Assignment – 3

Temporal Analysis

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(a) The monthly sales and profit line chart shows clear seasonality in customer activity. Sales gradually increase from March and peak sharply in November and December, likely due to holiday shopping, year-end business purchasing, or targeted promotions. However, profits do not rise at the same pace, which may suggest that peak sales months rely on discounting strategies or lower-margin products. The sharp dip in both sales and profit during July points to a seasonal lull or lack of marketing activity. This month could be an opportunity to introduce new campaigns or incentives to stabilize performance. The divergence between sales and profit also indicates the importance of managing profitability, not just transaction volume. Increasing sales in high-traffic months must be accompanied by better margin strategies to sustain growth. The business could benefit from re-evaluating its discount approach during Q4 and leveraging bundle deals or premium upsells. Optimizing high-margin offerings during peak demand can significantly improve profit without compromising volume.

(b) The year-over-year bar chart reveals a strong growth trajectory in overall revenue from 2011 to 2014. Sales nearly double across this period, demonstrating the company's ability to scale and maintain customer acquisition. However, profit increases at a slower rate, suggesting that rising revenue may not be translating into proportional gains. This raises important questions about the business's operational efficiency, cost control, and pricing strategy. If costs are increasing alongside sales, or if the business is relying on aggressive discounting, long-term profitability could be at risk. The company should examine whether certain product lines or regions are contributing disproportionately to expenses or lower margins. Sustaining this growth will require optimizing both the top line and the bottom line. Revisiting supplier agreements, streamlining operations, or adjusting pricing strategies could help ensure that profit keeps pace with revenue. Identifying categories with low profit-to-sales ratios could also inform better resource allocation and promotional focus.

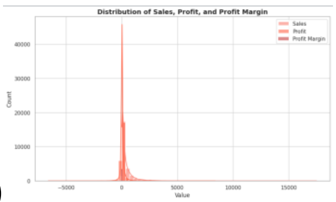
(c) This bar chart provides insights into weekly sales behavior. The data reveals that sales are highest from Tuesday through Saturday, with peak performance typically occurring on Fridays and Saturdays. Conversely, Sunday sees the lowest sales, followed closely by Monday. This trend suggests that customer purchasing behavior is heavily concentrated in the mid-to-late week. The higher performance on weekdays could reflect business-related purchases, procurement cycles, or consumer habits. Understanding these patterns can help businesses better time their promotions, staffing, and restocking schedules. The weaker performance on Sundays may represent an untapped opportunity. Campaigns or flash sales could be tested on weekends to see if engagement can be lifted. Similarly, focusing digital outreach or email marketing around Wednesday through Friday may lead to higher conversions. In-store staffing, customer service coverage, and inventory planning can also be aligned to these peak days. This chart supports the case for building a more responsive and behavior-driven marketing calendar.

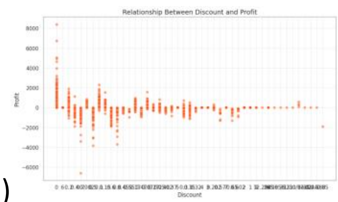
(d) The heatmap visualizes monthly sales across multiple years, using color intensity to highlight trends. A consistent pattern emerges where November and December show the darkest shades, indicating the highest sales volumes. This confirms that Q4 is the most critical revenue-generating period each year. Other months, such as June and August, also show moderate performance depending on the year, while February and July consistently appear lighter, reflecting low sales. These findings reinforce the importance of seasonal planning. Businesses must ensure they are fully prepared for Q4 with sufficient inventory, staffing, and marketing investments. At the same time, underperforming months like July present opportunities for innovative promotions to smooth out revenue fluctuations. Aligning advertising spend and product launches with this seasonal rhythm can lead to more efficient resource usage. The consistent strength of Q4 across all years suggests deeply ingrained consumer behavior that can be further amplified with the right campaigns. Meanwhile, a focus on product innovation or limited time offers in slow months could drive demand when it is traditionally weak.

