**Python for Business Analytics - Spring 2024, Final Project Report**
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**Team: Jeremy Perez and Shajibul Islam**

## Prompt:

I am your VP of Sales and have presented you with the following question: I am looking to improve this year's performance – ***what suggestions do you have for success*?**

## Data Source:

Conducted data analysis on largest of data using the database provided containinng the following tables:

*CustomerData:*

```
1  SELECT *
2  FROM CustomerData
3
```

Results | Messages

| | column1 | Customer_City | Customer_Country | Customer_Email | Customer_Fname | Customer_Id | C |
|---|---|---|---|---|---|---|---|
| 3 | 2 | San Jose | EE. UU. | XXXXXXXXX | Gillian | 19491 | |
| 4 | 3 | Los Angeles | EE. UU. | XXXXXXXXX | Tana | 19490 | |
| 5 | 4 | Caguas | Puerto Rico | XXXXXXXXX | Orli | 19489 | |
| 6 | 5 | Tonawanda | EE. UU. | XXXXXXXXX | Kimberly | 19488 | |
| 7 | 6 | Caguas | Puerto Rico | XXXXXXXXX | Constance | 19487 | |
| 8 | 7 | Miami | EE. UU. | XXXXXXXXX | Erica | 19486 | |
| 9 | 8 | Caguas | Puerto Rico | XXXXXXXXX | Nichole | 19485 | |
| 10 | 9 | San Ramon | EE. UU. | XXXXXXXXX | Oprah | 19484 | |
| 11 | 10 | Caguas | Puerto Rico | XXXXXXXXX | Germane | 19483 | |
| 12 | 11 | Freeport | EE. UU. | XXXXXXXXX | Freya | 19482 | |
| 13 | 12 | Salinas | EE. UU. | XXXXXXXXX | Cassandra | 19481 | |
| 14 | 13 | Caguas | Puerto Rico | XXXXXXXXX | Natalie | 19480 | |

⚠ 0 Ln 3, Col 1 Spaces: 4 UTF-8 LF 20,652 rows MSSQL 00:00:01 johndroescher.com : Fall_2023 (60)

*DataDictionary:*

```
1  SELECT *
2  FROM DataDictionary
3
```

Results | Messages

| | FIELDS | DESCRIPTION |
|---|---|---|
| 1 | Type | : Type of transaction made |
| 2 | Days for shipping (real) | : Actual shipping days of the purchased product |
| 3 | Days for shipment (scheduled) | : Days of scheduled delivery of the purchased produ… |
| 4 | Benefit per order | : Earnings per order placed |
| 5 | Sales per customer | : Total sales per customer made per customer |
| 6 | Delivery Status | : Delivery status of orders: Advance shipping , Lat… |
| 7 | Late_delivery_risk | : Categorical variable that indicates if sending is… |
| 8 | Category Id | : Product category code |
| 9 | Category Name | : Description of the product category |
| 10 | Customer City | : City where the customer made the purchase |
| 11 | Customer Country | : Country where the customer made the purchase |
| 12 | Customer Email | : Customer's email |
| 13 | Customer Fname | : Customer name |

Results grid

⚠ 0 Ln 2, Col 20 Spaces: 4 UTF-8 LF 52 rows MSSQL 00:00:00 johndroescher.com : Fall_2023 (60)

*MainTable:*

```
1  SELECT *
2  FROM MainTable
3
```

Results | Messages

| | column1 | Category_Id | Customer_Id | Department_Id | Order_Customer_Id | Order_Id | Order_Ite |
|---|---|---|---|---|---|---|---|
| 1 | 0 | 73 | 20755 | 2 | 20755 | 77202 | 1360 |
| 2 | 1 | 73 | 19492 | 2 | 19492 | 75939 | 1360 |
| 3 | 2 | 73 | 19491 | 2 | 19491 | 75938 | 1360 |
| 4 | 3 | 73 | 19490 | 2 | 19490 | 75937 | 1360 |
| 5 | 4 | 73 | 19489 | 2 | 19489 | 75936 | 1360 |
| 6 | 5 | 73 | 19488 | 2 | 19488 | 75935 | 1360 |
| 7 | 6 | 73 | 19487 | 2 | 19487 | 75934 | 1360 |
| 8 | 7 | 73 | 19486 | 2 | 19486 | 75933 | 1360 |
| 9 | 8 | 73 | 19485 | 2 | 19485 | 75932 | 1360 |
| 10 | 9 | 73 | 19484 | 2 | 19484 | 75931 | 1360 |
| 11 | 10 | 73 | 19483 | 2 | 19483 | 75930 | 1360 |
| 12 | 11 | 73 | 19482 | 2 | 19482 | 75929 | 1360 |

⚠ 0 Ln 2, Col 15 Spaces: 4 UTF-8 LF 180,519 rows MSSQL 00:00:05 johndroescher.com : Fall_2023 (60)

