

Project Report

eCommerce Web Analytics using Advanced SQL

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Project Overview

The project undertakes analysis and optimization of website traffic, marketing channels, user behavior and product portfolio for an online retailer startup.

As an eCommerce Database Analyst my job is to work alongside management including the CEO, the Head of Marketing, and the Website Manager to help steer the business.

The project follows analysis and optimization of marketing channels, measuring and testing website conversion performance, and using data to understand the impact of new product launches as the business grows.

Key Objectives:

- Traffic Analysis & Optimization – Identify top traffic sources, measure conversion rates, analyze trends, and segment data for bidding optimization.
- Website Measurement & Testing – Find the most-visited pages, analyze bounce rates, and analyze conversion funnels.
- Channel Analysis & Optimization – Compare marketing channels, evaluate performance, and develop an optimized channel portfolio.
- Product-Level & User-Level Analysis – Understand sales trends, assess the effectiveness of cross-selling strategies, and analyze customer behavior patterns.

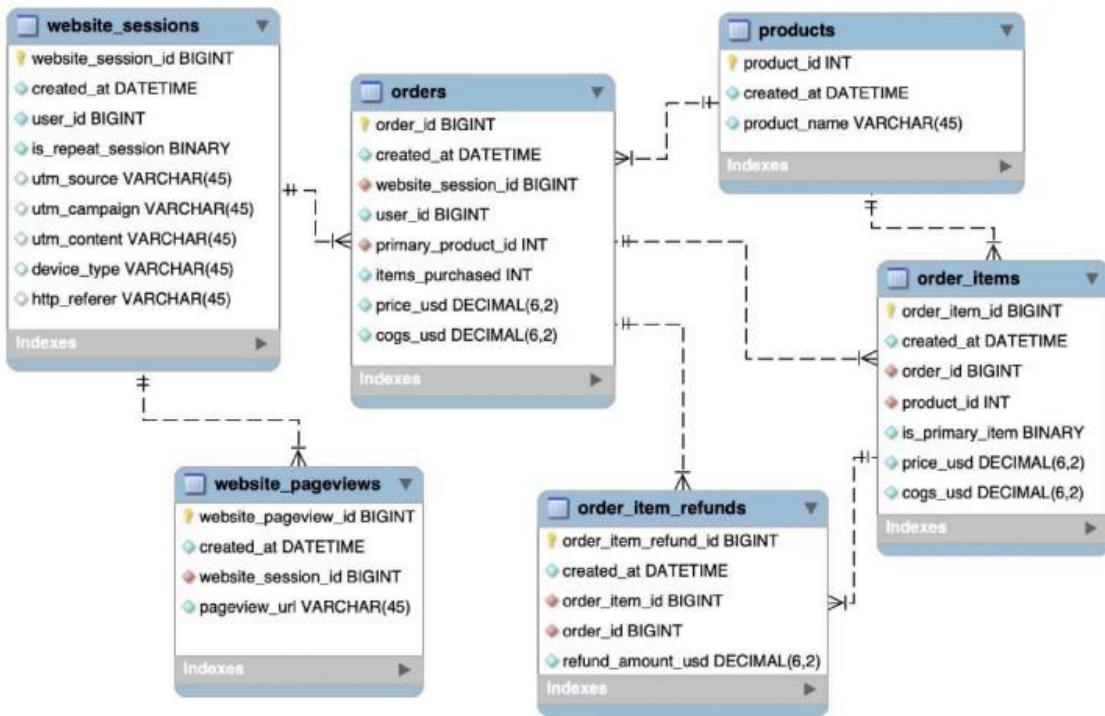
Such web analytics help building a data-driven strategy for improving website traffic, increasing conversions, and maximizing marketing ROI ultimately contributing to business growth over time.

Analysis Tools:

- Elaborative and comprehensive SQL queries form the foundation of this analysis journey, employing advanced SQL functionalities and building data- programs for multi-step analysis such as product-level conversion funnels.
- Mid-journey board presentation to communicate business growth, as well as later a presentation to potential investor utilizes **data-visualization** techniques for summarizing the insights in appealing and easy to grasp visual manner.

Introducing the Database:

The eCommerce Database models a real-world eCommerce platform, tracking data for user interactivity with the website, user journey metrics from landing page to completion of order, and details on products, orders and refunds.



