

### Power BI Assignment: Comprehensive Data Analysis with DAX's Power Query Objective:

Students will develop a Power BI report while learning:

- **Power Query Editor** (Data Transformation)
- **Data Understanding s Preparation**
- **Data Modeling s Schema Design**
- **DAX Functions:**
  - Text Functions
  - Logical Functions
  - Time Intelligence Functions
- **Dataset:**
- Use the **AdventureWorks Sales Dataset** (CSV format) available on **Kaggle** (Download Here) or an **E-commerce Sales dataset** from Kaggle.

## Assignment Tasks

### Task 1: Understanding Power Query Editor (Data Cleaning & Transformation)

1. Import the dataset into Power BI using **Power Query Editor**.

The screenshot shows the Microsoft Power BI desktop interface. The 'Home' ribbon tab is selected. In the top-left corner of the ribbon, the 'Get data' button is highlighted with a red box. The 'Clipboard' section of the ribbon also has a red box around its icon. The 'Common data sources' pane on the left lists various options: Excel workbook, Power BI semantic models, Dataflows, Dataverse, SQL Server, Analysis Services, and Text/CSV. Below this, there's a preview of the data with columns: ProductKey, ProductSubcategoryKey, ProductSKU, ProductName, ModelName, and ProductDescription. The data pane shows several rows of product information. The ribbon tabs include File, Home, Help, Table tools, Data, Queries, Relationships, Calculations, Security, Sensitivity, and Share. The status bar at the bottom right shows the user's name 'Pratiksha Chandar' and other system details.

## 2. Perform the following transformations:

- Remove missing values and duplicates.

Queries [10]

|    | OrderDate | StockDate  | OrderNumber | ProductKey | CustomerKey |
|----|-----------|------------|-------------|------------|-------------|
| 1  | 1/1/2022  | 13/12/2021 | S061285     | 529        | 23          |
| 2  | 1/1/2022  | 24/09/2021 | S061285     | 214        | 23          |
| 3  | 1/1/2022  | 04/09/2021 | S061285     | 540        | 23          |
| 4  | 1/1/2022  | 28/09/2021 | S061301     | 529        | 16          |
| 5  | 2/1/2022  | 20/09/2021 | S061318     | 215        | 18          |
| 6  | 2/1/2022  | 16/10/2021 | S061327     | 223        | 15          |
| 7  | 2/1/2022  | 05/09/2021 | S061327     | 214        | 15          |
| 8  | 2/1/2022  | 16/11/2021 | S061327     | 358        | 15          |
| 9  | 3/1/2022  | 12/11/2021 | S061400     | 528        | 14          |
| 10 | 3/1/2022  | 12/10/2021 | S061400     | 215        | 14          |
| 11 | 3/1/2022  | 18/11/2021 | S061386     | 480        | 27          |
| 12 | 3/1/2022  | 08/12/2021 | S061386     | 530        | 27          |
| 13 | 3/1/2022  | 20/09/2021 | S061386     | 541        | 27          |
| 14 | 3/1/2022  | 14/12/2021 | S061377     | 223        | 18          |
| 15 | 3/1/2022  | 28/10/2021 | S061373     | 478        | 11          |
| 16 | 3/1/2022  | 19/10/2021 | S061398     | 528        | 23          |
| 17 | 3/1/2022  | 08/11/2021 | S061420     | 223        | 13          |
| 18 | 3/1/2022  | 21/09/2021 | S061420     | 485        | 13          |
| 19 | 3/1/2022  | 04/10/2021 | S061420     | 362        | 13          |
| 20 | 3/1/2022  | 18/09/2021 | S061420     | 487        | 13          |
| 21 |           |            |             |            |             |

1 COLUMNS, 999+ ROWS Column profiling based on top 1000 rows

Query Settings

Properties

Name: AdventureWorks Sales Data 2020

All Properties

Applied Steps

Source: Promoted Headers, Changed Type

PREVIEW DOWNLOAD

Queries [10]

|    | OrderDate | StockDate  | OrderNumber | ProductKey | CustomerKey |
|----|-----------|------------|-------------|------------|-------------|
| 1  | 1/1/2022  | 13/12/2021 | S061285     | 529        | 23          |
| 2  | 1/1/2022  | 24/09/2021 | S061285     | 214        | 23          |
| 3  | 1/1/2022  | 04/09/2021 | S061285     | 540        | 23          |
| 4  | 1/1/2022  | 28/09/2021 | S061301     | 529        | 16          |
| 5  | 2/1/2022  | 20/09/2021 | S061318     | 215        | 18          |
| 6  | 2/1/2022  | 16/10/2021 | S061327     | 223        | 15          |
| 7  | 2/1/2022  | 05/09/2021 | S061327     | 214        | 15          |
| 8  | 2/1/2022  | 16/11/2021 | S061327     | 358        | 15          |
| 9  | 3/1/2022  | 12/11/2021 | S061400     | 528        | 14          |
| 10 | 3/1/2022  | 12/10/2021 | S061400     | 215        | 14          |
| 11 | 3/1/2022  | 18/11/2021 | S061386     | 480        | 27          |
| 12 | 3/1/2022  | 08/12/2021 | S061386     | 530        | 27          |
| 13 | 3/1/2022  | 20/09/2021 | S061386     | 541        | 27          |
| 14 | 3/1/2022  | 14/12/2021 | S061377     | 223        | 18          |
| 15 | 3/1/2022  | 28/10/2021 | S061373     | 478        | 11          |
| 16 | 3/1/2022  | 19/10/2021 | S061398     | 528        | 23          |
| 17 | 3/1/2022  | 08/11/2021 | S061420     | 223        | 13          |
| 18 | 3/1/2022  | 21/09/2021 | S061420     | 485        | 13          |
| 19 | 3/1/2022  | 04/10/2021 | S061420     | 362        | 13          |
| 20 | 3/1/2022  | 18/09/2021 | S061420     | 487        | 13          |
| 21 |           |            |             |            |             |

