# DAD 220 Data Analysis RMA Report

**Analysis of the return merchandise authorizations (RMAs) revealed the following:**

**General research background:**

* Table RMA contains 38162 records of returned items from all over the 48 states in the USA.
* Query: Shows the total number of returned items

SELECT COUNT(RMAID) AS TotalNumOfReturns FROM RMA;

* Query: Shows the total number of states having returned.

SELECT COUNT(DISTINCT State) AS StatesWithReturns

FROM Orders INNER JOIN RMA ON RMA.OrderID = Orders.OrderID

INNER JOIN Collaborators ON Collaborators.CollaboratorID = Orders.CustomerID;

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* The main reasons for the returned merchandise are Incorrect item shipped (34% - 13116 items), Defective (33% - 12609 items), Rejected (2% - 596 items), and other reasons (31% - 11841 items) out of 38162 returns.

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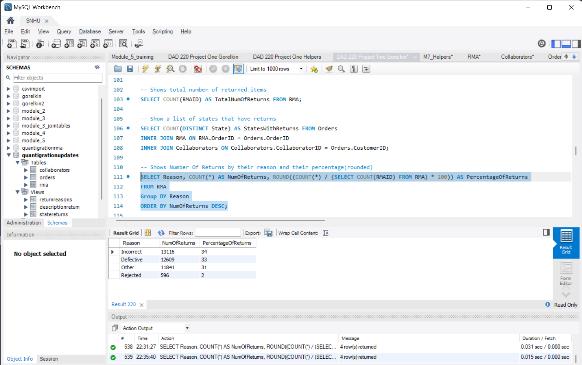
* Query: Shows the number of returns by their reason and their percentage(rounded)

SELECT Reason, COUNT(\*) AS NumOfReturns, ROUND((COUNT(\*) / (SELECT COUNT(RMAID) FROM RMA) \* 100)) AS PercentageOfReturns

FROM RMA Group BY Reason

ORDER BY NumOfReturns DESC;

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* The Findings show the highest percentage of returned items due to incorrect items being shipped.

The reason for this might be that there might be an error with the correlation between the item’s SKU and the Description. To make sure that each item has the correct SKU and no SKU has a repeating Description, the following check was performed and showed that each SKU is associated with exactly one description – No errors were found:

A list of switches

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* Query:

SELECT COUNT(\*) AS NumOfOrders, SKU, Description FROM Orders

GROUP BY Description, SKU;

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* The next step is to break down the frequencies of items returned by country and its return percentage. This step provides us with a view of where the greatest number of returns comes from. The findings show that most items being returned come from Massachusetts (MA). It shows that 988 items from MA were returned, and they represent 2.6% of total returned items. In addition, it could be seen that returns that came from MA, outstand the regular (linear) return rate between the states.

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* Query: Shows the frequency of returns by State.

SELECT State, COUNT(\*) AS Frequency, (COUNT(\*) / (SELECT COUNT(RMAID) FROM RMA) \* 100) AS PercentageOfReturns

FROM Orders INNER JOIN RMA ON RMA.OrderID = Orders.OrderID

INNER JOIN Collaborators ON Collaborators.CollaboratorID = Orders.CustomerID

GROUP BY State

ORDER BY Frequency DESC;

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* The next step is to analyze the percentage of returns by product type and find what items are being returned the most and what percentage out of all the returns they represent. The outcome shows the highest rate of returns comes from the (SKU 'BAS-08-1 C') - Basic Switch 10/100/1000 BaseT 8 port. 8422 units of it were returned to the company and it represents 22% of all the returned items. That item shows a return rate higher by 11% above the average.

Also, outstanding the Enterprise Switch 40GigE SFP+ 48 port, (SKU 'ENT-48-40F'') followed with a 16.28% return rate (5% above the average) with 6213 returns.

A graph with blue bars

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* Query: Returns the number and the percentage of returned items.

SELECT Description, COUNT(\*) AS Returns, (COUNT(\*) / (SELECT COUNT(RMAID) FROM RMA) \* 100) AS ReturnPercentage FROM Orders INNER JOIN RMA ON RMA.OrderID = Orders.OrderID GROUP BY Description ORDER BY Returns DESC;

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* Query: Create a view table of the number of returned products and their percentage.

