Question 1: E-commerce Funnel Analysis and Insights

### Task 1 Data Exploration and SQL Query:

#### Data Exploration and SQL Query:



#### Attached Jupyter notebook performs the following tasks.

#### Cleanse the raw data.

#### Load cleaned data into a SQL server table using SQL .

#### Performs below checks using SQL

#### Unique events in the dataset using SQL.

#### Check the Date Range in the Dataset.

#### Comprehensive Funnel Segment Analysis.

#### Stores the Funnel Segment into a .csv for analysis in later stage. All the python and SQL code are in the embedded file below.

### Task 2 Data Presentation:

Attached Jupyter notebook performs the following tasks.



* Load and validate your CSV data.
* Create detailed funnel visualizations showing performance over time. See below A close-up of a graph

  AI-generated content may be incorrect.
* Generate summary tables
  + With daily and weekly performance comparisons

A list of daily performance

AI-generated content may be incorrect.

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AI-generated content may be incorrect.

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AI-generated content may be incorrect.

* Provide advanced analytics including drop-off rates and correlations.

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AI-generated content may be incorrect.

A screenshot of a computer

AI-generated content may be incorrect.

* Save results for further use.

### Task 3 Insights and Analysis:

Funnel Analysis: Key Findings

a) Main Reasons Behind Funnel Drops

1. Major Drop-off Points Identified:

Site Visit → Product View:

The most significant drop-off occurs immediately after the site visit stage. From the bar chart ("Average Funnel Drop-off"), out of 5,404 average site visits, only 3,319 progresses to product views. This means nearly 39% of users leave without viewing a product, indicating issues with homepage engagement, unclear navigation, or ineffective calls-to-action.

Product View → Add to Cart:

Another substantial drop is observed here: only 351 users, on average, add products to their cart after viewing. This suggests that only about 10.6% of product viewers are motivated to add items to their cart. Possible reasons include:

Unattractive product details or images.

Lack of trust (e.g., missing reviews or ratings).

Pricing concerns or lack of promotions.

Checkout → Purchase:

The final step shows a sharp drop: only 86 purchases from 261 checkouts on average. This is a 67% drop-off at checkout, often due to:

Complicated or lengthy checkout process

Unexpected costs (shipping, taxes)

Limited payment options or technical issues

2. Data Support:

The "Average Funnel Drop-off" chart visually confirms that the largest absolute drop is from site visits to product views, followed by product view to add to cart, and then a significant relative drop at the checkout stage.

The daily and weekly tables reinforce these findings, showing consistently low numbers for add to cart, checkout, and purchase compared to initial visits and product views.

b) Notable Trends in Stepwise Conversion Rates

1. Stepwise Conversion Rates Over Time:

Stable Early-Stage Conversion:

The "Daily Conversion Rates Over Time" chart shows that the conversion rate from site visit to product view remains relatively stable, with minor fluctuations. This suggests consistent performance in attracting product interest from visitors.

Volatility in Later Stages:

The conversion rates from cart to checkout and checkout to purchase are more volatile, with some days showing sharp drops or spikes. For instance, the checkout-to-purchase rate dips significantly on certain days, possibly due to technical issues or external factors (e.g., payment gateway downtime).

Overall Conversion Rate Trend:

The "Overall Conversion Rate Trend" chart shows a general upward trend, peaking at 3.53% on 2023-06-10. This suggests that recent optimizations or campaigns may have positively impacted user behavior, but the conversion rate remains below 2% on most days.

2. Best and Worst Days:

Best Day (2023-06-10):

Highest conversion rate (3.53%), possibly due to a successful promotion, improved UX, or targeted campaign.

Worst Day (2023-06-07):

Lowest conversion rate (0.77%), which may warrant investigation into site issues, external factors, or ineffective campaigns on that day.

Recommendations

Improve Homepage Engagement:

Address the high drop-off after site visits by enhancing homepage content, navigation, and calls-to-action.