3 COLUMNS, 506 ROWS Column profiling based on top 1000 rows

Query Settings

Properties

Name: AdventureWorks Sales Data 2022

All Properties

Applied Steps

Source: Promoted Headers, Changed Type, Removed Blank Rows

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Queries [10]

|    | Date     | Product Category | North Region | Central Region | South Region |
|----|----------|------------------|--------------|----------------|--------------|
| 1  | 7/1/2022 | Bikes            | 10           | 19             | 25           |
| 2  | 7/1/2022 | Components       | 14           | 31             | 16           |
| 3  | 7/1/2022 | Clothing         | 35           | 32             | 46           |
| 4  | 7/1/2022 | Accessories      | 13           | 42             | 26           |
| 5  | 7/2/2022 | Bikes            | 47           | 23             | 41           |
| 6  | 7/2/2022 | Components       | 41           | 36             | 9            |
| 7  | 7/2/2022 | Clothing         | 13           | 14             | 27           |
| 8  | 7/2/2022 | Accessories      | 45           | 21             | 28           |
| 9  | 7/3/2022 | Bikes            | 18           | 24             | 12           |
| 10 | 7/3/2022 | Components       | 11           | 32             | 18           |
| 11 | 7/3/2022 | Clothing         | 43           | 35             | 35           |
| 12 | 7/3/2022 | Accessories      | 49           | 8              | 15           |
| 13 | 7/4/2022 | Bikes            | 36           | 33             | 43           |
| 14 | 7/4/2022 | Components       | 16           | 17             | 30           |
| 15 | 7/4/2022 | Clothing         | 15           | 18             | 28           |
| 16 | 7/4/2022 | Accessories      | 34           | 28             | 31           |

Query Settings

Properties

Name: Product Category Sales (Unpivot Demo)

All Properties

Applied Steps

Source: Promoted Headers, Changed Type

Queries [10]

|   | Date     | Product Category | North Region | Central Region | South Region |
|---|----------|------------------|--------------|----------------|--------------|
| 1 | 7/1/2022 | Bikes            | 10           | 19             | 25           |
| 2 | 7/2/2022 | Bikes            | 47           | 23             | 41           |
| 3 | 7/3/2022 | Bikes            | 18           | 24             | 12           |
| 4 | 7/4/2022 | Bikes            | 36           | 33             | 43           |
| 5 | 7/5/2022 | Bikes            | 16           | 43             | 14           |

Query Settings

Properties

Name: Product Category Sales (Unpivot Demo)

All Properties

Applied Steps

Source: Promoted Headers, Changed Type, Removed Duplicates

Screenshot of Power BI Data Editor showing the transformation of a date column. The 'OrderDate' column is being converted from text to date type.

**APPLIED STEPS**

- Source
- Promoted Headers
- Changed Type

Screenshot of Power BI Data Editor showing the removal of duplicates from the 'OrderDate' column.

**APPLIED STEPS**

- Source
- Promoted Headers
- Changed Type
- Removed Duplicates

- Change data types (e.g., Date, Currency, Categories).

Screenshot of Power BI Data Editor showing the promotion of headers and changing data types for the 'OrderNumber' column.

**APPLIED STEPS**

- Source
- Promoted Headers

**Query Settings**

**Properties**

**Applied Steps**

Queries [10]

```
= Table.TransformColumnTypes(#"Promoted Headers", {"OrderDate", type date})
```

Query Settings

- PROPERTIES**
  - Name: AdventureWorks Sales Data 2020
  - All Properties
- APPLIED STEPS**
  - Source
  - Promoted Headers
  - Changed Type

Queries [11]

```
= Table.PromoteHeaders(Source, [PromoteAllScalars=true])
```

Query Settings

- PROPERTIES**
  - Name: Internet Sales
  - All Properties
- APPLIED STEPS**
  - Source
  - Promoted Headers

Queries [11]

```
= Table.TransformColumnTypes(#"Promoted Headers", {"CurrencyKey", Currency.Type})
```

Query Settings

- PROPERTIES**
  - Name: Internet Sales
  - All Properties
- APPLIED STEPS**
  - Source
  - Promoted Headers
  - Changed Type

- Split full names into first and last names.

Queries [12]

```
= Table.TransformColumnTypes(#"Promoted Headers", {"ProductKey", Int64.Type}, {"ProductAlternateKey", type text}, {"ProductSubcategoryKey", type text}, {"WeightUnitMeasureCode", type text}, {"SizeUnitMeasureCode", type text}, {"EnglishProductName", type text}, {"SpanishProductName", type text}, {"FrenchProductName", type text}, {"StandardCost", type text}, {"FinishedGoodsFlag", Int64.Type}, {"Color", type text}, {"SafetyStockLevel", Int64.Type}, {"ReorderPoint", Int64.Type}, {"LastUpdateDate", type date})
```

Query Settings

- PROPERTIES**
  - Name: Product
  - All Properties
- APPLIED STEPS**
  - Source
  - Promoted Headers
  - Changed Type

Queries [12]

AdventureWorks Product...  
AdventureWorks Custo...  
AdventureWorks Returns...  
AdventureWorks Sales D...  
AdventureWorks Sales D...  
AdventureWorks Sales D...  
Product Category Sales (...  
AdventureWorks Calend...  
AdventureWorks Product...  
AdventureWorks Product...  
Internet Sales

**Product**

ProductKey ProductAlternateKey ProductSubcategoryKey WeightUnitMeasureCode

| ProductKey | ProductAlternateKey | ProductSubcategoryKey | WeightUnitMeasureCode |
|------------|---------------------|-----------------------|-----------------------|
| 1          | AR-5381             |                       |                       |
| 2          | BA-8327             |                       |                       |
| 3          | BE-2349             |                       |                       |
| 4          | BE-2908             |                       |                       |
| 5          | BL-2036             |                       |                       |
| 6          | CA-5965             |                       |                       |
| 7          | CA-6738             |                       |                       |
| 8          | CA-7457             |                       |                       |
| 9          | CB-2903             |                       |                       |
| 10         | CN-6137             |                       |                       |
| 11         | CR-7833             |                       |                       |
| 12         | CR-9981             |                       |                       |
| 13         | CS-2812             |                       |                       |
| 14         | DC-8732             |                       |                       |
| 15         | DC-9824             |                       |                       |
| 16         | DT-2377             |                       |                       |
| 17         | EC-M092             |                       |                       |
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35 COLUMNS: 606 ROWS Column profiling based on too 1000 rows

Add as New Query

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Queries [12]

AdventureWorks Product...  
AdventureWorks Custo...  
AdventureWorks Returns...  
AdventureWorks Sales D...  
AdventureWorks Sales D...  
AdventureWorks Sales D...  
Product Category Sales (...  
AdventureWorks Calend...  
AdventureWorks Product...  
AdventureWorks Product...  
Internet Sales

**Product**

ProductKey ProductAlternateKey

| ProductKey | ProductAlternateKey |
|------------|---------------------|
| 1          | AR-5381             |
| 2          | BA-8327             |
| 3          | BE-2349             |
| 4          | BE-2908             |
| 5          | BL-2036             |
| 6          | CA-5965             |
| 7          | CA-6738             |
| 8          | CA-7457             |
| 9          | CB-2903             |
| 10         | CN-6137             |
| 11         | CR-7833             |
| 12         | CR-9981             |
| 13         | CS-2812             |
| 14         | DC-8732             |
| 15         | DC-9824             |
| 16         | DT-2377             |
| 17         | EC-M092             |
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Split Column by Delimiter

Specify the delimiter used to split the text column.

