# Sales Data-Analysis

## Data Verification

- Three distinct data sources—Order (CSV), Shipping (JSON), and Customers (Excel)—have been provided for analysis.
- Data normalization and verification were conducted using Python to ensure consistency across formats thus enabling streamlined and accurate analytical processing.
- Below Python commands were utilized to structure and prepare it for further business intelligence activities.

```
>>> import pandas as pd
>>> cust = pd.read_excel("C:/Users/anm/Downloads/Customer.xls",engine='xlrd')
>>> cust.to_csv("C:/Users/anm/Downloads/Customer.csv", index=False)
>>> order=pd.read_csv("C:/Users/anm/Downloads/Order.csv")
>>> Shipping=pd.read_json("C:/Users/anm/Downloads/Shipping.json")
>>> Shipping.to_csv("C:/Users/anm/Downloads/Shipping.csv")
>>>
```

- Next, we check for Missing Values in all 3 data sources

```
print(order.isnull().sum())
Order_ID        0
Item            0
Amount          0
Customer_ID     0
dtype: int64
print(Shipping.isnull().sum())
Shipping_ID     0
Status          0
Customer_ID     0
dtype: int64
'
print(cust.isnull().sum())
Customer_ID     0
First           0
Last            0
Age             0
Country         0
dtype: int64
'
```

- Duplicate records were proactively identified and removed, where present, to eliminate data redundancy and enhance the overall quality

```
print("Orders:", order.duplicated().sum())
Orders: 0
print("Shipping", Shipping.duplicated().sum())
Shipping 0
print("Customers:", cust.duplicated().sum())
Customers: 0
```

- Data types for each column are verified

```
print("Orders data types:\n", order.dtypes)

Orders data types:
 Order_ID        int64
Item            object
Amount           int64
Customer_ID      int64
dtype: object
print("Customers data types:\n", cust.dtypes)

Customers data types:
 Customer_ID     int64
First           object
Last            object
Age              int64
Country         object
dtype: object
print("Shipping data types:\n", Shipping.dtypes)

Shipping data types:
 Shipping_ID     int64
Status          object
Customer_ID      int64
dtype: object
```

- Each data source should have a Primary Key column which is Non-Null and Unique, next step is to ensure this constraint is met in all 3 data sources. We compare the number of Unique and non-null values with the complete row count in each.

```
print("Unique Values in Orders:\n",order.nunique().sort_values(ascending=False))

Unique Values in Orders:
 Order_ID       250
Customer_ID     160
Amount            9
Item              8
dtype: int64
print("Orders Total Row Count:", len(order))

Orders Total Row Count: 250
print("Unique Values in Shipping:\n",Shipping.nunique().sort_values(ascending=False))

Unique Values in Shipping:
 Shipping_ID    250
Customer_ID     154
Status            2
dtype: int64
print("Shipping Total Row Count:", len(Shipping))

Shipping Total Row Count: 250
print("Unique Values in Customers:\n",cust.nunique().sort_values(ascending=False))

Unique Values in Customers:
 Customer_ID    250
Last            189
First           171
Age              62
Country           3
dtype: int64
print("Customers Total Row Count:", len(cust))

Customers Total Row Count: 250
```

- Hence, by observation **Order_ID** from Orders, **Shipping_ID** from Shipping and **Customer_ID** from Customers data can be used as **Primary Keys**.
- Next, we check the referential Integrity Constraint, to ensure there is no Customer ID in Orders whose details are not present in Customers data and similarly in Shipping data

```
print("Invalid Customers:",Shipping[~Shipping['Customer_ID'].isin(cust['Customer_ID'])])

Invalid Customers: Empty DataFrame
Columns: [Shipping_ID, Status, Customer_ID]
Index: []
print("Invalid Customers:",order[~order['Customer_ID'].isin(cust['Customer_ID'])])

Invalid Customers: Empty DataFrame
Columns: [Order_ID, Item, Amount, Customer_ID]
Index: []
```