*OrderData:*

```
1  SELECT *
2  FROM OrderData
3
```

Results | Messages

| | column1 | Benefit_per_order | Order_City | Order_Country | Order_Customer_Id | order_date_DateOrd |
|---|---|---|---|---|---|---|
| 1 | 0 | 91.25 | Bekasi | Indonesia | 20755 | 2018-01-31 22:5 |
| 2 | 1 | -249.08999633789062 | Bikaner | India | 19492 | 2018-01-13 12:2 |
| 3 | 2 | -247.77999877929688 | Bikaner | India | 19491 | 2018-01-13 12:0 |
| 4 | 3 | 22.860000610351562 | Townsville | Australia | 19490 | 2018-01-13 11:4 |
| 5 | 4 | 134.2100067138672 | Townsville | Australia | 19489 | 2018-01-13 11:2 |
| 6 | 5 | 18.579999923706055 | Toowoomba | Australia | 19488 | 2018-01-13 11:0 |
| 7 | 6 | 95.18000030517578 | Guangzhou | China | 19487 | 2018-01-13 10:4 |
| 8 | 7 | 68.43000030517578 | Guangzhou | China | 19486 | 2018-01-13 10:2 |
| 9 | 8 | 133.72000122070312 | Guangzhou | China | 19485 | 2018-01-13 10:0 |
| 10 | 9 | 132.14999389648438 | Guangzhou | China | 19484 | 2018-01-13 09:3 |
| 11 | 10 | 130.5800018310547 | Tokio | Japón | 19483 | 2018-01-13 09:1 |
| 12 | 11 | 45.689998626708984 | Manado | Indonesia | 19482 | 2018-01-13 08:5 |

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*ProductData:*

```
SELECT *
FROM ProductData
```

Results | Messages

| | column1 | Category_Id | Category_Name | Product_Card_Id | Product_Category_Id | Product_Descripti |
|---|---|---|---|---|---|---|
| 1 | 0 | 73 | Sporting Goods | 1360 | 73 | NULL |
| 2 | 1 | 17 | Cleats | 365 | 17 | NULL |
| 3 | 2 | 29 | Shop By Sport | 627 | 29 | NULL |
| 4 | 3 | 24 | Women's Apparel | 502 | 24 | NULL |
| 5 | 4 | 13 | Electronics | 278 | 13 | NULL |
| 6 | 5 | 12 | Boxing & MMA | 249 | 12 | NULL |
| 7 | 6 | 9 | Cardio Equipment | 191 | 9 | NULL |
| 8 | 7 | 41 | Trade-In | 917 | 41 | NULL |
| 9 | 8 | 37 | Electronics | 828 | 37 | NULL |
| 10 | 9 | 29 | Shop By Sport | 642 | 29 | NULL |
| 11 | 10 | 37 | Electronics | 818 | 37 | NULL |
| 12 | 11 | 37 | Electronics | 825 | 37 | NULL |

⚠ 0 Ln 2, Col 17 Spaces: 4 UTF-8 LF 118 rows MSSQL 00:00:00 johndroescher.com : Fall_2023 (60)

*ShippingData:*

```
SELECT *
FROM ShippingData
```

Results | Messages

| | column1 | Days_for_shipping_real | Days_for_shipment_scheduled | Delivery_Status | Late_delivery_ris |
|---|---|---|---|---|---|
| 1 | 0 | 3 | 4 | Advance shipping | 0 |
| 2 | 1 | 5 | 4 | Late delivery | 1 |
| 3 | 2 | 4 | 4 | Shipping on time | 0 |
| 4 | 3 | 3 | 4 | Advance shipping | 0 |
| 5 | 4 | 2 | 4 | Advance shipping | 0 |
| 6 | 5 | 6 | 4 | Shipping canceled | 0 |
| 7 | 6 | 2 | 1 | Late delivery | 1 |
| 8 | 7 | 2 | 1 | Late delivery | 1 |
| 9 | 8 | 3 | 2 | Late delivery | 1 |
| 10 | 9 | 2 | 1 | Late delivery | 1 |
| 11 | 10 | 6 | 2 | Shipping canceled | 0 |
| 12 | 11 | 5 | 2 | Late delivery | 1 |

⚠ 0 Ln 2, Col 18 Spaces: 4 UTF-8 LF 65,752 rows MSSQL 00:00:01 johndroescher.com : Fall_2023 (60)

*StoreData:*

```
SELECT *
FROM StoreData
```

Results | Messages

| | column1 | Department_Id | Department_Name | Latitude | Longitude |
|---|---|---|---|---|---|
| 1 | 0 | 2 | Fitness | 18.251453399658203 | -66.03705596923828 |
| 2 | 1 | 2 | Fitness | 18.279451370239258 | -66.03706359863281 |
| 3 | 2 | 2 | Fitness | 37.292232513427734 | -121.88127899169922 |
| 4 | 3 | 2 | Fitness | 34.125946044921875 | -118.291015625 |
| 5 | 4 | 2 | Fitness | 18.253768920898438 | -66.03704833984375 |
| 6 | 5 | 2 | Fitness | 43.01396942138672 | -78.87906646728516 |
| 7 | 6 | 2 | Fitness | 18.242538452148438 | -66.03705596923828 |
| 8 | 7 | 2 | Fitness | 25.928869247436523 | -80.16287231445312 |
| 9 | 8 | 2 | Fitness | 18.2332296142578 | -66.03705596923828 |
| 10 | 9 | 2 | Fitness | 37.773990631103516 | -121.96662902832031 |
| 11 | 10 | 2 | Fitness | 18.28284454345703 | -66.03705596923828 |
| 12 | 11 | 2 | Fitness | 40.65486526489258 | -73.58707427978516 |
| 13 | 12 | 2 | Fitness | 36.67633819580078 | -121.65651702880859 |