Select or enter delimiter: --Custom--

Split at: Left-most delimiter

Advanced options: Quote Character: " Split using special characters: Insert special character: ▾

OK Cancel

Queries [12]

AdventureWorks Product...  
AdventureWorks Custo...  
AdventureWorks Returns...  
AdventureWorks Sales D...  
AdventureWorks Sales D...  
AdventureWorks Sales D...  
Product Category Sales (...  
AdventureWorks Calend...  
AdventureWorks Product...  
AdventureWorks Product...  
Internet Sales

**Product**

ProductKey ProductAlternateKey.1 ProductAlternateKey.2 ProductSubcategoryKey WeightUnitMeasureCode

| ProductKey | ProductAlternateKey.1 | ProductAlternateKey.2 | ProductSubcategoryKey | WeightUnitMeasureCode |
|------------|-----------------------|-----------------------|-----------------------|-----------------------|
| 1          | AR                    | 5381                  |                       |                       |
| 2          | BA                    | 8327                  |                       |                       |
| 3          | BE                    | 2349                  |                       |                       |
| 4          | BE                    | 2908                  |                       |                       |
| 5          | BL                    | 2036                  |                       |                       |
| 6          | CA                    | 5965                  |                       |                       |
| 7          | CA                    | 6738                  |                       |                       |
| 8          | CA                    | 7457                  |                       |                       |
| 9          | CB                    | 2903                  |                       |                       |
| 10         | CN                    | 6137                  |                       |                       |
| 11         | CR                    | 7833                  |                       |                       |
| 12         | CR                    | 9981                  |                       |                       |
| 13         | CS                    | 2812                  |                       |                       |
| 14         | DC                    | 8732                  |                       |                       |
| 15         | DC                    | 9824                  |                       |                       |
| 16         | DT                    | 2377                  |                       |                       |
| 17         | EC                    | M092                  |                       |                       |
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- Merge tables based on keys (e.g., Orders and Customers).

**Merge**

Select a table and matching columns to create a merged table.

AdventureWorks Product Categories Lookup

| ProductCategoryKey | CategoryName |
|--------------------|--------------|
| 1                  | Bikes        |
| 2                  | Components   |
| 3                  | Clothing     |
| 4                  | Accessories  |

AdventureWorks Product Subcatego...

| ProductSubcategoryKey | SubcategoryName | ProductCategoryKey |
|-----------------------|-----------------|--------------------|
| 1                     | Mountain Bikes  | 1                  |
| 2                     | Road Bikes      | 1                  |
| 3                     | Touring Bikes   | 1                  |
| 4                     | Handlebars      | 2                  |
| 5                     | Bottom Brackets | 2                  |

Join Kind: Full Outer (all rows from both)

Use fuzzy matching to perform the merge

Fuzzy matching options

The selection matches 4 of 4 rows from the first table, and 37 of 37 rows from the second table.

**OK** **Cancel**

2 COLUMNS, 4 ROWS Column profiling based on top 1000 rows

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**Properties**

Name: AdventureWorks Product Categories Loo

All Properties

**Applied Steps**

Source Promoted Headers Changed Type

**Merge Queries**

AdventureWorks Product Subcategories Lookup = Table.NestedJoin(#"Changed Type", {"ProductCategoryKey"}, #"AdventureWorks Product Subcategories Lookup", {"ProductCategoryKey"}, "AdventureWorks Product Subcategories Lookup", JoinKind.FullOuter)

**Properties**

Name: AdventureWorks Product Categories Loo

All Properties

**Applied Steps**

Source Promoted Headers Changed Type Merged Queries

**Merged Queries**

AdventureWorks Product Subcategories Lookup = #"Merged Queries"(0)[Adventureworks Product Subcategories Lookup]

**Properties**

Name: AdventureWorks Product Categories Loo

All Properties

**Applied Steps**

Source Promoted Headers Changed Type Merged Queries AdventureWorks Product Sub...

**Merged Queries**

AdventureWorks Product Subcategories Lookup = #"Merged Queries"(1)[Adventureworks Product Subcategories Lookup]

**Properties**

Name: AdventureWorks Product Categories Loo

All Properties

**Applied Steps**

Source Promoted Headers Changed Type Merged Queries AdventureWorks Product Sub...

Queries [12]

= "#Merged Queries"(2)[Adventureworks Product Subcategories Lookup]

| ProductSubcategoryKey | SubcategoryName | ProductCategoryKey |
|-----------------------|-----------------|--------------------|
| 1                     | Bib-Shorts      | 3                  |
| 2                     | Caps            | 3                  |
| 3                     | Gloves          | 3                  |
| 4                     | Jerseys         | 3                  |
| 5                     | Shorts          | 3                  |
| 6                     | Socks           | 3                  |
| 7                     | Tights          | 3                  |
| 8                     | Vests           | 3                  |

Query Settings

Properties

Name: AdventureWorks Product Categories Loo

All Properties

Applied Steps

Source, Promoted Headers, Changed Type, Merged Queries, AdventureWorks Product Sub...

Queries [12]

= "#Merged Queries"(3)[Adventureworks Product Subcategories Lookup]

| ProductSubcategoryKey | SubcategoryName   | ProductCategoryKey |
|-----------------------|-------------------|--------------------|
| 1                     | Bike Racks        | 4                  |
| 2                     | Bike Stands       | 4                  |
| 3                     | Bottles and Cages | 4                  |
| 4                     | Cleaners          | 4                  |
| 5                     | Fenders           | 4                  |
| 6                     | Helmets           | 4                  |
| 7                     | Hydration Packs   | 4                  |
| 8                     | Lights            | 4                  |
| 9                     | Locks             | 4                  |
| 10                    | Panniers          | 4                  |
| 11                    | Pumps             | 4                  |
| 12                    | Tires and Tubes   | 4                  |

Query Settings

Properties

Name: AdventureWorks Product Categories Loo

All Properties

Applied Steps

Source, Promoted Headers, Changed Type, Merged Queries, AdventureWorks Product Sub...