Traffic Source Analysis

The aim of this is to understand the traffic split on the website by channel, which helps analyze user intent, behavior and inform future marketing strategy such as bidding optimization, campaigns and keywords to invest marketing budget in. This helps reduce wasted effort and spend and re-allocate resources efficiently. Prominent traffic sources include search, email, social and direct.

UTM parameters are short tags added to the end of a URL to track where website traffic comes from. In this project, I will use these to see which channel, campaign, ad, or post etc. brought a visitor to the site to track and analyze the business performance.

a. Top Traffic Sources:

Note: The eCommerce website became operational in third week of March 2012. Please refer to GitHub repository for detailed code and SQL queries.



Key Finding(s):

- Based on data up until Apr 2012, one month into operations, the bulk of traffic volume (nearly 97%) is observed to be from paid Google (gsearch) nonbrand campaign.

- The business received 112 orders in around 3900 sessions in the first month, seeing a conversion rate of ~3% for this campaign.

 **Recommendation(s):**

- Adjust campaign bid strategy based on current conversion rate to maintain positive cashflow.
- We expect to see the traffic source diversify with time as the brand recognition and customer awareness in the market grows.

b. Trend Analysis:

 **Key Finding(s):**

- The focus is directed to gsearch nonbrand campaign which drives the bulk of traffic.
- The volume has dropped by nearly 40% moving into June (~ 600 sessions/week) compared to start of April (~ 1000 weekly sessions) since bidding down at start of third week of April, indicating that gsearch nonbrand campaign is sensitive to bid changes.

 **Recommendation(s):**

- Monitor customer session value by evaluating KPIs such as conversion rates to gauge ROI of paid search marketing spend.
- Re-consider bidding strategy for the campaign based on other factors such as the device type used by the visitor to prevent loss of potential volume.
- Continue monitoring the traffic volume levels.

c. Bid Optimization:

 **Key Finding(s) and Opportunity:**

- Desktop session convert nearly 4x better compared to mobile sessions. 146 orders in 3911 desktop sessions placed as opposed to 24 orders in 2492 mobile sessions by the second week of May.
- This provides the opportunity to segment the bidding strategy by user device type to minimize wasted spent and capitalize on high-intent traffic share.

 **Key Takeaways:**

- Lower mobile conversions pose the necessity to investigate its causes. Potential reasons include poor user experience on mobile including but not limited to navigation ease, UI/UX design, lack of effective CTA.

- New ad creatives can be tested specifically for mobile traffic to counteract declining volumes without increasing its bid to safeguard wasted spend while driving more potential mobile traffic to website.
 - Such implementations will **increase traffic volume** to site, help achieve **better ROI on marketing** and lead to **more conversions**.
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Website Performance Analysis

Identifying the most visited webpages on the website, along with the most common entry points. This helps gauge different landing pages performance based on key metrics such as bounce rates, progression to order completion and conversion performance. The user navigation journey is mapped by conversion funnels to spot the areas of website where most users drop-off.

This enables to increase customer engagement, improve conversion efficiency, work on improving specific website areas such as webpage design and user navigation, and testing out new pages which ultimately helps increase revenue and ROI on marketing spend.

a. Most Viewed Pages:

Key Finding(s):

- As of end of first week of June, the ‘home-page’ is the most visited (around 10,400 sessions), followed by ‘/products’ and ‘/original-mr-fuzzy’ page which have been visited in less than half the sessions compared to that of the homepage. All the traffic has been landing on ‘home-page’.
- This indicates potential high bounce rate off the homepage, which requires looking at potential reasons of user not proceeding, including poor homepage content, poor navigation guidance to other pages and/or lack of adequate CTA.
- The ‘/billing’ page has only been viewed in 306 sessions in the nearly 2.5-month period that the business has been operational. It indicates that visits are not converting to orders well and may not justify the current CPC spent for paid search traffic.

Recommendation(s):

- Invest in landing page personalization so that the landing page matches the ad search term, which helps reduce bounces and encourages purchase.
- Test out different landing pages to see if customer engagement improves.
- Locate specific pages with highest bounce rates to improve the conversion efficiency and drive in more revenue per session.

b. Landing Page Performance & Testing:

i. Bounce Rate Analysis:

Key Finding(s):

- The homepage sees 11048 sessions, out of which only users proceed further in only 6538 sessions.
- The high bounce rate of 59% is alarming since most of the traffic is paid search traffic which is supposed to be high-intent user share and poses itself as a major area of improvement.
- Test out a new custom landing page through a A/B test to see if the user engagement increases.

ii. Landing Page Testing:

The lander-page test is conducted for a month from end of June to July testing out a customer '/lander-1' page to see if there are any improvements in the bounce rate and the landing page performance in terms of conversion.