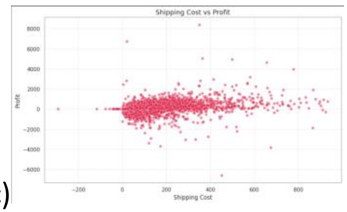
(e) This histogram shows the number of delivery days between order and shipment. Most orders are fulfilled within 2 to 5 days, with a noticeable peak at 4 days. This suggests a relatively efficient logistics operation for the majority of customers. However, there are still smaller spikes at 6 and 7 days, as well as same-day shipping, which may reflect differences in shipping method, geography, or fulfillment center processing. While most deliveries fall within an acceptable window, the longer delivery times highlight a potential customer satisfaction risk. Streamlining the fulfillment pipeline to reduce tail-end delays could improve repeat purchase rates and customer loyalty. Regional analysis may uncover if certain areas or product types consistently face delays. Optimizing shipping partnerships or considering local warehousing could be strategic next steps. Encouraging customers to choose standard shipping through incentives could also help better balance fulfillment capacity. Overall, this visualization provides clear insights for improving consistency and setting accurate delivery expectations.

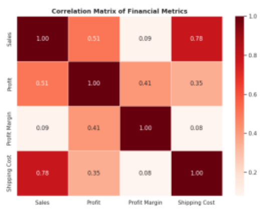
(f) This line chart tracks the annual sales performance of three major product categories: Furniture, Office Supplies, and Technology. All three categories show steady growth between 2011 and 2014, but Technology stands out with the sharpest upward trajectory, surpassing the others by the final year. This trend reflects a possible shift in customer preference toward tech-driven solutions, likely influenced by increased digital adoption in both business and personal contexts. Office Supplies maintain a strong presence with moderate growth, while Furniture rises at a slower pace, possibly due to longer replacement cycles or less frequent purchases. This data signals an opportunity for the business to invest more in its Technology segment by expanding inventory, improving marketing, or bundling accessories to increase average order value. Simultaneously, Office Supplies can be paired with tech products to increase cart size. Furniture, while slower, may benefit from design innovation, seasonal promotions, or space-saving product lines. Understanding these trends enables better inventory planning, campaign targeting, and cross-selling strategies across the catalog.

Financial Analysis

a) 

b) 

c) 

d) 

e) 

(a) The distribution chart of sales, profit, and profit margin reveals that most transactions cluster around lower values, with sharp peaks near zero. This pattern indicates a high volume of small-scale transactions, while higher-value purchases and larger profits are significantly less frequent. Interestingly, the profit margin shows a tighter concentration than sales and profit, suggesting that despite varying order values, margins across orders remain fairly uniform. However, the presence of left-side outliers—negative sales, profits, and margins—points to orders that are being fulfilled at a loss. This could result from excessive discounting, high fulfillment costs, or unprofitable product mixes. The visualization highlights a critical operational insight: a large portion of revenue may be coming from lower-margin or even loss-making orders. For a retail business, this emphasizes the importance of going beyond sales volume and focusing on order profitability. To improve performance, the company should identify which products or customer segments are frequently associated with negative profit or margins. These could either be eliminated, repriced, or bundled with higher-margin items to enhance overall profitability. Furthermore, tracking profitability by segment over time would allow more accurate targeting and pricing. Implementing margin-based performance dashboards could also help teams shift focus from just driving revenue to driving value.

(b) This scatter plot highlights a clear negative relationship between discount and profit. As discounts increase, profit consistently declines, with heavily discounted transactions often falling into significant losses. While a few full-priced orders result in high profits, discounted orders rarely generate strong returns. This visualization strongly suggests that the company's discounting strategy may be overly aggressive, particularly for products with already low margins. It's a common retail mistake to assume that more discounting drives more volume — but this graph shows that the trade-off can erode profitability to unsustainable levels. The business must therefore reconsider its promotional strategies, especially blanket discounts across categories. Instead, discounts should be strategically applied to price-elastic products or bundled offerings where margins can still be protected. Segmenting customers based on purchase behavior or loyalty can also enable personalized, profitable discounting. In addition, products that repeatedly show negative profit despite being discounted should either be discontinued or reformulated. A smarter, data-driven discount strategy can ensure competitiveness without undermining the business's bottom line. It's also important to A/B test future discount levels to find the tipping point where volume growth still supports profit, rather than sacrificing it.