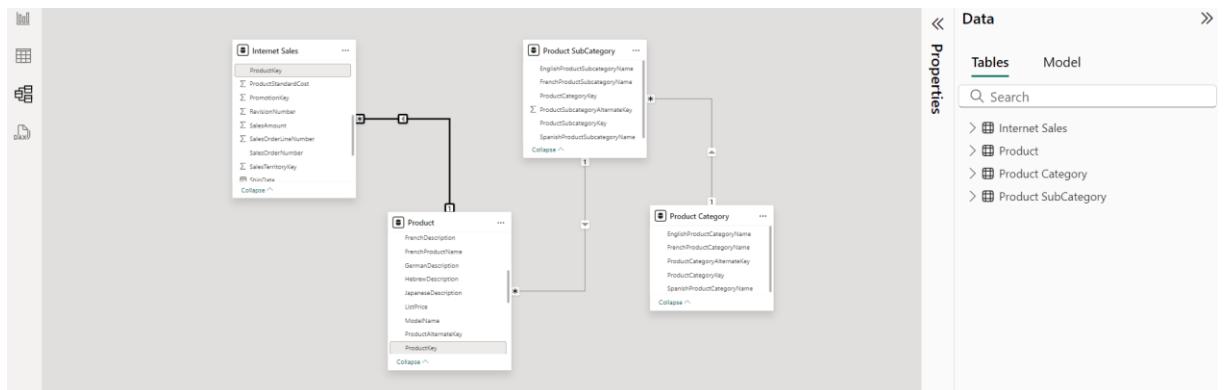
- Save a step-by-step documentation of transformations done.

## Task 2: Understanding Data and Data Modeling

- Define Primary & Foreign Keys and create relationships in Model View.

Primary Key: ProductKey

Foreign Key: ProductCategoryKey, ProductKey.

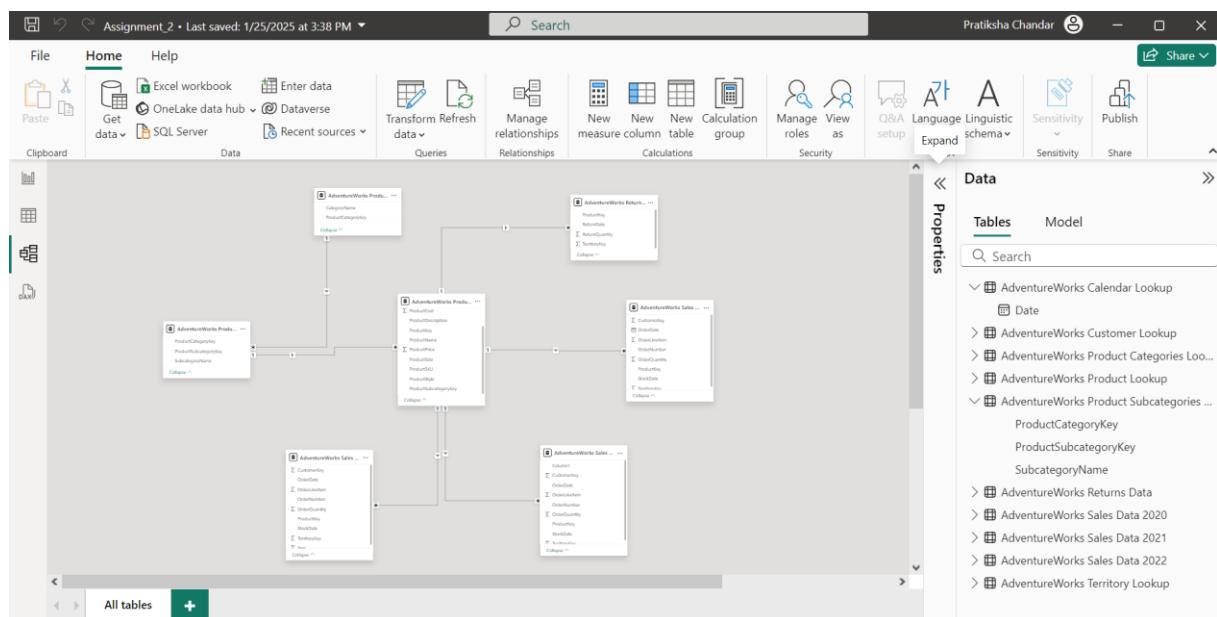


2. Identify key tables: Fact (Sales, Orders) and Dimension (Customers, Products, Regions).

**Fact Tables** (AdventureWorks Product Lookup) were connected to

**Dimension Tables** (AdventureWorks Returns Data, AdventureWorks Sales Data 2021, AdventureWorks Sales Data 2020, AdventureWorks Product Subcategories Lookup, AdventureWorks Sales Data 2022) using primary and foreign keys.

3. Implement **Star Schema** for better performance.



4. Explain why schema design is important in a short document (1-2 pages).

## 1. Optimized Data Models for Performance

- A well-designed schema ensures that your Power BI data model is efficient, reducing memory consumption and improving query performance. Avoiding unnecessary tables or columns ensures faster report generation and better refresh times.

## 2. Simplified Data Relationships

- Power BI heavily relies on relationships between tables to provide insights. Proper schema design defines relationships (one-to-many, many-to-many) clearly, ensuring accurate calculations and eliminating potential ambiguity in measures or visuals.

### 3. Minimized Redundancy

- Avoid duplicating data across tables by using a star schema or snowflake schema. This ensures data consistency and reduces the size of your Power BI file, making it easier to share and maintain.

#### 4. Enhanced Usability for End Users

- By creating a logical structure (e.g., separating dimensions from fact tables), users can easily navigate and understand the model. Hiding unnecessary fields and organizing data improves the end-user experience.

## Task 3: Implementing DAX Functions

### A) Text Functions

Create calculated columns using the following **Text DAX Functions**:

- Extract the first 3 letters of Product Category:

|  |                    | 1 first_3 = LEFT('Product Category'[EnglishProductCategoryName],3) |                            |                    |                   |         |  |
|--|--------------------|--|----------------------------|--------------------|-------------------|---------|--|
|  | ProductCategoryKey | ProductCategoryAlternateKey  | EnglishProductCategoryName | SpanishProductName | FrenchProductName | first_3 |  |
|  | 1                  |  | Bikes                      | Bicicleta          | Vélo              | Bik     |  |
|  | 2                  |  | Components                 | Componente         | Composant         | Com     |  |
|  | 3                  |  | Clothing                   | Prenda             | Vêtements         | Clo     |  |
|  | 4                  |  | Accessories                | Accesorio          | Accessoire        | Acc     |  |