Key Finding(s):

- Both pages see roughly 2300 sessions representing 50-50 split of the traffic for the A/B test.
- '/home' page sees 1319 bounced sessions, bounce rate of 58%.
- '/lander-1' receives 1233 bounced sessions, bounce rate of 53%.

Recommendation(s):

- The improved bounce rate for the newly tested landing page indicates higher user engagement. The new page has helped prolong the user journey on the website.
- Compare the conversion rate to see if it has led to an improvement or not. This helps narrow down if further improvements are required on webpages down the funnel.
- Weigh out cost-benefit options between improving the previous '/home' page for its content, navigation and appeal alongside the new lander page, or otherwise directing all traffic to the new lander page.

iii. Landing Page Trend Analysis:

Key Finding(s) and Impact:

- The weekly trended analysis of bounce rate shows the bounce rate decreased from around 60% before the lander page A/B test, seeing 1%-2% week-on-week drop to around 50% by the end of August.

- This is a positive sign showing that business can retain user attention for longer via the new landing page which has been rolled out. This potentially leads to increase in purchase volume and better ROI on ad spent.

C. Conversion Funnel Analysis:

The aim of conversion funnel analysis is to track the user journey from landing page to completion of order. It helps identify drop-off points, gauge user engagement and optimize the funnel for improving conversions.

Key Finding(s):

- The complete user journey is tracked from the lander-1 page to products, from there to the mr-fuzzy page, then to cart, shipping and billing. The drop off rate at each stage is noted to narrow areas that need improvement for driving more traffic through to conversion.
- In August, the website received 4629 sessions out of which only 49% proceeded to products page. Mr. fuzzy page, and the billing page also have the lowest click rates alongside lander-1 of 44% and 43.6% respectively.
- This indicates that the first bottle neck is at the mr-fuzzy page where although users are clicking on it but not adding it to cart. This can also mean general lower interest in buying the product rather than lack in the page appeal.
- The second most significant drop-off point in the user journey is the billing page. Users tend to abandon the purchase at the very last stage, which provides major room for improvement.

Recommendation(s):

- Introduce more billing options, reduce user entry pain points such as the amount of information required to be filled in on the billing page. Provide the option to save billing information for smoother user experience in subsequent visits. Cart abandonment emails and/or push notifications can help increase more conversions per session.
- Conduct a A/B test for a new billing page design to gauge impact on conversion ratio and order abandonment.



Channel Portfolio Management

Analyzing the share of traffic and order conversion from each of the marketing channel. It helps understand the user characteristics and conversion performance across marketing channels. This helps optimize the bid strategy across different channels and allocate budget for maximum efficiency.

a. Channel Portfolio Analysis

The business launched second paid search channel, bsearch for the nonbrand campaign in late August. Weekly trended session volume is analyzed since then and compare to gsearch nonbrand.

i. Trend Analysis

Key Finding(s) and Recommendation:

- Since its launch, bsearch consistently constitutes around 25% of nonbrand traffic with approximately 300-400 weekly sessions, which helps diversify paid-search channel portfolio and reduce dependency on single source for traffic.
- The growth of bsearch campaign is positive for the business, segment the two channels by device type to see if the traffic volume is segregated or similar across desktop and mobile. Study how well sessions convert across these two mediums. This helps strategize bidding to maximize the profit per click.

ii. Channel Characteristics & Bid Optimization:

Key Finding(s):

- Gsearch and bsearch channels are quite different from a device standpoint.
- From last week of August to end of November, gsearch had a 3:1 split between desktop and mobile sessions. Bsearch received a third of volume of that of gsearch, as is expected with the relatively new channel. Unlike gsearch, however, bsearch traffic was majorly desktop driven, with only 8.6% of its share being mobile traffic.
- As per session to order conversion rate, desktop traffic converts better across both channels- 4.5% and 3.8% for gsearch and bsearch respectively, while only 1.3% of mobile traffic converts from gsearch channel and less than 1% from bsearch.
- This disparity indicates to possible bottlenecks specifically on mobile device.