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***From these tables, we queried the data to find patterns or inconsistency:***

- Depicts the total sales, profits and the quantity of each product sold from every order made from 2015 to 2018 by the product's name and its category:

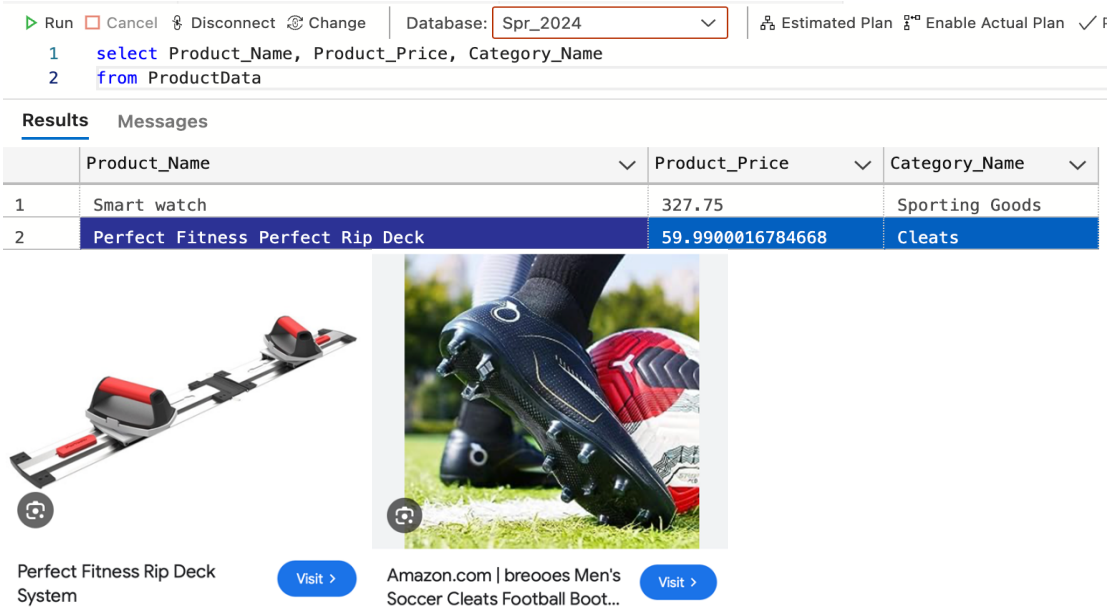
```
select CONVERT (DATE, order_date_DateOrders) as Date_of_order,
       Product_name, Category_Name,
       sum(Sales) as sum_sales, Order_Profit_Per_Order, Order_Item_Quantity

from ProductData

-- Used INNER/LEFT JOIN to attach the fields/columns from MainTable to ProductData table using the same column, Category_Id
left join dbo.MainTable on dbo.ProductData.Category_Id = dbo.MainTable.Category_Id

-- Used OUTER JOIN to  attach the fields/columns from OrderData to MainTable using the same column, Order_Id
full outer join dbo.OrderData on dbo.MainTable.Order_Id = dbo.OrderData.Order_Id

GROUP by Product_Name,Category_Name, order_date_DateOrders,Order_Profit_Per_Order, Order_Item_Quantity

ORDER by order_date_DateOrders desc
```

Results Messages

| | Date_of_order | Product_name | Category_Name | sum_sales | Order_Profit_Per_Order | Order_Item_Quantity |
|---|---|---|---|---|---|---|
| 1 | 2018-01-31 | Fighting video games | Video Games | 39.75 | 9.789999962 | 1 |
| 2 | 2018-01-31 | Toys | Toys | 11.539999961853027 | 1.529999971 | 1 |
| 3 | 2018-01-31 | Smart watch | Sporting Goods | 327.75 | 91.25 | 1 |
| 4 | 2018-01-31 | Summer dresses | Women's Clothing | 215.82000732421875 | -126.5599976 | 1 |
| 5 | 2018-01-31 | Summer dresses | Women's Clothing | 215.82000732421875 | -107.9599991 | 1 |
| 6 | 2018-01-31 | Summer dresses | Women's Clothing | 215.82000732421875 | 103.5899963 | 1 |
| 7 | 2018-01-31 | Summer dresses | Women's Clothing | 215.82000732421875 | 70.51000214 | 1 |
| 8 | 2018-01-31 | Summer dresses | Women's Clothing | 215.82000732421875 | 21.14999962 | 1 |
| 9 | 2018-01-31 | Summer dresses | Women's Clothing | 215.82000732421875 | -48.77999878 | 1 |
| 10 | 2018-01-31 | Summer dresses | Women's Clothing | 215.82000732421875 | -51.79999924 | 1 |
| 11 | 2018-01-31 | Summer dresses | Women's Clothing | 215.82000732421875 | 71.76000214 | 1 |
| 12 | 2018-01-31 | Summer dresses | Women's Clothing | 215.82000732421875 | 71.37999725 | 1 |
| 13 | 2018-01-31 | Summer dresses | Women's Clothing | 215.82000732421875 | -301.0700073 | 1 |
| 14 | 2018-01-31 | Summer dresses | Women's Clothing | 215.82000732421875 | -20.22999954 | 1 |
| 15 | 2018-01-31 | Summer dresses | Women's Clothing | 215.82000732421875 | 17.09000015 | 1 |
| 16 | 2018-01-31 | Summer dresses | Women's Clothing | 215.82000732421875 | 89.26000214 | 1 |