- Create a full name column from First and Last Names:

|  | CustomerKey | Prefix | FirstName | LastName  | BirthDate                    | MaritalStatus | Gender | EmailAddress                   | AnnualIncome |
|--|-------------|--------|-----------|-----------|------------------------------|---------------|--------|--------------------------------|--------------|
|  | 11479       | MR.    | DARRYL    | WU        | Sunday, April 22, 1973       | M             | M      | darryl6@adventure-works.com    | 40000        |
|  | 11483       | MR.    | CALVIN    | CHANDE    | Monday, May 22, 1972         | M             | M      | calvin13@adventure-works.com   | 40000        |
|  | 11584       | MR.    | DEVIN     | CARTER    | Monday, November 22, 1965    | M             | M      | devin33@adventure-works.com    | 40000        |
|  | 11586       | MR.    | ALBERTO   | ROMERO    | Wednesday, December 15, 1965 | M             | M      | alberto10@adventure-works.com  | 40000        |
|  | 11596       | MR.    | ROGER     | RAJE      | Tuesday, September 3, 1963   | M             | M      | roger41@adventure-works.com    | 40000        |
|  | 11615       | MR.    | DWAYNE    | NAVARRO   | Friday, November 21, 1975    | M             | M      | dwayne9@adventure-works.com    | 40000        |
|  | 11633       | MR.    | THOMAS    | ANDERSON  | Friday, May 26, 1972         | M             | M      | thomas71@adventure-works.com   | 40000        |
|  | 11785       | MR.    | THEODORE  | DIAZ      | Friday, February 25, 1972    | M             | M      | theodore3@adventure-works.com  | 40000        |
|  | 11793       | MR.    | XAVIER    | ROGERS    | Thursday, March 20, 1969     | M             | M      | xavier87@adventure-works.com   | 40000        |
|  | 12381       | MR.    | JOHNNY    | LAL       | Sunday, February 17, 1974    | M             | M      | johnny9@adventure-works.com    | 40000        |
|  | 12498       | MR.    | EDUARDO   | DIAZ      | Saturday, April 20, 1963     | M             | M      | eduardo65@adventure-works.com  | 40000        |
|  | 12504       | MR.    | ARTHUR    | GUTIERREZ | Wednesday, February 20, 1963 | M             | M      | arthur35@adventure-works.com   | 40000        |
|  | 12505       | MR.    | DALTON    | MARTIN    | Sunday, February 3, 1963     | M             | M      | dalton13@adventure-works.com   | 40000        |
|  | 12506       | MR.    | PRESTON   | SANCHEZ   | Tuesday, July 2, 1963        | M             | M      | preston18@adventure-works.com  | 40000        |
|  | 12509       | MR.    | MARC      | FERRIER   | Monday, February 19, 1962    | M             | M      | marc12@adventure-works.com     | 40000        |
|  | 12510       | MR.    | ROBERTO   | SANZ      | Tuesday, November 20, 1962   | M             | M      | roberto10@adventure-works.com  | 40000        |
|  | 12739       | MR.    | EVAN      | YOUNG     | Wednesday, December 12, 1973 | M             | M      | evan43@adventure-works.com     | 40000        |
|  | 12844       | MR.    | GERALD    | GONZALEZ  | Sunday, March 28, 1965       | M             | M      | gerald4@adventure-works.com    | 40000        |
|  | 12854       | MR.    | REGINALD  | ROMERO    | Thursday, May 22, 1962       | M             | M      | reginald16@adventure-works.com | 40000        |

|  | MaritalStatus | Gender | EmailAddress                  | AnnualIncome | TotalChildren | EducationLevel | Occupation     | HomeOwner | Column |
|--|---------------|--------|-------------------------------|--------------|---------------|----------------|----------------|-----------|--------|
|  | M             | M      | darryl6@adventure-works.com   | 40000        | 1             | Bachelors      | Skilled Manual | Y         |        |
|  | M             | M      | calvin13@adventure-works.com  | 40000        | 1             | Bachelors      | Skilled Manual | Y         |        |
|  | M             | M      | devin33@adventure-works.com   | 40000        | 1             | Bachelors      | Skilled Manual | Y         |        |
|  | M             | M      | alberto10@adventure-works.com | 40000        | 1             | Bachelors      | Skilled Manual | Y         |        |
|  | M             | M      | roger41@adventure-works.com   | 40000        | 1             | Bachelors      | Skilled Manual | Y         |        |
|  | M             | M      | dwayne9@adventure-works.com   | 40000        | 1             | Bachelors      | Skilled Manual | Y         |        |
|  | M             | M      | thomas71@adventure-works.com  | 40000        | 1             | Bachelors      | Skilled Manual | Y         |        |
|  | M             | M      | theodore3@adventure-works.com | 40000        | 1             | Bachelors      | Skilled Manual | Y         |        |
|  | M             | M      | xavier87@adventure-works.com  | 40000        | 1             | Bachelors      | Skilled Manual | Y         |        |
|  | M             | M      | johnny9@adventure-works.com   | 40000        | 1             | Bachelors      | Skilled Manual | Y         |        |
|  | M             | M      | eduardo65@adventure-works.com | 40000        | 1             | Bachelors      | Skilled Manual | Y         |        |
|  | M             | M      | arthur35@adventure-works.com  | 40000        | 1             | Bachelors      | Skilled Manual | Y         |        |
|  | M             | M      | dalton13@adventure-works.com  | 40000        | 1             | Bachelors      | Skilled Manual | Y         |        |
|  | M             | M      | preston18@adventure-works.com | 40000        | 1             | Bachelors      | Skilled Manual | Y         |        |
|  | M             | M      | marc12@adventure-works.com    | 40000        | 1             | Bachelors      | Skilled Manual | Y         |        |
|  | M             | M      | roberto10@adventure-works.com | 40000        | 1             | Bachelors      | Skilled Manual | Y         |        |
|  | M             | M      | evan43@adventure-works.com    | 40000        | 1             | Bachelors      | Skilled Manual | Y         |        |