Recommendation(s):

- The low overall order conversion rate means improvements are required towards later stages of the funnel, specifically on mobile devices.
- Adjust the bidding strategy to reallocate greater share of the marketing budget towards gsearch campaign by bidding down on bsearch based on its under-performance.

iii. Channel Portfolio Trends:

The weekly session volume for gsearch and bsearch nonbrand campaigns, broken down by device, is studied for first week of November up until end of third week of December. The bsearch nonbrand campaign was bid down in first week of December due to low conversions.

Key Finding(s):

- Last couple of weeks of November see a seasonal surge in traffic, volumes increasing by nearly 100% across both channels compared to weeks preceding, due to Cyber Monday and Black Friday which are major retail online holidays.
- The ratio of bsearch to gsearch sessions help isolate the impact of bid- down v/s seasonality, season is expected to impact both paid search campaigns so any difference b/w them observed via this ratio is very likely due to the bid-down impact.
- Bsearch as a percent of gsearch traffic dropped from 39%-41% in initial weeks of November to 23%-28% towards end of December. This indicates that although both channels dropped in volume post seasonal surge, the bid down caused bsearch volume to drop further down.

b. Analysis of Direct Traffic

It is equally important to keep track of the direct traffic on the website. These are users that either search for the website directly or are routed from organic search results on browser. The volume from direct traffic is an indicator of the brand recognition amongst potential users in the market. Since there is no cost of acquisition, the margins are higher which makes it more valuable for the business's financial success.

The first nine months of data is analyzed for volume received from different direct channels and compared to that received by paid channels.

Key Finding(s):

- Organic and direct type-in traffic along with paid brand traffic volumes are growing, seeing nearly seven-fold increase from roughly 70 sessions in April to around 470 sessions in December.
- It indicates that the business is building momentum with its brand since unpaid traffic share relative to nonbrand paid traffic has grown consistently MoM showing an overall increase by roughly 5 percentage points, hence decreasing dependency on paid traffic for bringing in potential business to website.



Business Patterns & Seasonality

Analyzing seasonality to better prepare for upcoming spikes or slowdowns in demand as well as performing day-parting analysis to understand how much support staff is required at different times of day or days of the week.

a. Seasonality Analysis:

Key Finding(s):

- Both the traffic volume and orders has consistently shown growth which is a positive health indicator for the business.
- The first two weeks of April saw surge in traffic receiving around 1,100 sessions on average, potentially contributed by Easter holiday.
- The last two weeks of November saw surge in traffic and order volume due to Black Friday and Cyber Monday (seasonal traffic surge). These two weeks received between 4,000 to 5,200 sessions each which is 273% higher than the weekly average of 1,245 sessions prior to this.
- Relatively higher volume and orders in December as well leading up to Christmas, where the website saw average of 2,600 sessions a week.

b. Business Patterns Analysis:

As the business grows with strives being made to acquire new customers, it is equally important to provide high quality customer service to current users to convert lead to customers and to increase chances of repeat business.

The average hourly website session volume is analyzed from mid-September to mid-November to identify peak volume periods to staff the customer support appropriately.

This time frame is chosen to get an idea of typical volume load in off-season period.

Key Finding(s):

hour	average sessions	mon	tue	wed	thu	fri	sat	sun
0	6.7	8.7	7.7	6.3	7.4	6.8	5	5
1	5.5	6.6	6.7	5.3	4.9	7.1	5	3
2	4.6	6.1	4.4	4.4	6.1	4.6	3.7	3
3	4.3	5.7	4	4.7	4.6	3.6	3.9	3.4
4	4.8	5.9	6.3	6	4	6.1	2.8	2.4
5	4.8	5	5.4	5.1	5.4	4.6	4.3	3.9
6	5	5.4	5.6	4.8	6	6.8	4	2.6
7	7.2	7.3	7.8	7.4	10.6	7	5.7	4.8
8	10.4	12.3	12.2	13	16.5	10.5	4.3	4.1
9	14.6	17.6	15.7	19.6	19.3	17.5	7.6	6
10	15.5	18.4	17.7	21	18.4	19	8.3	6.3
11	16.9	18	19.1	24.9	21.6	20.9	7.2	7.7
12	17.7	21.1	23.3	22.8	24.1	19	8.6	6.1
13	17.1	17.8	23	20.8	20.6	21.6	8.1	8.4
14	16.4	17.9	21.6	22.3	18.5	19.5	8.7	6.7
15	17.4	21.6	17.1	25.3	23.5	21.3	6.9	7.1
16	17.7	21.1	23.7	23.7	19.6	20.9	7.6	6.6
17	14.5	19.4	15.9	20.2	19.8	12.9	6.4	7.6
18	11.5	12.7	15	14.8	15.3	10.9	5.3	6.8
19	11.3	12.4	14.1	13.3	11.6	14.3	7.1	6.4
20	10.5	12.1	12.4	14.2	10.6	10.3	5.7	8.4
21	9.4	9.1	12.6	11.4	9.4	7.3	5.7	10.2
22	9	9.1	10	9.8	12.1	6	5.7	10.2
23	8.4	8.8	8.6	9.6	10.6	7.6	5.3	8.3

