Exploratory Data Analysis (EDA): Diagnosing Product Sales Trends

Product Sales Performance Analysis: Who's Winning the Market?

How do product sales vary across different days of the week, and what insights can be drawn from the distribution of order volumes by product and day?

1. Overview

This diagnostic analysis aims to uncover meaningful patterns in product sales performance across different days of the week. By leveraging pivot tables and visual heatmaps, we explore how daily fluctuations in order volumes reflect customer purchasing behavior. The insights derived from this analysis are intended to inform strategic decisions in product stocking, marketing campaigns, and operational efficiency, ultimately driving sales growth and customer satisfaction.

2. Goal

- Understand how product sales volumes vary across the days of the week.
- Identify peak and low-performance days for each product.
- Reveal sales concentration trends to support demand forecasting.
- Provide visual insights for easier interpretation and decision-making.
- Equip sales and inventory teams with data-backed recommendations for optimizing schedules and stock levels.

3. Business Challenge

- Uneven Sales Distribution: Inconsistent sales across the week could lead to overstocking or understocking.
- Lack of Day-Specific Product Strategy: Without knowing which products sell best on which days, marketing efforts may miss key opportunities.
- Operational Inefficiency: Misaligned staffing or logistics planning due to unpredictable order volumes.
- Missed Revenue Opportunities: Failure to capitalize on high-demand days with tailored promotions or upselling.

4. Analysis Approach

- Data Preparation: Clean and structure sales data with clear date and product columns.
- Pivot Table Creation: Generate a cross-tab view to summarize unit purchases by product and day of week.
- Visual Analysis: Build a heatmap to highlight volume intensity and uncover patterns at a glance.
- Insight Extraction: Interpret high and low sales zones to understand demand cycles.
- Strategic Recommendations: Advise stakeholders on product scheduling, inventory management, and promotional timing based on insights.

Importing libraries

```
In [9]:  import pandas as pd
         import matplotlib.pyplot as plt
```

Loading the clean dataframe (post-ETL process)

```
In [11]:  df = pd.read_csv("C:\\Monthly_Sales\\cleaned_data.csv")
```

```
In [12]:  df.head()
```

Out[12]:

	Order ID	Product Name	Units Purchased	Unit Price	Order Date	Delivery Address	Month	Month Name	Year	Day Week
0	160155	Alienware Monitor	1	400.99	2024-01-01 05:04:00	765 Ridge St, Portland, OR 97035	1	January	2024	Mo
1	151041	AAA Batteries (4-pack)	1	4.99	2024-01-01 05:04:00	964 Lakeview St, Atlanta, GA 30301	1	January	2024	Mo
2	146765	AAA Batteries (4-pack)	1	4.99	2024-01-01 05:20:00	546 10th St, San Francisco, CA 94016	1	January	2024	Mo
3	145617	Amana Washing Machine	1	600.00	2024-01-01 05:24:00	961 Meadow St, Portland, OR 97035	1	January	2024	Mo
4	156535	Lightning Charging Cable	2	14.95	2024-01-01 05:45:00	451 Elm St, Los Angeles, CA 90001	1	January	2024	Mo

Pivot Table

In [14]:
```python
pivot_table = df.pivot_table(index = 'Product Name', columns = 'Day of Week' , valu
                             aggfunc = 'sum', observed=False )
pivot_table
```

Out[14]:

Day of Week	Fri	Mon	Sat	Sun	Thu	Tue	Wed
Product Name							
AA Batteries (4-pack)	3266	3332	3376	3179	3208	3297	3199
AAA Batteries (4-pack)	3349	3522	3450	3462	3365	3488	3357
Alienware Monitor	581	560	570	564	509	556	521
Amana Dryer	94	106	89	87	85	88	73
Amana Washing Machine	88	99	92	90	77	75	90
Apple Airpods Headphones	2053	2166	2007	2099	1989	2084	2066
Bose SoundSport Headphones	1730	1922	1770	1793	1697	1795	1692
Dell Laptop	537	564	560	546	517	541	534
Dell UltraSharp Monitor	827	807	814	898	806	860	808
Flatscreen TV	609	662	646	604	626	630	647
Galaxy buds Headphones	2526	2521	2478	2474	2311	2614	2494
Google Phone	749	771	710	701	734	775	735
LG UltraGear Monitor	1010	1020	1046	1002	1004	999	1025
Lightning Charging Cable	3055	3067	3016	3134	3037	3215	2974
Macbook Pro Laptop	638	578	624	633	598	666	609
Samsung Galaxy Phone	277	275	271	269	256	253	258
Samsung Odyssey Monitor	841	802	793	817	772	838	883
USB-C Charging Cable	3101	3208	3094	3128	3054	3198	3183
iPhone	950	943	875	919	875	923	815

