			
				S018	10	18			
				S019	9	18			

Store Visited	Loyalty Rate
S017	42.42%
S008	38.71%
S005	38.10%

❖ What are the top 3 stores with the most Loyalty rate?

❖ 1. **S017** 2. **S008** 3. **S005**

**To be filled by candidate*

Store Segme	Loyal?
H	No
H	Yes
H	No
H	Yes
M	No
L	Yes
M	Yes
L	No
L	Yes
M	No
L	No
L	No
M	No
M	No
L	Yes
H	No
L	No
M	Yes
M	Yes
L	No
L	Yes
L	Yes
H	Yes
H	No
L	No
H	No

Pivot Table

Row Labels	Average of AOV	Count of CustomerID	Store Segment
S001	\$3,670	34	M
S002	\$3,455	20	L
S003	\$3,681	26	M
S004	\$3,692	26	M
S005	\$3,544	42	H
S007	\$3,633	53	H
S008	\$3,315	31	M
S009	\$3,678	39	M
S010	\$3,687	30	M
S011	\$3,590	35	M
S013	\$3,515	29	L
S015	\$3,445	47	M
S017	\$3,387	33	M
S018	\$3,422	28	L
S019	\$3,197	27	L

Formula used for store segment calculation

```
=IF(AA9>=3534,
  IF(AB9>=40, "H",
    IF(AB9>=30, "M", "M")),
  IF(AB9>=40, "M",
    IF(AB9>=30, "M", "L")))
```

Thank You