- It is observed that weekdays are most busy from 9am to 5pm.
- Weekends are less busy compared to weekdays; Sunday sees a spike of volume from 8pm-11pm.

Key Takeaways:

- Consult outsource staffing companies to see how much traffic can be handled per support person. Increase the staffing accordingly in the identified peak periods.
 - Outsourcing staffing can save financial burden; however, it would require stricter audit for maintaining quality standards.
 - Moving into 2023, the trended analysis should be used as the baseline for inventory management and customer support planning.
 - Forecast monthly demand for current product portfolio for the next year, especially for the seasonal period, to avoid last-minute stock-outs and/or back-order issues. This prevents loss of business to competitor and helps in planning for yearly sales targets.
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Product Analysis

Analyzing multi-product product portfolio to gauge the performance of each on the website, see how well each convert and the impact of launching new products.

Through product-specific conversion funnels, it can be observed if certain products convert better than others. This helps manage the portfolio expansion to drive more business while maintaining profitability targets, detect and timely rectify any product quality or service issues the customers are faced with.

a. Product Sales and Launch Analysis:

i. Product-Level Sales Analysis:

The monthly trends from March to December 2012 for number of sales, total revenue, and total margin generated for the business for the current flagship product ‘Mr Fuzzy’ is analyzed to see the trend and any noticeable peak and/or drop.

Key Finding(s):

- The business has seen significant growth in revenue generation over the eight-month period that the business has been operational in. The revenue has grown on average by around \$2,500 per month.
- On average, monthly revenue during the peak season of Nov and Dec was around \$18,000 higher than the average monthly revenue in the pre-season period, with nearly three-fold increase in average monthly order volume from 200/month to 562/month.

ii. Product Launch Performance:

The business launched new product 'in the first week of January 2013. The trended analysis studies the impact of this launch on key business metrics.

Key Finding(s):

- Since the launch of the new product, the session to order conversion rate has increased from around 4.5% to 6% and revenue per session has increased by roughly \$1.1 which is positive for the business. These can be attributed to expression of user interest in the new product.
- The month of February saw a surge in orders of the new product with 162 orders compared to an average of 56 orders in the preceding and following months.

b. Product Level Website Pathing:

i. Product Pathing:

The three-month period before and after the second product launch is analyzed to see what impact the new product has had.

Key Finding(s):

- Both pre and post product launch periods received roughly equal sessions proceeding from the main products page. The overall clickthrough rate has gone up by around 4%.
- Before the launch, 72.3% of users proceeded to Mr Fuzzy page, while post launch this number dropped to 62.1% while 14.4% of users visited The Forever Love Bear page.
- This indicates that although users are showing interest in the new product, it has impacted the traffic volume on the flagship product which is concerning.

Recommendation(s):

- Analyze the complete funnel for each product to see how well each convert.
- It is important that the new product is converting well to meet the overall revenue per session targets and counter the reduced traffic to the flagship product.

ii. Product Conversion Funnel Analysis:

Key Finding(s) and Recommendations:

- The new product has a better click rate to the /cart page of 55% compared to 43% for the flagship Mr Fuzzy product, and comparable rates throughout the rest of the funnel.
- The cannibalization of traffic from the flagship product and lower conversions can be counteracted with limited promotions if the trend continues.

C. Cross Selling & Portfolio Expansion:

As the business sees growth, it is highly beneficial to understand which products the customers are more likely to buy together. Test out and optimize different combinations to see how they sell, the impact on conversions and revenue of introducing new combinations.