(c) The scatter plot analyzing shipping cost and profit reveals a loosely spread distribution with no strong linear relationship. Most orders with low-to-medium shipping costs tend to have moderate profit, but many transactions with higher shipping costs show negative profits. This points to a possible issue: shipping costs are not always being fully recovered from the customer. Some of the largest shipping costs are associated with the steepest profit losses. This could be due to long-distance deliveries, bulky products, or inefficient logistics partnerships. For a retail business, this insight is crucial—fulfillment costs must be either incorporated into pricing or explicitly passed on to the buyer. If left unchecked, high shipping costs could drain profit even from otherwise high-value sales. To address this, the company should re-evaluate its shipping fee structure and consider implementing tiered delivery pricing based on order size, location, or product weight. Additionally, offering free shipping only above a specific cart threshold could encourage customers to spend more while offsetting the expense. Partnerships with regional warehouses or third-party logistics providers might also reduce costs. Tracking loss-making deliveries by region or product type could uncover opportunities for targeted optimization. Ultimately, profitability must account for all cost factors — not just the product, but the path it takes to reach the customer.

(d) The correlation matrix visualizes the relationships among four key financial metrics: sales, profit, profit margin, and shipping cost. The most prominent correlation is between sales and shipping cost (0.78), which is intuitive—higher-value or larger orders tend to cost more to ship. Profit is moderately correlated with sales (0.51), which shows that larger transactions often drive profit, though not always proportionately. However, the correlation between profit and profit margin is only 0.41, which means profit can increase even if margins remain relatively constant. The weakest link is between profit margin and sales (0.09), which reinforces the idea that high-revenue orders do not automatically yield high-margin outcomes. The low correlation between shipping cost and profit margin (0.08) is also telling—logistics expenses do not seem to be consistently managed against profit outcomes. This matrix confirms that focusing solely on increasing sales won't necessarily lead to improved margins or profitability. The company must instead treat margin and fulfillment efficiency as distinct levers. Margin performance should be tracked independently, with targeted strategies to boost it. Teams should explore margin-enhancing tactics like bundling, premium versions, and better vendor negotiations. Sales teams should also be measured on contribution margins, not just top-line growth, to foster accountability across departments.

(e) The bar chart comparing sales and profit across order priority levels offers interesting insights into customer behavior and fulfillment performance. Medium-priority orders generate the highest sales volume, followed by high-priority and low-priority orders. However, profit does not increase at the same rate. In fact, while high-priority orders drive significant sales, their profit levels remain comparable to lower-priority categories. This discrepancy may suggest that high-priority orders are associated with added fulfillment costs, such as express shipping or expedited handling, without corresponding pricing adjustments to maintain margins. Another possibility is that customers choosing high-priority delivery are more price-sensitive, using promo codes or discounts that erode profitability. The takeaway is clear: fulfilling urgency at the cost of margin is unsustainable. The business should consider adjusting pricing or adding small surcharges for high-priority orders to account for the higher operational strain. It could also promote mid-priority orders as the default to better manage resource loads while still delivering quickly. Additionally, identifying which products or customers are most likely to choose high-priority delivery could help tailor service offerings and pricing more effectively. Ensuring that urgency-driven demand does not undermine the bottom line is essential for balancing customer satisfaction with financial sustainability.

Geographic Analysis

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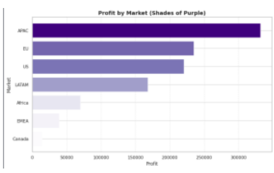

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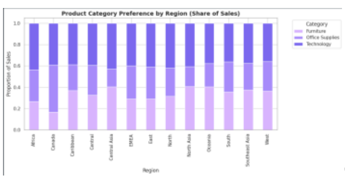

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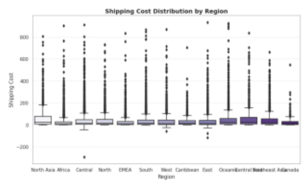


d)