Optimize Product Pages:

Increase add-to-cart rates by improving product information, adding reviews, and offering incentives.

Streamline Checkout:

Reduce checkout abandonment by simplifying forms, providing clear cost breakdowns, and offering multiple payment options.

Monitor and React to Volatility:

Investigate causes behind daily conversion rate swings, especially on the worst-performing days.

Summary:

The funnel analysis highlights that the largest user losses occur at the very first step (site visit to product view) and at checkout. While overall conversion rates show some improvement, addressing these key drop-off points will be critical for boosting overall performance. Continuous monitoring and targeted optimizations are recommended to sustain and enhance conversion rates.

### Task 4. A/B Test Hypotheses:

**Hypothesis 1: Enhanced Homepage/Product Discovery**

**What to Test and Why:**

Test a redesigned homepage that features:

- Clearer navigation

- Prominent product categories

- Personalized product recommendations

The goal is to reduce the significant drop-off between site visits and product views, as nearly 39% of users currently leave without viewing a product.

**Metrics to Track:**

Product views per site visit (product view rate)

Bounce rate

Average session duration

**Expected Outcome and Business Impact:**

Improved homepage clarity and product discovery should increase the percentage of visitors who view products, resulting in a higher product view rate.

This can lead to more users progressing through the funnel, ultimately increasing add-to-cart and purchase rates.

The business impact is a larger pool of engaged users, boosting top-of-funnel efficiency and potential revenue.

**Hypothesis 2: Streamlined Add-to-Cart Experience**

**What to Test and Why:**

Test a simplified product page and add-to-cart process by incorporating:

- One-click add-to-cart buttons

- Clearer pricing

- Trust signals (e.g., reviews, guarantees)

The data shows a sharp drop from product views to add-to-cart, with only about 10.6% conversion at this step.

**Metrics to Track:**

Add-to-cart rate (add-to-cart actions per product view)

Click-through rate on add-to-cart buttons

Cart abandonment rate

**Expected Outcome and Business Impact:**

Making it easier and more appealing to add items to the cart should increase the add-to-cart rate.

This will drive more users into the checkout process, increasing the likelihood of purchases.

The business impact is a higher volume of potential sales and improved mid-funnel performance.

Question 2: Analysis of PDP Heatmap **Product‑Detail Page (PDP) Heat‑Map Analysis – Mobile View**