## Data Restrictions:

1. Upon querying the data, I discovered that for the year 2018, the data is only limited to the month of January to quantify yearly performance and compare it to previous years. Whereas for previous years, 2015 to 2017 had data for all months of the year.
2. The data in certain columns do not match. For instance, in the table ProductData, most of the products in the column Product_Name were categorized incorrectly with the values in the column Category_Name.



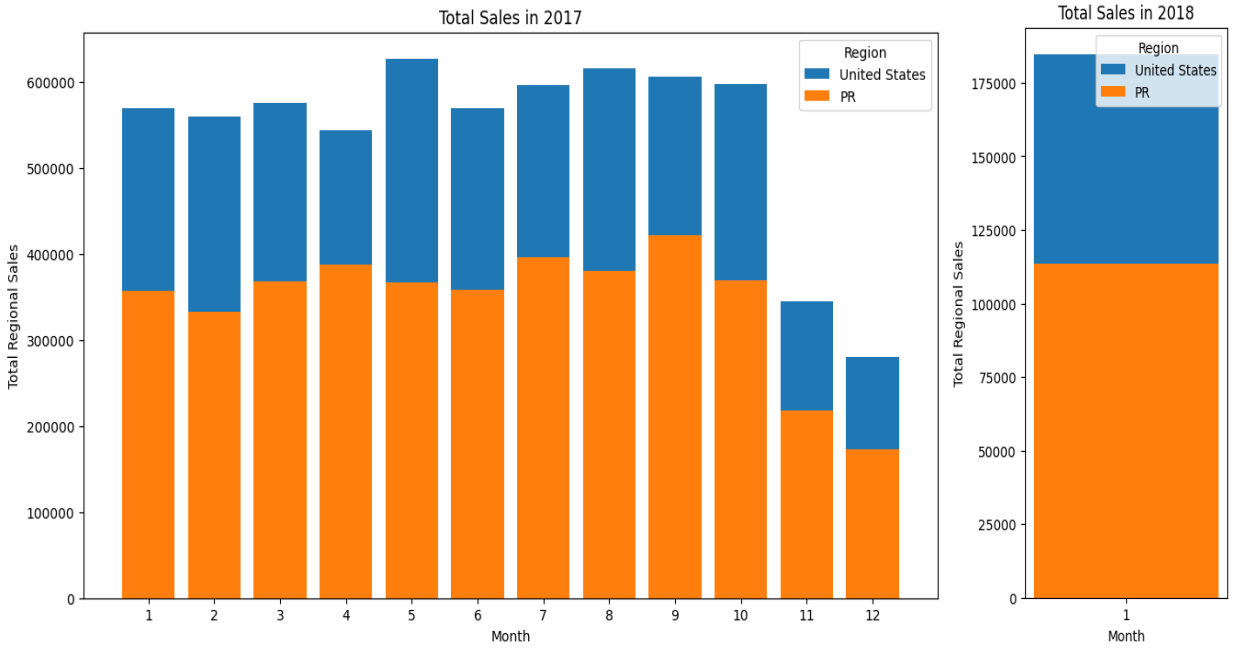

## Data Preparation:

- Using Python's pandas library to manipulate the data, I used the loc function to update the Category name based on the condition; if a product's name is present in the data frame, product_type, change the value in the column Category_Name for that product name.
- Using the SQL database, I queried the necessary data for the analysis. Then converted the queried data into a csv file and utilizing pandas, a python library, read the csv file into a pandas Data Frame. Using pandas, I performed functions to modify the columns, such as merge and drop columns.
- Lastly, I utilized python to make additional aggregations and create visualizations (bar graphs, pie charts and line graphs) using the matplotlib and seaborn python libraries