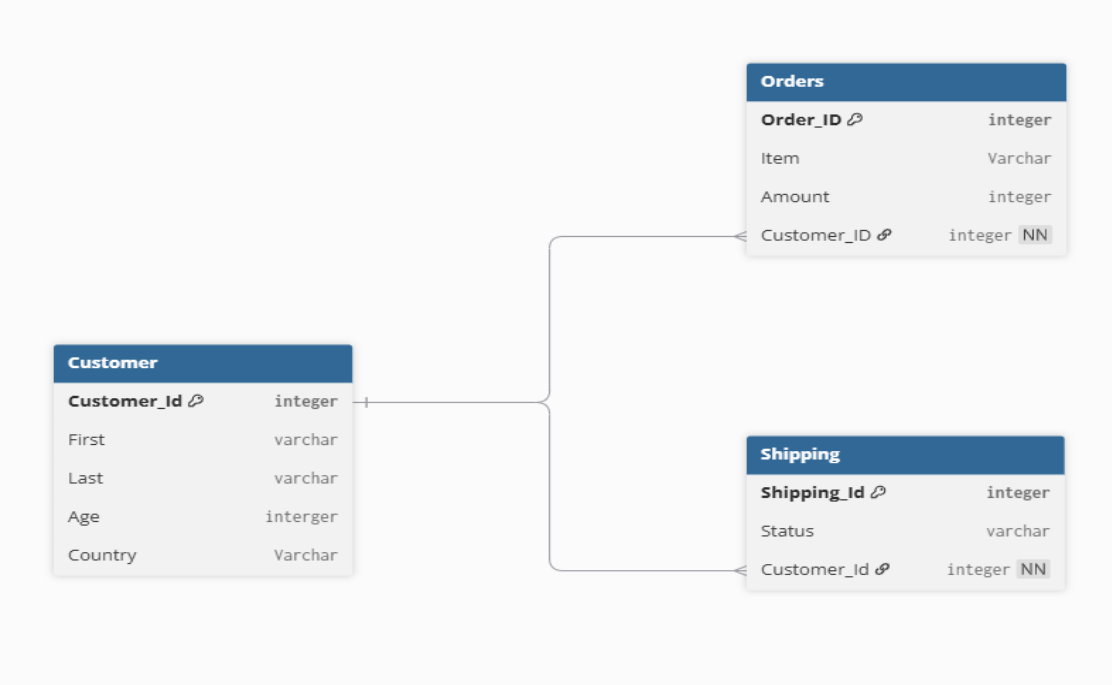
- Above output indicates that Customers table has information about all customers who have placed an order or whose order has been shipped
- Upon validation, it was observed that certain customers listed in the Orders dataset do not have corresponding Shipping details, and vice versa, indicating incomplete data linkage across sources.

```
print("Invalid Customers:",Shipping[~Shipping['Customer_ID'].isin(order['Customer_ID'])])

Invalid Customers:      Shipping_ID     Status  Customer_ID
0               1    Pending          173
1               2    Pending          155
4               5  Delivered           72
8               9    Pending          199
12             13  Delivered          141
..            ...        ...          ...
238           239    Pending          173
240           241    Pending           22
243           244    Pending           21
244           245  Delivered          199
249           250  Delivered           27

[98 rows x 3 columns]
print("Invalid Customers:",order[~order['Customer_ID'].isin(Shipping['Customer_ID'])])

Invalid Customers:      Order_ID      Item  Amount  Customer_ID
0            1  Keyboard     400          139
1            2     Mouse     300          250
2            3   Monitor   12000          239
3            4  Keyboard     400          153
4            5  Mousepad     250          153
..         ...       ...     ...          ...
230        231  Keyboard     400          162
232        233   Monitor   12000          206
237        238  Mousepad     200          200
242        243   Monitor   12000          123
248        249   DDR RAM    1500          176

[94 rows x 4 columns]
```

Conclusions: The 3 datasets have non-null values with no duplicates and **Order_ID** from Orders, **Shipping_ID** from Shipping and **Customer_ID** from Customers data can be used as **Primary Keys**. With **Customer_ID** being the foreign key in Orders and Shipping data. The datatype of each column is known and also we noticed that Orders and Shipping data cannot be a complete join.

## ER Diagram

The below represents an Entity-Relation Diagram which serves as a reference for the Data Engineer to build the tables.




Customers:

- The Customer_ID is the primary key.
- A customer can have multiple orders and shipping records, but each record in Orders and Shipping refers to exactly one customer (1:N relationship).

Orders:

- The Order_ID is the primary key.
- Each order is associated with a Customer_ID (foreign key from Customers).
- A customer can place multiple orders, but an order is associated with exactly one customer.

Shipping:

- The Shipping_ID is the primary key.
- Each shipping record is associated with a Customer_ID (foreign key from Customers).
- A customer can have multiple shipping records, but a shipping record is associated with exactly one customer.

- As depicted in the diagram, the Customer_ID fields in both the Orders and Shipping dataset's function acts as foreign key columns referencing the Customers dataset. These fields are expected to be non-null, to maintain referential integrity.
- Additionally, Quality Assurance Engineers should ensure that these columns adhere to the defined data types during testing to uphold data consistency and schema compliance.

Part-2

## Business Reporting Queries

To execute the Queries 3 tables : CUSTOMERS_TEST, ORDERS_TEST, SHIPPING_TEST is created as below using SQL

```
CREATE OR REPLACE TABLE EXA_DM.CUSTOMERS_TEST (
CUSTOMER_ID VARCHAR(30) PRIMARY KEY ,
FIRST_NAME VARCHAR(30),
LAST_NAME VARCHAR(30),
AGE INTEGER,
COUNTRY VARCHAR(100)
);

IMPORT INTO EXA_DM.CUSTOMERS_TEST
FROM LOCAL CSV FILE 'C:/Users/anm/Downloads/Customer.csv' skip=1;

CREATE OR REPLACE TABLE EXA_DM.ORDERS_TEST (
ORDER_ID INTEGER PRIMARY KEY ,
ITEM VARCHAR(30),
AMOUNT INTEGER,
CUSTOMER_ID INTEGER);


IMPORT INTO EXA_DM.ORDERS_TEST
FROM LOCAL CSV FILE 'C:/Users/anm/Downloads/Order.csv' skip=1;

CREATE OR REPLACE TABLE EXA_DM.SHIPPING_TEST (
SHIPPING_ID INTEGER PRIMARY KEY ,
STATUS VARCHAR(30),
CUSTOMER_ID INTEGER);

IMPORT INTO EXA_DM.SHIPPING_TEST
FROM LOCAL CSV FILE 'C:/Users/anm/Downloads/Shipping.csv'
SKIP= 1;
```