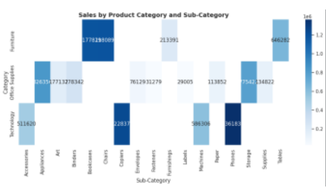
(a) This visualization ranks regions by total profit, highlighting a strong performance from Central and North regions, which are leading in profitability. In contrast, regions like Southeast Asia, Caribbean, and Canada contribute the least and may even be operating close to break-even or at a loss. The distribution shows that profitability is not evenly spread, which can be due to varying product demand, logistics costs, or customer preferences across geographies. For retail strategy, this reveals that regional performance must be actively tracked to avoid over-investment in underperforming areas. One surprising observation is Canada's position at the bottom, which might not be expected given the typical market maturity—this could indicate an issue with pricing, competition, or delivery inefficiencies specific to that region. The business should consider reallocating marketing and operational budgets toward the more profitable regions while investigating loss-making regions for potential restructuring or repositioning. Additionally, analyzing the product mix sold in each region can uncover which categories drive higher margins locally. Offering tailored promotions or exclusive regional bundles could improve performance. Finally, investing in local partnerships or warehousing in high-profit regions may reduce costs and increase responsiveness, further strengthening profitability where it already excels.

(b) The profit analysis by market reveals that the APAC region dominates with the highest profit, followed by the EU and US markets. These markets significantly outperform LATAM, Africa, and Canada in profitability. The disparity implies differences in consumer purchasing power, product preferences, and possibly operational efficiency. Interestingly, even developed markets like Canada and EMEA rank at the bottom, raising questions about logistics costs, pricing strategies, or ineffective targeting. For retail planning, this visualization suggests a need for market-specific approaches rather than blanket global strategies. A key insight here is that despite having relatively lower overall sales in some markets, strong margins or cost control can still yield high profit. On the other hand, some markets may require higher investment in brand building, channel development, or fulfillment infrastructure to reach their potential. Actionable recommendations include optimizing product portfolios per market based on profitability trends, introducing region-specific campaigns tailored to local customer behavior, and renegotiating vendor contracts in low-profit markets. Moreover, evaluating local delivery partners or establishing fulfillment hubs in high-performing markets like APAC could reduce cost-to-serve and improve service levels. A market-based profitability lens ensures that strategic decisions are financially sound and tailored to each region's maturity and margin opportunity.

(c) The stacked bar chart displays the proportional sales distribution of product categories—Furniture, Office Supplies, and Technology—across regions. Technology emerges as the most favored category in nearly every region, contributing the largest share to overall sales. Office Supplies maintains a steady presence across most regions, while Furniture shows more variation, peaking in Central and West regions and dipping in Southeast Asia and Canada. This trend suggests that consumer behavior and business needs vary significantly by geography. For instance, technology's consistent performance may indicate a global shift towards digital tools and connectivity, which retail strategy can tap into with bundled tech promotions or upsells. Conversely, Furniture's uneven popularity might be influenced by real estate trends, purchasing power, or cultural preferences. Retailers can use this insight to tailor inventory, pricing, and marketing strategies per region. For example, stocking more technology items in Southeast Asia and offering regional promotions for Furniture in Central and West could boost category performance. Furthermore, cross-category bundles can encourage customers to diversify their purchases. The company should also investigate product satisfaction and return rates across regions to identify hidden dissatisfaction or unmet needs. Category-level segmentation by region is a powerful lever for improving margins while meeting customer demand with precision.

(d) This box plot provides insight into shipping cost variability across different regions. The most significant observation is the wide spread of shipping costs in nearly all regions, with a notable number of outliers—especially in Central, Southeast Asia, and North Asia. These high-cost deliveries may stem from longer distances, lack of nearby fulfillment centers, or expensive carriers. Surprisingly, regions like Africa and EMEA, often assumed to be costlier to serve, have a narrower shipping cost distribution than expected. This may indicate more centralized urban deliveries or subsidized costs. The business implication is clear: shipping inefficiencies disproportionately impact certain regions, which could erode overall profitability. To address this, the company should conduct a detailed cost-to-serve analysis by region. Implementing regional hubs or working with local last-mile delivery partners in high-cost zones could reduce variability. Another approach is to introduce minimum order thresholds for free shipping, tailored to the cost structure of each region. Additionally, machine learning models could be applied to forecast shipping costs and flag potentially unprofitable orders in advance. Redesigning shipping policies regionally ensures that customer satisfaction is maintained while protecting profit margins. Optimizing logistics by geography could be one of the most impactful levers for long-term financial improvement.