**Analysis:**

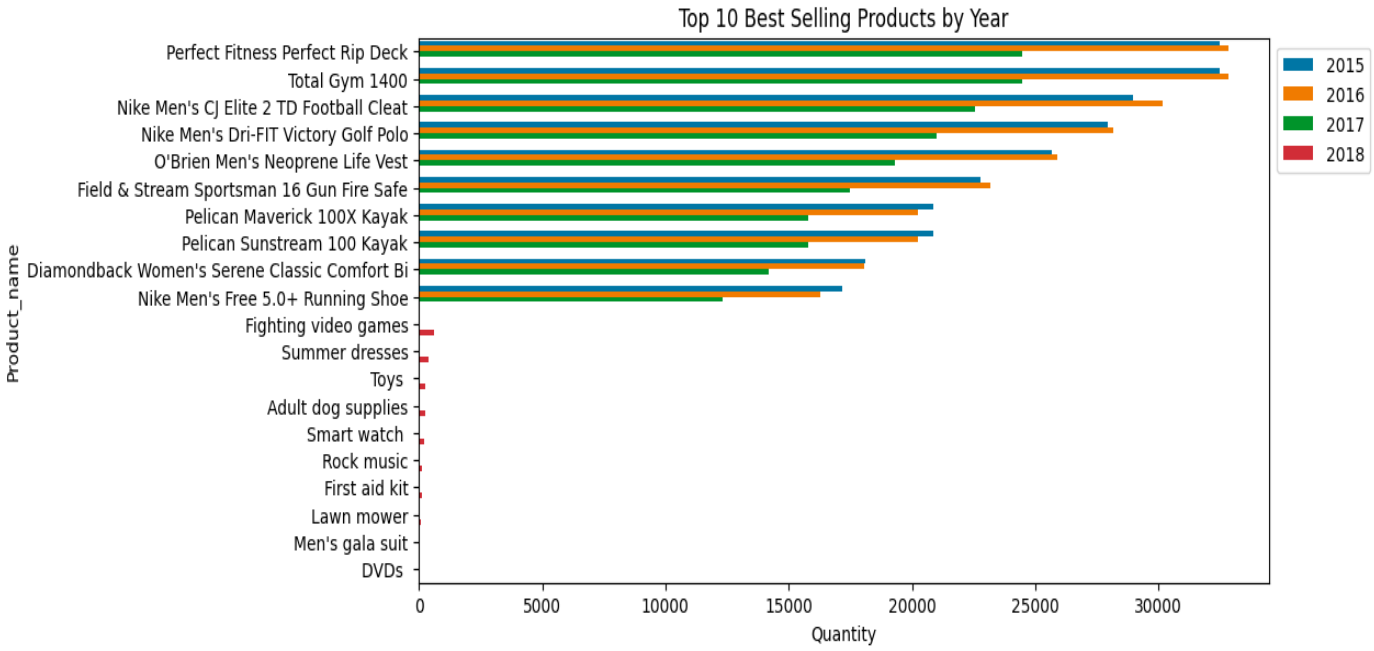
1. **Compared the sales data. Notice a drastic change in sales from 2017 to 2018**

| Year | Total Sales |
|---|---|
| 2015 | $11,089,543.55 |
| 2016 | $11,055,996.76 |
| 2017 | $10,610,910.01 |
| 2018 | $297,952.05 |



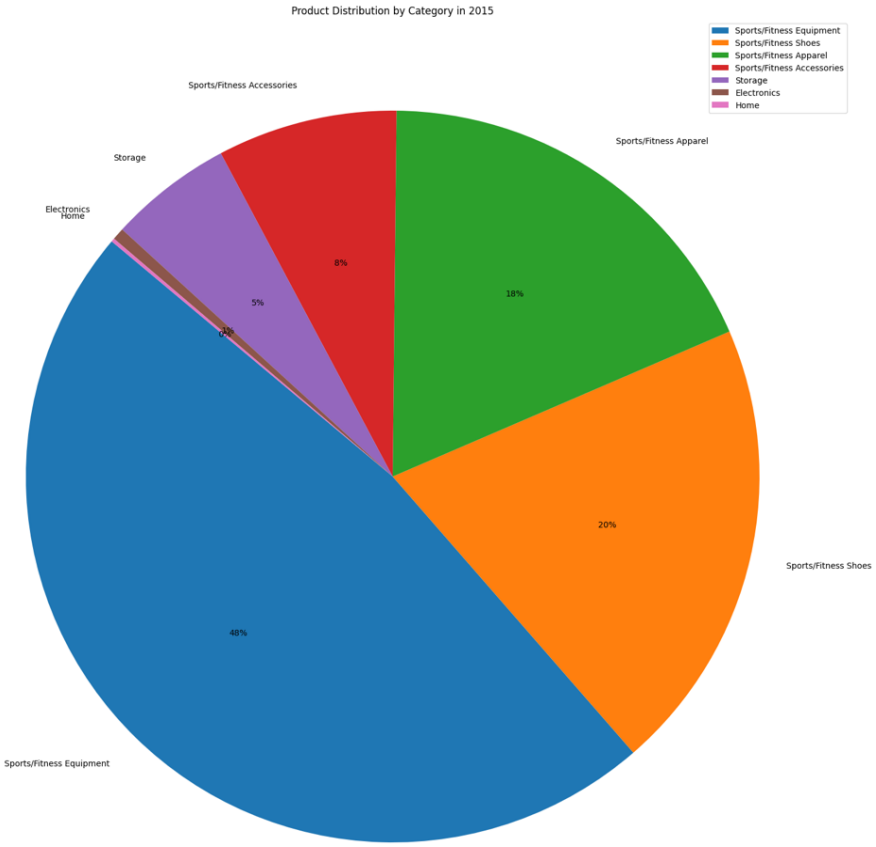

- Sales in the United States are significantly higher than those in Puerto Rico throughout the year. (USA is a country while Puerto Rico is territory owned by the United States compared to each state Puerto Rico is significantly higher)
- The total sales for both regions combined reach their peak in May and remain relatively high in all the other months.
- The lowest combined sales started to occur in November, with a notably sharp decrease, especially in the United States, and continued to decrease till the end of the year and the beginning of the New year.
- Although the total sales values fluctuate monthly, the proportion of sales from Puerto Rico to the United States remains relatively consistent. This indicates that any factors affecting sales trends will impact both regions similarly