|  | Gender | EmailAddress                  | AnnualIncome | TotalChildren | EducationLevel | Occupation     | HomeOwner | FULL_NAME            |
|--|--------|-------------------------------|--------------|---------------|----------------|----------------|-----------|----------------------|
|  | M      | darryl6@adventure-works.com   | 40000        | 1             | Bachelors      | Skilled Manual | Y         | MR. DARRYL WU        |
|  | M      | calvin13@adventure-works.com  | 40000        | 1             | Bachelors      | Skilled Manual | Y         | MR. CALVIN CHANDE    |
|  | M      | devin33@adventure-works.com   | 40000        | 1             | Bachelors      | Skilled Manual | Y         | MR. DEVIN CARTER     |
|  | M      | alberto10@adventure-works.com | 40000        | 1             | Bachelors      | Skilled Manual | Y         | MR. ALBERTO ROMERO   |
|  | M      | roger41@adventure-works.com   | 40000        | 1             | Bachelors      | Skilled Manual | Y         | MR. ROGER RAJE       |
|  | M      | dwayne9@adventure-works.com   | 40000        | 1             | Bachelors      | Skilled Manual | Y         | MR. DWAYNE NAVARRO   |
|  | M      | thomas71@adventure-works.com  | 40000        | 1             | Bachelors      | Skilled Manual | Y         | MR. THOMAS ANDERSON  |
|  | M      | theodore3@adventure-works.com | 40000        | 1             | Bachelors      | Skilled Manual | Y         | MR. THEODORE DIAZ    |
|  | M      | xavier87@adventure-works.com  | 40000        | 1             | Bachelors      | Skilled Manual | Y         | MR. XAVIER ROGERS    |
|  | M      | johnny9@adventure-works.com   | 40000        | 1             | Bachelors      | Skilled Manual | Y         | MR. JOHNNY LAL       |
|  | M      | eduardo65@adventure-works.com | 40000        | 1             | Bachelors      | Skilled Manual | Y         | MR. EDUARDO DIAZ     |
|  | M      | arthur35@adventure-works.com  | 40000        | 1             | Bachelors      | Skilled Manual | Y         | MR. ARTHUR GUTIERREZ |
|  | M      | dalton13@adventure-works.com  | 40000        | 1             | Bachelors      | Skilled Manual | Y         | MR. DALTON MARTIN    |
|  | M      | preston18@adventure-works.com | 40000        | 1             | Bachelors      | Skilled Manual | Y         | MR. PRESTON SANCHEZ  |

## B) Logical Functions

Use **Logical DAX Functions** for analysis:

### 1. Discount Category: Create a calculated column to categorize discounts

The screenshot shows the Power BI Desktop interface with the 'Column tools' tab selected. A new column is being defined with the name 'DiscountCategory'. The formula entered is:

```
1 DiscountCategory = IF(Orders[discount_amt]> 10, "High Discount",  
2 IF(Orders[discount_amt] > 7, "Medium Discount", "Low Discount"))  
3
```

The Data pane on the right shows the structure of the 'Orders' table, including columns like Region, SalesTerritoryKey, Category, City, Country/Region, Customer ID, Customer Name, customer\_type, Order Date, Order ID, Postal Code, Product ID, and Product Name.

### 2. High-Value Customers:

The screenshot shows the Power BI Desktop interface with the 'Column tools' tab selected. A new column is being defined with the name 'High\_Value\_Customer'. The formula entered is:

```
1 High_Value_Customer = IF(Orders[Sales]>100,"H","L")
```

The Data pane on the right shows the structure of the 'Orders' table, including columns like Region, SalesTerritoryKey, Category, City, Country/Region, Customer ID, Customer Name, customer\_type, Order Date, Order ID, Postal Code, Product ID, and Product Name.

## C) Time & Intelligence Functions Use Time Intelligence DAX Functions to analyze sales trends:

### 1. Calculate Total Sales Last Year:

1 TotalSalesLastYear = CALCULATE(SUM(Orders[Sales]), SAMEPERIODLASTYEAR(Orders[Sales]))

| Row ID | Order ID       | Order Date                 | Ship Date                    | Ship Mode      | Customer ID | Customer Name    | Segment   | Country/Region | Data                         |
|--------|----------------|----------------------------|------------------------------|----------------|-------------|------------------|-----------|----------------|------------------------------|
| 43     | CA-2020-101343 | Friday, July 17, 2020      | Wednesday, July 22, 2020     | Standard Class | RA-19885    | Ruben Ausman     | Corporate | United States  | Product Name                 |
| 514    | CA-2021-163405 | Tuesday, December 21, 2021 | Saturday, December 25, 2021  | Standard Class | BN-11515    | Bradley Nguyen   | Consumer  | United States  | Σ Profit                     |
| 515    | CA-2021-163405 | Tuesday, December 21, 2021 | Saturday, December 25, 2021  | Standard Class | BN-11515    | Bradley Nguyen   | Consumer  | United States  | Region                       |
| 1606   | US-2020-115819 | Sunday, April 19, 2020     | Friday, April 24, 2020       | Second Class   | JO-15280    | Jas O'Carroll    | Consumer  | United States  | Σ Row ID                     |
| 1607   | US-2020-115819 | Sunday, April 19, 2020     | Friday, April 24, 2020       | Second Class   | JO-15280    | Jas O'Carroll    | Consumer  | United States  | Σ Sales                      |
| 1609   | US-2020-115819 | Sunday, April 19, 2020     | Friday, April 24, 2020       | Second Class   | JO-15280    | Jas O'Carroll    | Consumer  | United States  | Segment                      |
| 1807   | US-2020-116729 | Friday, December 25, 2020  | Monday, December 28, 2020    | First Class    | GK-14620    | Grace Kelly      | Corporate | United States  | > Ship Date                  |
| 2060   | CA-2018-106439 | Mondays, October 31, 2022  | Friday, November 4, 2022     | Standard Class | GG-14650    | Greg Guthrie     | Corporate | United States  | Ship Mode                    |
| 2061   | CA-2018-106439 | Mondays, October 31, 2022  | Friday, November 4, 2022     | Standard Class | GG-14650    | Greg Guthrie     | Corporate | United States  | State                        |
| 2063   | CA-2018-106439 | Mondays, October 31, 2022  | Friday, November 4, 2022     | Standard Class | GG-14650    | Greg Guthrie     | Corporate | United States  | Sub-Category                 |
| 2065   | CA-2018-106439 | Mondays, October 31, 2022  | Friday, November 4, 2022     | Standard Class | GG-14650    | Greg Guthrie     | Corporate | United States  | TotalProfit                  |
| 2068   | CA-2018-106439 | Mondays, October 31, 2022  | Friday, November 4, 2022     | Standard Class | GG-14650    | Greg Guthrie     | Corporate | United States  | TotalQuantity                |
| 2191   | CA-2020-118913 | Thursday, June 25, 2020    | Monday, June 29, 2020        | Standard Class | AS-10240    | Alan Shonely     | Consumer  | United States  | TotalSales                   |
| 2492   | CA-2018-113579 | Tuesday, December 13, 2022 | Thursday, December 15, 2022  | Second Class   | KD-16345    | Katherine Ducich | Consumer  | United States  | TotalSalesLastYear           |
| 2944   | CA-2021-126242 | Friday, November 19, 2021  | Wednesday, November 24, 2021 | Standard Class | MC-18100    | Mick Crebagga    | Consumer  | United States  | > Orders1                    |
| 3534   | CA-2018-110849 | Mondays, April 18, 2022    | Saturday, April 23, 2022     | Standard Class | JL-15835    | John Lee         | Consumer  | United States  | > sales_06_FY2020-21         |
| 3535   | CA-2018-110849 | Mondays, April 18, 2022    | Saturday, April 23, 2022     | Standard Class | JL-15835    | John Lee         | Consumer  | United States  | > SYNTHETIC Markdown Dataset |
| 3536   | CA-2018-110849 | Mondays, April 18, 2022    | Saturday, April 23, 2022     | Standard Class | JL-15835    | John Lee         | Consumer  | United States  |                              |
| 3565   | CA-2020-130029 | Friday, July 3, 2020       | Monday, July 6, 2020         | First Class    | GT-14755    | Guy Thornton     | Consumer  | United States  |                              |
| 3566   | CA-2020-130029 | Friday, July 3, 2020       | Monday, July 6, 2020         | First Class    | GT-14755    | Guy Thornton     | Consumer  | United States  |                              |