The business introduced the feature to buy a second product while on the /cart page in September 2013. The analysis studies the impact on key metrics such as average order value and revenue per cart pageview for the month preceding and following the introduction of this feature on the website.

i. Cross Sell Analysis:

Key Finding(s):

- The clickthrough rate from the cart page has been stable at around 68% which indicates that cross sell has not impacted the drop off rate negatively. This shows that people have received the cross-sell option well and are interested to explore it.
- The average order value increased by nearly \$3, and revenue per /cart session saw 0.6% rise.

Recommendation(s):

- Consider the product characteristics which are being bought together often in the portfolio expansion strategy to maximize revenue.
- Optimize suggested items to the customer based on their purchase history and product preference such as those liked or added to wish list.

ii. Product Portfolio Expansion Analysis:

The portfolio is expanded with the launch of third product in December 2013 targeting the birthday gift market. The months preceding and following the launch are analyzed to see what impact on customer engagement, revenue generation and conversions.

Key Finding(s):

- Despite less website sessions in the month following the launch, as is expected in post seasonal period, more products are purchased per order increasing from 1.05 to 1.12.
- The launch has brought an increment of more than \$2.5 in the average basket value and a 21% increase in the revenue per session.

Recommendation(s):

- With the increment in revenue per session brought in by the new product launch, the ad spend/bidding budget can be increased to capture a larger customer share from the market. The budget can be allocated towards ad creatives and/or improving site experience, landing pages especially over mobile devices.

- This will contribute to increasing the ad relevance and thus the quality score, ranking the ad higher and making it more likely to win the traffic bid over competitors, thereby contributing to higher footfall.

d. Product Refund Analysis:

The product refund analysis encompasses analyzing which products are ranking high in terms of refund rates. This can indicate towards potential supplier issues. Moreover, it helps see the user appetite for different product price points which guides pricing and discount strategy. Refunds come with its own associated costs and thus are a key component of business profitability.

The monthly trend of orders and refund rates is analyzed for the period up until mid-October 2014 to gauge the overall performance of the business and identify any issues with particular product(s).



Key Finding(s):

- The monthly refund rates are relatively lower in the range of 2-3% for second product 'Forever Love Bear'.
- Refund rates of the flagship product 'Mr Fuzzy' and the third product 'Birthday Sugar Panda' have been similar ranging between 4-7%, however, it has been very poor in August and September, 13-14%.



Recommendation(s):

- The high refund rates more than 10% for Mr Fuzzy indicate towards potential quality issues with the product which needs to be investigated. Customer reviews is a good source for identifying specific issues with the product.
- If the issue is from supplier side, look towards alternate providers and maximize the opportunity by bargaining for lower costs, thereby potentially improving the profitability two-fold.



User Analysis

User analysis is about analyzing repeat visits to the website to understand user behavior and identify some of the most valuable customers. It is used to see which users are coming back to the website, how often they visit, which channels are being used in the repeat visits. This helps gauge if the business is paying more than once for a customer through a paid channel and understand the value of a customer to better optimize marketing channels.

The data from Jan to Oct 2014 is analyzed for user behavior and characteristics of repeat visitors.

 **Key Finding(s):**

- Around 13% of the users had at least one repeat session, with repeat visitors returning about a month later, on average.
- The highest number of repeat visits is through organic traffic, around 11,500 repeat sessions in the ten-month period, followed by paid brand traffic and direct type-in traffic with approximately 11,000 and 10,500 repeat sessions respectively.
- One-third of repeat visits come through paid-channel which means the business is paying for customers with paid search ads more than once.
- The repeat sessions are more likely to convert to order at 8% and produces a lift of around \$1 in revenue per session.

 **Key Takeaway(s):**

- Invest in increasing the ratio of repeat visitors through email marketing, push notifications and targeted ads based on previous purchase or browse history.
- A high share of repeat visit is acquired through paid brand channel, factor that in the value of these repeat sessions when bidding on paid traffic.
- Set brand bids to the profit from the first paid-brand session, plus the expected profit from repeat sessions that also return via paid brand, minus the ad cost of those repeats, the contribution margin should be used rather than raw revenue.
- Plan on offering limited time discount(s) and/or targeted promotions to encourage frequent repeats to bring down the current return average.
- Increase the longevity of customer life with the business by offering special perks such as loyalty program, reserved discounts on personalized products based on previous purchase behavior to repeat visitors.

End of Document