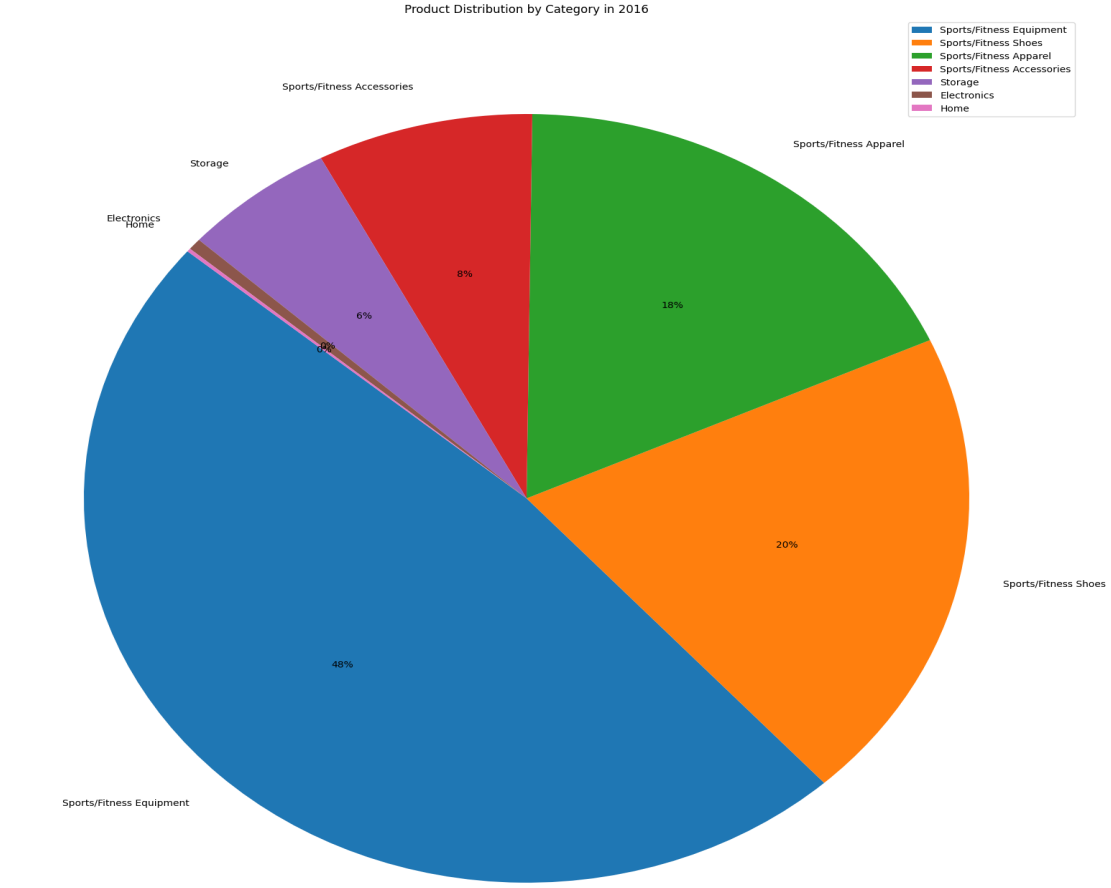
2. **Identified ten best-selling products for each year in the United States and Puerto Rico.**