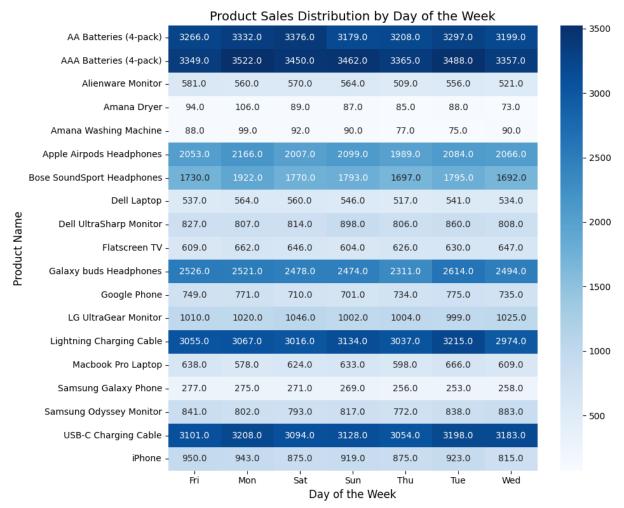## Plotting Product Sales Distribution by Day of the Week

In [16]:
```python
import matplotlib.ticker as ticker
import seaborn as sns

plt.figure(figsize=(10, 8))
sns.heatmap(pivot_table, annot = True, cmap = 'Blues', fmt='.1f', annot_kws={'size'

plt.title('Product Sales Distribution by Day of the Week', fontsize=14)
plt.xlabel('Day of the Week', fontsize=12)
plt.ylabel('Product Name', fontsize=12)

plt.tight_layout()
```

```
plt.savefig(r"C:/Users/DELL/OneDrive - COVENANT UNIVERSITY/Desktop/1. Retail Sales

plt.show()
```


Product Sales Distribution by Day of the Week

Key Insights

1. High-Demand Essentials Stay Consistent All Week: AAA & AA Batteries, Lightning/USB-C Charging Cables, and Galaxy Buds maintain consistently high sales across all days — essential, everyday items with minimal day-of-week fluctuation.

2. Headphones Show Slight Weekend Preference: Apple Airpods, Galaxy Buds, and Bose Headphones see mild sales bumps on weekends (Sat–Sun) — likely driven by leisure time, gifting, or casual shopping.

3. Monitors & Laptops Lean Toward Early Week Activity: Alienware, LG UltraGear, and Samsung Odyssey Monitors show slightly better performance on Mondays and Tuesdays, possibly reflecting corporate or productivity-driven purchases.

4. Smartphones Steady but Subtle Decline Midweek: Products like iPhone, Google Phone, and Samsung Galaxy display more stable demand, though there's a minor dip midweek (especially for iPhones on Wed: 815, the lowest).

5. Large Appliances Are Low Volume Overall: Amana Dryers & Washing Machines have low sales throughout the week, with slightly better traction on Mondays, which might suggest weekend browsing and Monday decision-making.

6. Weekend Electronics Spike: Flatscreen TVs and Dell UltraSharp Monitors peak subtly on Sunday (TV: 604 → 898 for monitor), pointing to consumer behavior around weekend entertainment or research-buying patterns.

Strategic Recommendations

1. Optimize Inventory Based on Product Consistency

- Maintain steady stock levels for essentials like charging cables and batteries throughout the week.
- Automate inventory reorder alerts for these top movers.

2. Launch Targeted Promotions by Day/Product

- Push headphone and gadget promotions on weekends to align with consumer browsing behavior.
- Offer Monday discounts on laptops/monitors to catch productivity-driven buyers.

3. Re-evaluate Shelf and Online Placement for Low Performers

- Low-volume appliances may benefit from bundling strategies or financing offers promoted early in the week.

4. Align Ad Spend and Email Campaigns with Peak Days

- Promote tech accessories midweek and larger electronics toward the weekend.
- Use weekend email marketing to spotlight headphones, entertainment tech, and leisure-related items.