*(focus on first‑screen content; five key interaction zones identified)*

| **#** | **Heat‑Map Observation** | **Behavioural Hypothesis** | **Potential Impact on Add‑to‑Cart** | **Data Needed to Validate / Deepen Insight** |
| --- | --- | --- | --- | --- |
| **1** | **Dense clicks on “SAVE XX” coupon strip (very top banner)** – especially the green coupon code badge. | Shoppers interpret the banner as a tappable promo field allowing them to *apply* or *copy* the code. They may also believe the mattress coupon applies to the pillow. | *Positive*: Shows high promo affinity. *Negative*: If the element is non‑interactive or irrelevant to pillows, it can create friction, divert attention—ultimately lowering pillow add‑to‑cart (ATC) likelihood. | • Tap‑level funnel: % of taps that open a new page vs. dead‑clicks. • Session replay to detect “rage clicks” (≥3 taps in 3 s) on the banner. • Segmented revenue impact analysis (pillow vs. mattress) from banner‑tap sessions. |
| **2** | **High click concentration on hero text “Get 15 % Off”** (overlaying sleeping image). | Users assume the discount headline is a CTA (e.g., opens pricing modal or reveals code). The copy affords action although the text itself isn’t (or shouldn’t be) clickable. | If taps yield no response, perceived site breakage reduces trust → drop‑offs before reaching ATC. Conversely, routing those taps to the price/variant selector may accelerate purchase intent. | • Dead‑click heat‑map layer (no‑URL / no‑event taps). • Correlation between hero dead‑clicks and bounce / scroll‑depth to ATC. • A/B test variant where hero text scrolls to price block or opens sticky ATC; measure lift in ATC CTR and conversion. |
| **3** | **Clustered taps on product title, star rating ★★★★★, and “301 Reviews” link**. | Visitors seek social proof and detailed reviews early in the journey; they may intend to scroll to the review section faster than the UI allows. | *Positive*: Strong interest in credibility signals—can boost purchase likelihood *if* reviews are accessible. *Risk*: If tap merely reloads page (or does nothing). | • Link‑event tracking: % of taps that jump to review anchor vs. page reload. • Scroll‑to‑review latency (time & pixels) after tap. • Compare ATC rate for sessions that view ≥3 reviews vs. 0. |
| **4** | **Pronounced clicks on icon row (“1XX‑Night Trial”, “Lifetime Warranty”, “Made in USA”, “Free Shipping & Returns”)**. | Icons are perceived as gateways to deeper policy details (e.g., terms of trial). Users want reassurance before commitment. | If icons aren’t interactive or open generic pop‑ups, perceived opacity may stall checkout ⇒ lower ATC. Turning them into concise, trust‑building modals could shorten decision time. | • Event log: icon taps → modal open vs. dead click. • Compare ATC velocity (# of steps & seconds to ATC) for sessions that view policy details vs. those that don’t. • Cohort test: interactive policy modals vs. static icons; measure lift in ATC and return rates. |
| **5** | **Moderate yet distinct taps on hamburger menu, phone, and chat icons** (header utilities), but *very few* observable taps on CTAs further down (price or variant picker not yet in viewport). | Users who can’t find critical info quickly resort to support channels or navigation—signals friction in PDP content hierarchy. Missing immediate price/variant/ATC above the fold forces deeper scroll. | Support‑seeking detours prolong the path to ATC and risk abandonment if answers aren’t immediate. A sticky ATC bar or pricing teaser above the fold could recapture intent sooner. | • Scroll‑depth & time‑to‑first‑ATC‑view metrics. • Conversion differential for sessions triggering chat/phone vs. not. • Heat‑map after introducing sticky ATC bar: does interaction shift from header utilities to ATC? |

Question 3: Analysis of Exclusive Discount Popup A/B Test Results 1. Funnel Context

| **Stage** | **Typical Puffy experience\*** | **Where the mystery‑discount e‑mail pop‑up acts** |
| --- | --- | --- |
| 1. Traffic / Homepage | Paid & organic visitors land on home or landing pages | — |
| 2. Engagement / Product Discovery | Users scroll, click “Shop Now”, view Mattress PDPs | Pop‑up triggers on exit‑intent or after x seconds |
| 3. **Lead Capture** | Visitor enters e‑mail (and sometimes phone) → becomes a subscriber | **Test treatment:** “Spin‑to‑reveal mystery % off” incentive |
| 4. Add‑to‑Cart | Click “Add to Cart / Buy Now” on PDPs | — |
| 5. Checkout | Fills checkout; discount code redeemed if provided | — |
| 6. Purchase / Thank‑You | Order placed; fires “Unique Conversion” event | — |
| 7. Post‑Purchase | Welcome‑series & subsequent flows drive LTV | Pop‑up quality influences list engagement |