CREATE VIEW ItemReturnPercentage AS

SELECT Description, COUNT(\*) AS Returns, (COUNT(\*) / (SELECT COUNT(RMAID) FROM RMA) \* 100) AS ReturnPercentage

FROM Orders INNER JOIN RMA ON RMA.OrderID = Orders.OrderID

GROUP BY Description ORDER BY Returns DESC;

* Query: Find the average item’s return rate.

SELECT AVG(ReturnPercentage) AS AverageReturnRate FROM ItemReturnPercentage;

* Query: for a list of items with a return percentage rate higher than the average.

SELECT \* FROM ItemReturnPercentage AS ITMRT

WHERE ReturnPercentage > (SELECT AVG(ReturnPercentage) FROM ItemReturnPercentage);

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* After finding the two items with the highest return rate, I would cross-check them with their return rate by state to look for abnormal activity. This query shows the Basic Switch 10/100/1000 BaseT 48 port having the highest return rates from Alabama(AB), with 193 items returned, and 163 returns for the Enterprise Switch 40GigE SFP+ 48 port from Massachusetts(MA). However, that query does not show any odd return pattern from any state. Therefore, Massachusetts remains the state with the higher return rate and as a model for analysis sampling.

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* Query: Check the found two high-return-items for unique return patterns.

SELECT State, Description, COUNT(\*) AS Returnes

FROM Orders

INNER JOIN RMA ON RMA.OrderID = Orders.OrderID

INNER JOIN Collaborators ON Collaborators.CollaboratorID = Orders.CustomerID

WHERE Orders.Description LIKE '%Basic Switch 10/100/1000 BaseT 48 port%'

OR Orders.Description LIKE '%Enterprise Switch 40GigE SFP+ 48 port%'

GROUP BY State, Description

ORDER BY State, Description, Returnes DESC;

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* Next, I would like to know the main reasons why MA has the highest return rate. To do so, I will first check for the most common return items from MA as the first step. Yet, the two most dominant return items are the BAS-48-1 C, and the ENT-48-40F. A similar pattern was discovered by looking at the returned items from Alabama for the same two items.

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* Query: Shows all the items that were returned from "Massachusetts".

SELECT Description, COUNT(\*) AS Returnes

FROM Orders

INNER JOIN RMA ON RMA.OrderID = Orders.OrderID

INNER JOIN Collaborators ON Collaborators.CollaboratorID = Orders.CustomerID

WHERE State LIKE '%Massachusetts%'

GROUP BY Description ORDER BY Returnes DESC;

\*- Perform the same query for ‘Alabama’ -\*

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* Finally, I will be looking into the reasons for MA and AL having that return rate in terms of all of the returned items. I'll do so by asking what the most common reasons are for the Basic Switch 10/100/1000 BaseT 48 port (the most common item to be returned) particularly being shipped back. The queries show that the most common reason for all of the merchandise being returned is due to existing defects (1/3 of the shipped items), followed by another one-third of wrong items being sent to customers, and the rest is due to various other partly known reasons. Analyzing the Basic Switch 10/100/1000 BaseT 48 particularly, shows that the most common reason for this item to be returned from MA is due defects and incorrectly shipped items to AL.

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* Query step 1: Create a view table "ReturnesState" that stores the total number of returns from each state.

CREATE VIEW ReturnesState AS

SELECT State, COUNT(\*) AS Returns FROM Orders

INNER JOIN RMA ON RMA.OrderID = Orders.OrderID

INNER JOIN Collaborators ON Collaborators.CollaboratorID = Orders.CustomerID

GROUP BY State ORDER BY Returns DESC;

SELECT Returns FROM ReturnesState

WHERE State LIKE '%Massachusetts%';

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* Query step 2: Create a view table that stores the reasons and percentage for the returns rates from Massachusetts, and read from the view table “MA\_ReturnBreakDown” the reason for returns from MA.