### 2. Find Year-to-Date (YTD) Sales:

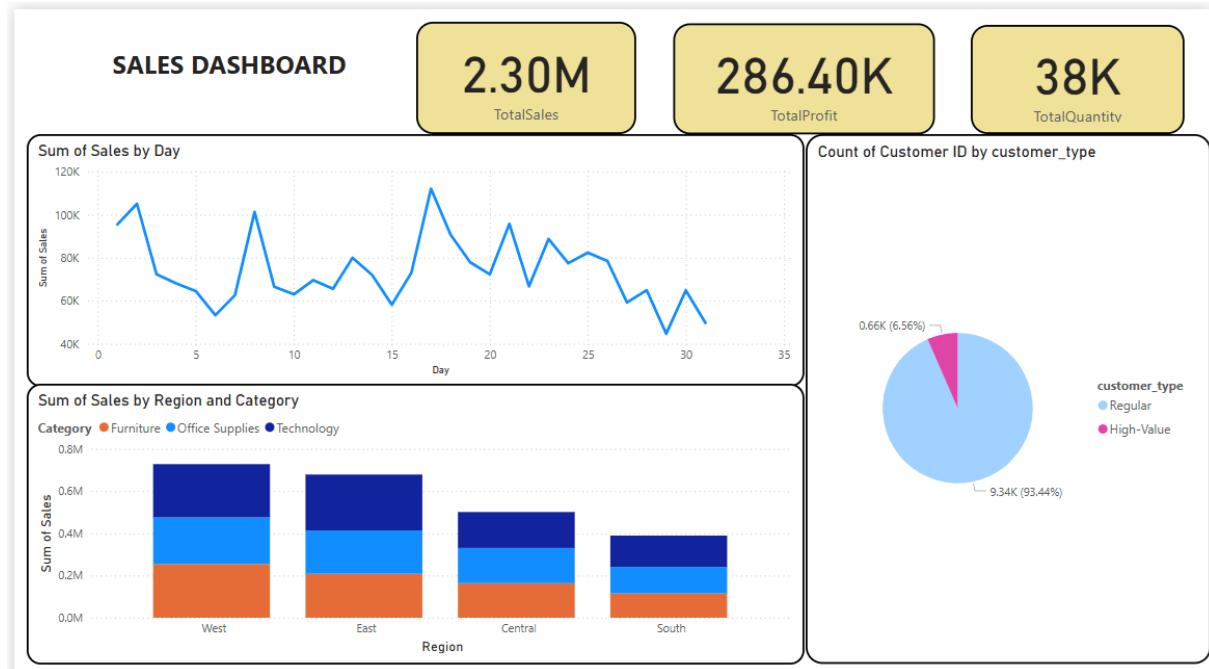
1 YearToDateSales = CALCULATE(SUM(Orders[Sales]), DATESYTD(Orders[Order Date]))

| Row ID | Order ID       | Order Date                 | Ship Date                    | Ship Mode      | Customer ID | Customer Name    | Segment   | Country/Region | Data                         |
|--------|----------------|----------------------------|------------------------------|----------------|-------------|------------------|-----------|----------------|------------------------------|
| 43     | CA-2020-101343 | Friday, July 17, 2020      | Wednesday, July 22, 2020     | Standard Class | RA-19885    | Ruben Ausman     | Corporate | United States  | Product Name                 |
| 514    | CA-2021-163405 | Tuesday, December 21, 2021 | Saturday, December 25, 2021  | Standard Class | BN-11515    | Bradley Nguyen   | Consumer  | United States  | Σ Profit                     |
| 515    | CA-2021-163405 | Tuesday, December 21, 2021 | Saturday, December 25, 2021  | Standard Class | BN-11515    | Bradley Nguyen   | Consumer  | United States  | Region                       |
| 1606   | US-2020-115819 | Sunday, April 19, 2020     | Friday, April 24, 2020       | Second Class   | JO-15280    | Jas O'Carroll    | Consumer  | United States  | Σ Row ID                     |
| 1607   | US-2020-115819 | Sunday, April 19, 2020     | Friday, April 24, 2020       | Second Class   | JO-15280    | Jas O'Carroll    | Consumer  | United States  | Σ Sales                      |
| 1609   | US-2020-115819 | Sunday, April 19, 2020     | Friday, April 24, 2020       | Second Class   | JO-15280    | Jas O'Carroll    | Consumer  | United States  | Segment                      |
| 1807   | US-2020-116729 | Friday, December 25, 2020  | Monday, December 28, 2020    | First Class    | GK-14620    | Grace Kelly      | Corporate | United States  | > Ship Date                  |
| 2060   | CA-2018-106439 | Mondays, October 31, 2022  | Friday, November 4, 2022     | Standard Class | GG-14650    | Greg Guthrie     | Corporate | United States  | Ship Mode                    |
| 2061   | CA-2018-106439 | Mondays, October 31, 2022  | Friday, November 4, 2022     | Standard Class | GG-14650    | Greg Guthrie     | Corporate | United States  | State                        |
| 2063   | CA-2018-106439 | Mondays, October 31, 2022  | Friday, November 4, 2022     | Standard Class | GG-14650    | Greg Guthrie     | Corporate | United States  | Sub-Category                 |
| 2065   | CA-2018-106439 | Mondays, October 31, 2022  | Friday, November 4, 2022     | Standard Class | GG-14650    | Greg Guthrie     | Corporate | United States  | TotalProfit                  |
| 2068   | CA-2018-106439 | Mondays, October 31, 2022  | Friday, November 4, 2022     | Standard Class | GG-14650    | Greg Guthrie     | Corporate | United States  | TotalQuantity                |
| 2191   | CA-2020-118913 | Thursday, June 25, 2020    | Monday, June 29, 2020        | Standard Class | AS-10240    | Alan Shonely     | Consumer  | United States  | TotalSales                   |
| 2492   | CA-2018-113579 | Tuesday, December 13, 2022 | Thursday, December 15, 2022  | Second Class   | KD-16345    | Katherine Ducich | Consumer  | United States  | TotalSalesLastYear           |
| 2944   | CA-2021-126242 | Friday, November 19, 2021  | Wednesday, November 24, 2021 | Standard Class | MC-18100    | Mick Crebagga    | Consumer  | United States  | > Orders1                    |
| 3534   | CA-2018-110849 | Mondays, April 18, 2022    | Saturday, April 23, 2022     | Standard Class | JL-15835    | John Lee         | Consumer  | United States  | > sales_06_FY2020-21         |
| 3535   | CA-2018-110849 | Mondays, April 18, 2022    | Saturday, April 23, 2022     | Standard Class | JL-15835    | John Lee         | Consumer  | United States  | > SYNTHETIC Markdown Dataset |
| 3536   | CA-2018-110849 | Mondays, April 18, 2022    | Saturday, April 23, 2022     | Standard Class | JL-15835    | John Lee         | Consumer  | United States  |                              |
| 3565   | CA-2020-130029 | Friday, July 3, 2020       | Monday, July 6, 2020         | First Class    | GT-14755    | Guy Thornton     | Consumer  | United States  |                              |
| 3566   | CA-2020-130029 | Friday, July 3, 2020       | Monday, July 6, 2020         | First Class    | GT-14755    | Guy Thornton     | Consumer  | United States  |                              |