Product and Customer Analysis



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a) The heatmap depicting sales by product category and sub-category reveals crucial insights into which product types drive revenue across the three main categories: Furniture, Office Supplies, and Technology. Technology leads the way with standout performance in Phones and Copiers, with Phones generating the highest sales overall. Within Furniture, Chairs and Tables dominate, while in Office Supplies, Binders and Storage appear as consistent contributors. Interestingly, some sub-categories such as Fasteners and Envelopes across Office Supplies and Furnishings under Furniture exhibit relatively low sales, highlighting potential underperformance or niche market segments. The sharp variation in sales intensity between sub-categories within the same category suggests significant disparities in customer preferences or market demand. This visual aids in identifying core revenue drivers and low-performing products. From a retail strategy standpoint, these insights can help optimize inventory and marketing efforts. Actionable recommendations include: 1) reallocating shelf space and marketing budgets toward top-performing sub-categories like Phones and Chairs; 2) conducting market research or bundling strategies to improve sales of weaker sub-categories; and 3) using high-performing products to anchor promotional campaigns and cross-sell related items. Retailers can further enhance profitability by phasing out or re-evaluating low-margin items. This chart provides a clear foundation for product-level strategic decision-making.

b) The scatter plot visualizing profit distribution across Consumer, Home Office, and Corporate segments provides meaningful insights into segment-level profitability. Corporate customers exhibit a dense concentration of higher-value profits, indicating that they are often involved in larger transactions. However, this segment also displays a wider range of variability, with some extreme profit and loss points, possibly due to large volume orders affected by high discounting or service costs. The Consumer and Home Office segments show a tighter profit distribution, suggesting more consistent but smaller-scale purchases. These patterns underscore the importance of customer segmentation in shaping pricing and marketing strategies. While Corporate customers bring in more revenue per transaction, they may also carry greater risk. Conversely, the Consumer segment offers a stable volume-driven revenue stream. From a retail strategy perspective, this visualization supports differentiated approaches per segment. Actionable recommendations include: 1) implementing stricter discount controls and contractual terms for Corporate clients to manage profit volatility; 2) designing targeted loyalty programs for the Consumer segment to boost frequency and basket size; and 3) exploring bundling or value-added services for Home Office clients to maximize margin. Understanding segment-specific profit trends enables more strategic targeting, pricing, and retention initiatives.

c) The bar chart depicting the top 10 most profitable products highlights a strong concentration of revenue in the technology segment, especially in office electronics. The Canon imageCLASS 2200 Advanced Copier significantly outpaces all other items in total profit, followed by high-performing smart phones from brands like Motorola, Cisco, and Nokia. The dominance of these items suggests that high-value electronics are crucial drivers of profitability. While office furniture like the Sauder Classic Bookcase also makes the list, the majority of top earners are tech-related, pointing to a consistent demand for communication and productivity tools. This insight is particularly important for inventory and marketing decisions, as it allows businesses to focus on stocking and promoting the items that yield the greatest return. The concentration of profitability among a few products also highlights the potential risk of over-reliance on limited inventory. Actionable recommendations include: 1) prioritizing inventory management and supplier relationships for these top-grossing items to avoid stockouts; 2) creating promotional bundles that pair less popular products with bestsellers to increase overall sales; and 3) expanding product lines or variations of high-performing items to meet broader customer needs. These strategies can help maintain revenue momentum and build resilience in product offerings.

d) The line chart illustrating customer buying patterns over time reveals a clear and steady growth in order volume across all customer segments from 2011 to 2014. The Consumer segment consistently leads in terms of order volume, followed by Corporate and Home Office segments. All three groups exhibit upward trends, with noticeable seasonal spikes toward the end of each year, likely aligning with year-end procurement cycles or holiday-related spending. This pattern suggests predictable peaks in customer activity that businesses can leverage for demand planning and promotional strategies. The Consumer segment's dominance also reinforces its central role in sustaining long-term sales growth. Meanwhile, the Corporate and Home Office segments show healthy expansion, indicating growing market penetration and potential for tailored engagement. These findings are significant for shaping inventory planning, marketing timing, and customer relationship management. Actionable recommendations include: 1) aligning promotional campaigns with year-end spikes to maximize conversion rates; 2) developing retention and loyalty strategies for the Consumer segment to strengthen recurring purchases; and 3) exploring personalized outreach and bulk purchase incentives for Corporate and Home Office clients. This time-based insight is crucial for aligning supply chain and sales operations with actual customer behavior trends.