2. Key Data‑Driven Inferences

| **#** | **Insight** | **Why it matters in the funnel** |
| --- | --- | --- |
| **1** | **E‑mail‑only sign‑up rate rose +18.8 %** (1.56 % → 1.86 %; +0.30 pp) but *p‑value ≈ 0.24, not yet significant*. | Promising widening of the very top of funnel, but volume (≈ 23 k visitors) is still too low to confirm. |
| **2** | **Phone‑number capture fell ‑32 %** (0.86 % → 0.58 %). | Fewer SMS leads may shrink a high‑ROI channel; trade‑off must be weighed. |
| **3** | **Down‑funnel purchase rate flat** (1.545 % → 1.543 %; essentially 0 % change). | Extra e‑mail sign‑ups did **not** translate into immediate incremental orders during the test window. |
| **4** | **Revenue per visitor ↓ 8.8 %** and **AOV ↓ 5.3 %** (both statistically inconclusive, but directionally negative). | Possible reasons: larger‑than‑usual discounts cannibalised margin, or incentive attracted lower‑intent shoppers. |
| **5** | **PDP Add‑to‑Cart + Buy‑Now click‑through fell ~3 % overall.** | Suggests the pop‑up may distract some shoppers from product exploration. |

3. Additional Data Needed

| **Desired metric** | **Why it unlocks deeper insight** |
| --- | --- |
| **a. Redemption‑rate & average %‑off of the mystery codes** | Quantifies margin impact and links the pop‑up directly to order‑level behaviour. |
| **b. Welcome‑series performance for new leads (open, click, placed‑order rates, 30‑day revenue/LTV)** | Determines whether the extra e‑mail sign‑ups are high‑quality and if value materialises after the test window. |
| **c. Visitor segmentation (new vs. returning, paid vs. organic traffic)** | Tells us *who* responds to the incentive and whether cannibalisation occurs among warm prospects. |

4. Recommendation & Next Steps

1. **Do *not* roll the mystery discount site‑wide yet.**
   * Uptick in raw e‑mail sign‑ups is encouraging but still statistically weak, while early revenue/AOV signals are negative.
   * Retain the current pop‑up as a 50/50 experiment and continue until ≥ 90 % power on the sign‑up metric (*≈ +17 k additional visitors per the sample‑size projections in the file*).
2. **Iterate on lead‑capture design – low‑hanging fruit:**
   * **Make phone optional but prominent** (checkbox or second step) to recover SMS opt‑ins lost in the test.
   * **Cap the mystery discount ceiling** (e.g., 10 – 15 %) and A/B test against a transparent fixed 10 % coupon to protect margin and compare perceived value.
3. **Instrument the missing metrics (Section 3).**
   * Push coupon‑code attributes to the order object so revenue‑per‑coupon can be analysed.
4. **Quick win outside the pop‑up:** leverage the new subscribers immediately:
   * Add an “expires in 48 h” reminder e‑mail + SMS to the Welcome flow to convert the incremental leads while urgency is fresh.

**Rationale.** The current data show that the pop‑up **may** widen the funnel’s mouth, but little (or even negative) evidence of incremental bottom‑line value yet. Extending the test while tightening discount economics and restoring SMS opt‑ins preserves upside potential and limits downside risk across all funnel stages.

Question 4: Process and AI Usage

* **Initial Research:** After reading the case study thoroughly, I conducted targeted research on e-commerce funnel analytics. I reviewed industry articles and academic research, then used **GPT-4o** to summarize key findings from papers. I compiled a one-pager of key concepts and metrics to guide my analysis.
* **Question 1 – Funnel Analysis:** I used **PyCharm** as my primary IDE and integrated **Claude 4.0** for AI-assisted coding. Claude helped create initial preliminary SQL and Python boilerplate code, which I manually reviewed and optimized. I used **Python** for data cleaning and visualization, and **SQL Server Local DB** for querying and transforming the dataset to extract conversion insights.
* **Question 2 & 3 – PDP & A/B Test Analysis:** For the PDP heatmap, I manually interpreted the visual to identify behavioral patterns. I used **GPT-3.5 Pro** to generate an initial answer, then refined it with my own observations and additional hypotheses not captured by the model. For the A/B test, I used **Python** to plot and analyze data related to the "Exclusive Discount Pop-up."
* **Final Edits:** I used **GPT-4o** for grammar correction, sentence tightening, and formatting, ensuring a polished and professional final submission. All strategic decisions and insight generation were human-driven.