CREATE VIEW MA\_ReturnBreakDown AS

SELECT Reason, COUNT(\*) AS NumOfReturns, ((COUNT(\*) / (SELECT Returns FROM ReturnesState

WHERE State LIKE '%Massachusetts%')) \* 100) AS ReturnPercent FROM Orders

INNER JOIN RMA ON RMA.OrderID = Orders.OrderID

INNER JOIN Collaborators ON Collaborators.CollaboratorID = Orders.CustomerID

WHERE Collaborators.State LIKE '%Massachusetts%'

Group BY Reason ORDER BY NumOfReturns DESC;

SELECT \* FROM MA\_ReturnBreakDown;

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* Query step 3: Show data on why "Basic Switch 10/100/1000 BaseT 48 port" were returned from MA.

SELECT Reason, COUNT(\*) AS NumOfReturns, ((COUNT(\*) / (SELECT NumOfReturns FROM MA\_ReturnBreakDown

WHERE Reason LIKE '%Defective%')) \* 100) AS ReturnPercent

FROM Orders

INNER JOIN RMA ON RMA.OrderID = Orders.OrderID

INNER JOIN Collaborators ON Collaborators.CollaboratorID = Orders.CustomerID

WHERE Orders.Description LIKE '%Basic Switch 10/100/1000 BaseT 48 port%'

AND Collaborators.State LIKE '%Massachusetts%'

Group BY Reason

ORDER BY Reason, NumOfReturns DESC;

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\*- Perform the same steps 1-3 on state “Alabama” to inspect its return data -\*

**Analysis Conclusions and Summary:**

The QuantigrationUpdates database shows 38162 records in the "RMA" table, meaning 38K items were received from 48 states across the USA. In general, those items were returned for four reasons: Incorrectly shipped items represent one-third (34%) of the returns, and another one-third appear as defective items (33%). 2% of the returned goods are due to rejection, and another (31%) 11,841 items were returned for other (unspecified) reasons.

In addition, the database contains the table "Orders," which stores nine different merchandise items with unique SKUs attached to each, and the table Customers that stores all customer details. Crossmatching the information from all the tables indicates that the majority of the returned items received from Massachusetts (MA) hold the highest item return rate of 2.59% (988 items), followed by Arkansas and West Virginia with 2.25% and 2.23%, respectively. Although the average return rate for that company is 2.08%, all other states have similar return rates fluctuating between 1.87% to 2.23%. Analyzing the reasons for a higher return rate from MA is impossible without having sales by state data.

Analysis of the nine returned products shows an average return rate of 11.11% per item. With this in mind, two products show a higher than regular return rate of 22.07% for the "Basic Switch 10/100/1000 BaseT 48 port" - (SKU: BAS-48-1 C) and 16.28% for (SKU: ENT-48-40F) - "Enterprise Switch 40GigE SFP+ 48 port". On the other edge, the "Basic Switch 10/100/1000 BaseT 24 port" (SKU: BAS-24-1 C) shows a significantly low return rate of less than 0.1%. Again, there is not enough information to analyze the reason for such a low return rate versus the average rate without knowing whether this item's sell quantity is equal or lower to all other items' sell average (No sales data to compare...).

Investigating further the reasons for the high return rate of "BAS-48-1 C" and "ENT-48-40F" shows the vast majority of return items for "BAS-48-1 C" (193/845 items) come from Alabama (AL), and his counterpart "ENT-48-40F" placing "Massachusetts" as the returns leader with 167/988 items returned. Comparing those two return leaders with all return states shows no particular return pattern. Either way, inspecting the reasons for the merchandise returns shows most of the items being returned due to being defective or incorrectly sent. The other reasons could only be analyzed further by having the sub-reasons for those returns.

Analysis Summary and Recommendations:

To tackle the 33% defective return rate, the company's QC process should be overlooked and revised back to back with an inspection of the product's preparation for the shipping process (packaging). Blaming the shipping company for poor transportation is less likely because no state outstands a high capacity of returns due to defective status. The other 34% of incorrectly shipped-out items should be overlooked by checking the preparation for the shipping prices and shipping labeling. Because there is no incorrectness between the SKUs and the item description, the case of incorrect order input is impossible (the case of wrong item description of a SKU).