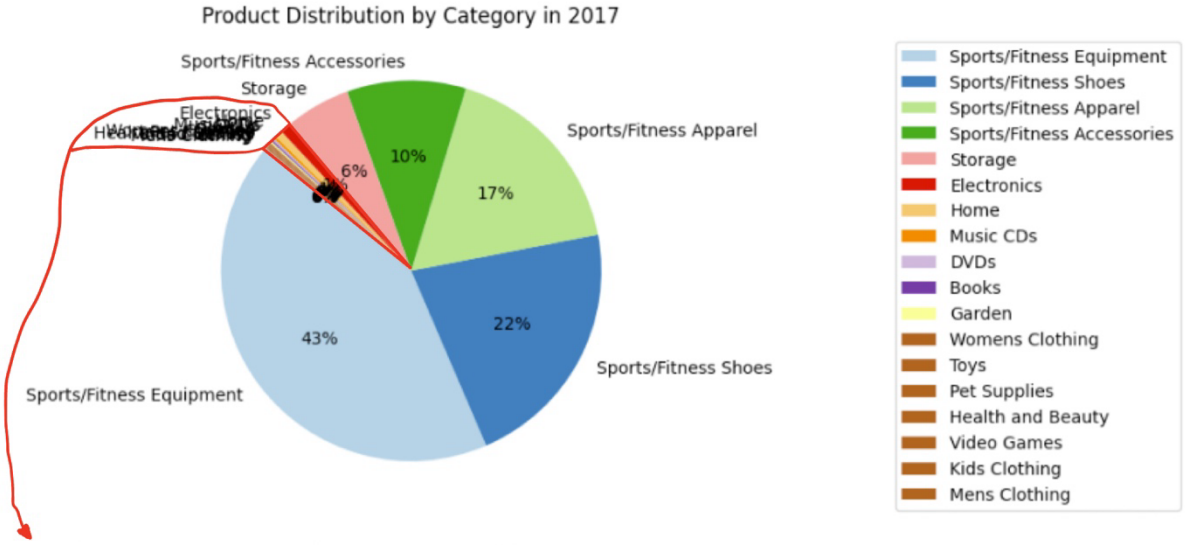

- From 2015 to 2016 the quantity of the top selling products slightly increased and plummeted in 2017.
- The decrease in sales for 2017, can be attributed to the rise of competitors that sell a variety of products such as Costco and Amazon.

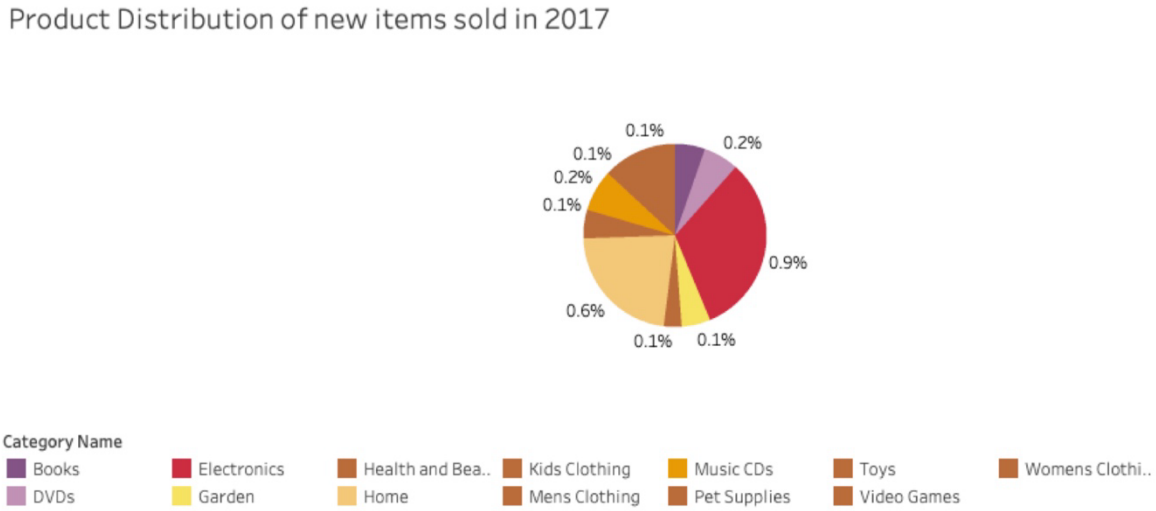
## 3. The product distribution is based on the product's category sold for each year:



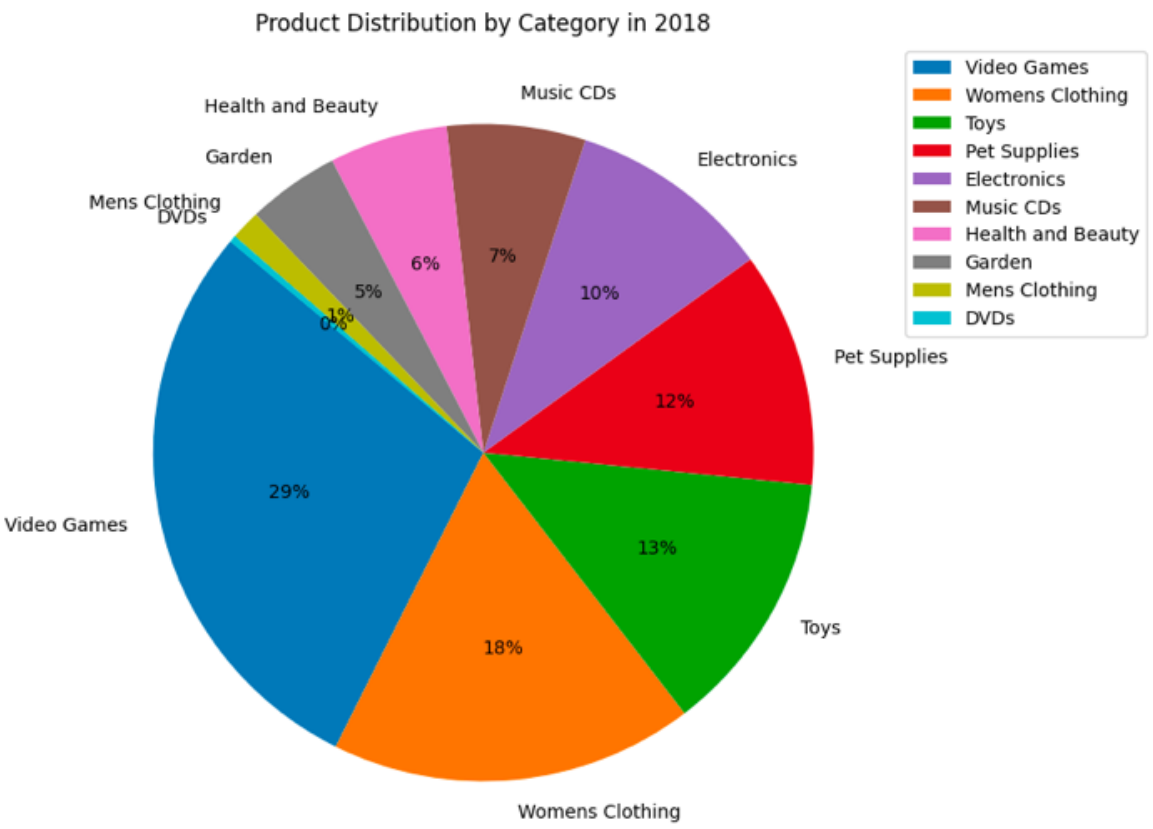




- In respects to the types of products sold in 2015 and 2016, there was very minimal changes.



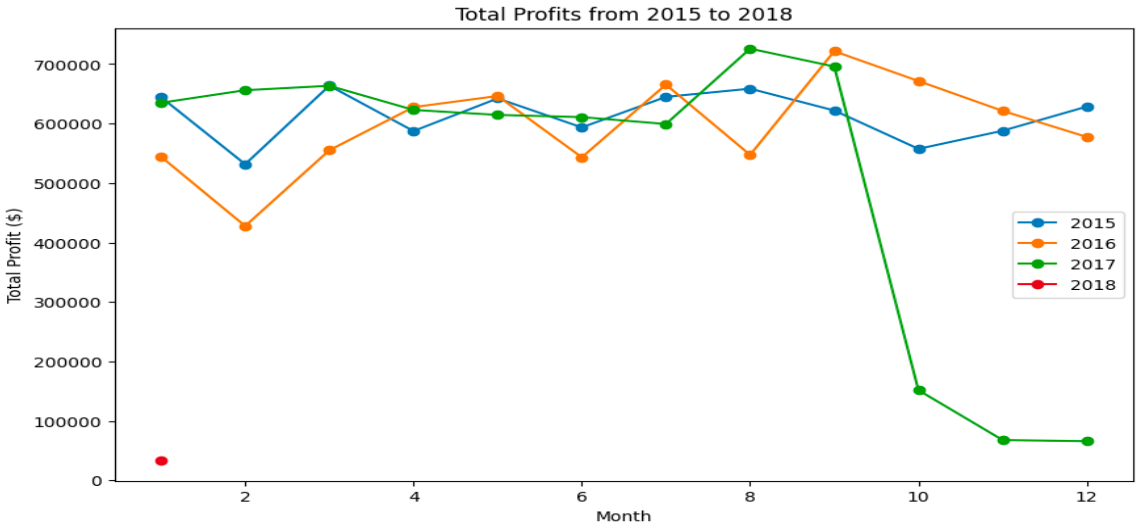




- In 2017, the company transitioned from only selling sports/fitness-related goods to offering new product types.
    - The new products are represented in the obscure clustered labels with very low percentages represent the products low sales.




- In 2018, the company no longer sold sports/fitness related products but continued to sell the new miscellaneous products instead.

4. **The decline in sales from 2017 and external factors that were inevitable greatly affected the company's profits from October 2017 to January 2018.**



**Why?**

- Puerto Rico was the company's best source of revenue. Although, “Hurricane Irma passed Puerto Rico on September 6, 2017, causing an estimated $1 billion in damages... Two weeks later, on September 20, Hurricane Maria, the largest hurricane to hit Puerto Rico... The storms had a tremendous impact on the Puerto Rican population beyond loss of life, injuries and destruction. They have caused major disruption in economic life, manufacturing, and research activities” ***(Welton, 2020)***.
- The aftermath affected many sectors, particularly the retail sector, including a noticeable decline in sporting goods sales
- Residents prioritized recovery and rebuilding, diverting spending away from non-essential items such as sporting goods and shifted focus to immediate needs like food, water, and essentials needed to help them get through this struggle.
- Since Puerto Rico to the United States sales are relatively consistent, because of the hurricane affecting sales in Puerto Rico it also affected sales performance in the USA.

**Suggestion**

The company should revert to selling sports/fitness products again. Focusing on the products that were most popular in the US. The company can also try to target new customers from nearby Caribbean countries such as the Dominican Republic.

**References:**

Welton, Michael et al. “Impact of Hurricanes Irma and Maria on Puerto Rico Maternal and Child Health Research Programs.” *Maternal and child health journal* vol. 24,1 (2020): 22-29. doi:10.1007/s10995-019-028242 https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7059554/#:~:text=Hurricane%20Irma%20passed%20Puerto%20Rico,3%20fatalities%20in%20Puerto%20Rico.

https://www.rand.org/pubs/research_reports/RR2600.html

https://www.rand.org/hsrd/hsoac/projects/puerto-rico-recovery/hurricanes-irma-and-maria.html