## Task 4: Data Visualizations Report Creation

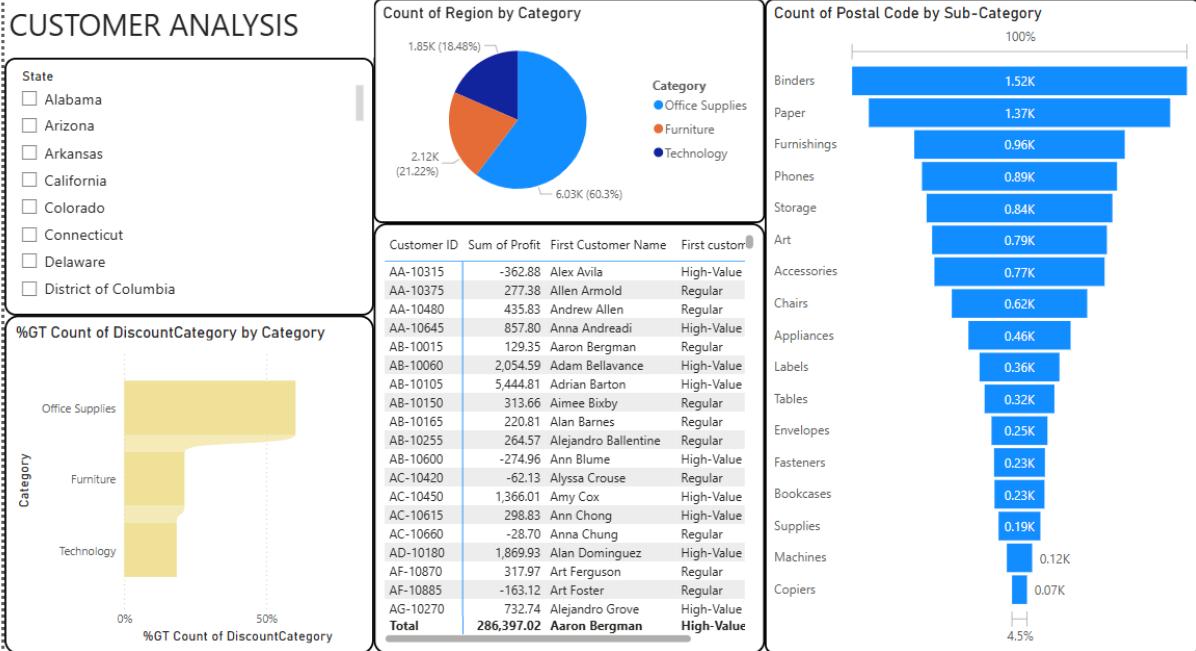
Create a **Sales Dashboard**:

- Total Sales, Profit, and Quantity (Cards)
- Sales Trends over time (Line Chart)
- Sales by Region and Product Category (Bar Chart)
- High-Value vs Regular Customers (Pie Chart)



Create **Customer Analysis Dashboard**:

- Customer-wise sales and profits (Table)
  - Top 10 Customers (Bar Chart)
  - Discount Categories (Stacked Bar Chart)
- Add **Filters** & **Slicers** for dynamic interactivity.



## Task 5: Submission Requirements

- **Power BI Report (.pbix) File**
- **Step-by-step Documentation** (for Power Query, Data Modeling, and DAX Functions)
- **Summary Report** (2-3 pages explaining insights and findings)

The dataset was analyzed to understand customer behavior, sales performance, and operational trends. This process included data cleaning, transformation, modeling, and the creation of interactive dashboards to derive actionable insights.

### Data Cleaning & Transformation

Using Power Query Editor, the following transformations were performed to ensure data accuracy and consistency:

- **Data Cleaning:** Removed duplicates and handled missing values.
- **Data Type Standardization:** Formatted dates, currency, and categorical fields appropriately.
- **Column Splitting and Merging:** Split full names into first and last names, and merged datasets based on primary keys.

These steps ensured a reliable foundation for analysis.

### Data Modeling

A star schema design was implemented for improved performance and structure:

- **Fact Tables** (AdventureWorks Product Lookup) were connected to **Dimension Tables** (AdventureWorks Returns Data, AdventureWorks Sales Data 2021, AdventureWorks Sales Data 2020, AdventureWorks Product Subcategories Lookup, AdventureWorks Sales Data 2022) using primary and foreign keys.
- **Many-to-One Relationships:** Established to enable accurate data filtering and aggregation.

## *DAX Function Implementation*

Custom DAX measures and calculated columns enabled advanced analytics:

- **Text Functions:** Extracted product category initials and created full-name columns.
- **Logical Functions:** Categorized discounts and identified high-value customers.

## *Insights & Recommendations*

### **Sales Performance:**

- **Trend Analysis:** Sales peak during specific months, indicating seasonal demand. Align marketing campaigns with these periods.
- **Regional Insights:** Regions with low sales require targeted strategies, such as localized promotions or improved distribution.

### **Customer Behavior:**

- **High-Value Customers:** Significant revenue contributors. Implement loyalty programs to ensure retention.
- **Discount Efficiency:** Discounts drive sales but may reduce profitability. Develop an optimal discounting strategy.

By leveraging these insights, strategic decisions can be made to enhance sales, customer retention, and operational efficiency.