1. *The total amount spent and the country for the Pending delivery status for each country.*

```
SELECT DISTINCT COUNTRY,SUM(AMOUNT)  FROM EXA_DM.CUSTOMERS_TEST C JOIN EXA_DM.ORDERS_TEST O ON
C.CUSTOMER_ID=O.CUSTOMER_ID   JOIN EXA_DM.SHIPPING_TEST S  ON C. CUSTOMER_ID=S.CUSTOMER_ID WHERE S.STATUS='Pending' GROUP BY 1;
```

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T DISTINCT COUNTRY,SUM(AMOUNT) FROM EXA_DM.CUSTOMERS... | Enter a SQL expression to filter results (use Ctrl+Space)

| A-Z COUNTRY | 123 SUM(O.AMOUNT) |
|---|---|
| UK | 136,300 |
| USA | 65,500 |
| UAE | 53,800 |

2. *the total number of transactions, total quantity sold, and total amount spent for each customer, along with the product details.*

```
SELECT DISTINCT FIRST_NAME,LAST_NAME ,ITEM ,COUNT(DISTINCT ORDER_ID) AS TRANSACTIONS, COUNT(DISTINCT SHIPPING_ID) AS QUANTITY,SUM(AMOUNT) AS AMOUNT
FROM EXA_DM.CUSTOMERS_TEST C JOIN EXA_DM.ORDERS_TEST O ON C.CUSTOMER_ID=O.CUSTOMER_ID   JOIN EXA_DM.SHIPPING_TEST S  ON C. CUSTOMER_ID=S.CUSTOMER_ID
GROUP BY 1,2,3 ORDER BY 3 DESC;
```

sults 1

Enter a SQL expression to filter results (use Ctrl+Space)

| FIRST_NAME | LAST_NAME | ITEM | TRANSACTIONS | QUANTITY | AMOUNT |
|---|---|---|---|---|---|
| Mark | R0berts | Monitor | 1 | 3 | 36,000 |
| R0bert | Shepherd | Monitor | 1 | 2 | 24,000 |
| Stacey | Welch | Monitor | 1 | 2 | 24,000 |
| Zachary | Williams | Monitor | 1 | 2 | 24,000 |
| Yesenia | White | Monitor | 1 | 2 | 24,000 |
| Amber | Banks | Monitor | 1 | 2 | 24,000 |
| Michael | Mann | Harddisk | 1 | 3 | 15,000 |
| Michele | Maxwell | Harddisk | 1 | 3 | 15,000 |
| Omar | Martin | Monitor | 1 | 1 | 12,000 |
| Erin | Taylor | Monitor | 1 | 1 | 12,000 |
| Steve | Braun | Monitor | 1 | 1 | 12,000 |
| Margaret | Hardy | Monitor | 1 | 1 | 12,000 |
| Miranda | Williams | Monitor | 1 | 1 | 12,000 |
| Philip | Newton | Monitor | 1 | 1 | 12,000 |
| Javier | Jones | Monitor | 1 | 1 | 12,000 |
| Christy | Rodriguez | Monitor | 1 | 1 | 12,000 |
| Regina | Wong | Monitor | 1 | 1 | 12,000 |
| Jodi | Gonzalez | Harddisk | 1 | 2 | 10,000 |
| Carolyn | Green | Harddisk | 1 | 2 | 10,000 |
| Amber | Banks | Harddisk | 1 | 2 | 10,000 |
| Michael | Williams | Harddisk | 1 | 2 | 10,000 |
| Michelle | Edwards | Harddisk | 1 | 1 | 5,000 |
| Adrian | West | Harddisk | 1 | 1 | 5,000 |
| Jose | Poole | Harddisk | 1 | 1 | 5,000 |
| Jessica | Welch | Harddisk | 1 | 1 | 5,000 |
| Xavier | Miles | Harddisk | 1 | 1 | 5,000 |
| Robin | Snyder | Harddisk | 1 | 1 | 5,000 |
| Taylor | Reed | Harddisk | 1 | 1 | 5,000 |
| Sandra | Mcmahon | Harddisk | 1 | 1 | 5,000 |
| Andrea | Velasquez | Harddisk | 1 | 1 | 5,000 |
| Jonathan | Middleton | DDR RAM | 1 | 3 | 4,500 |

3. *the maximum product purchased for each country.*

```
SELECT
    COUNTRY,ITEM,PURCAHSES
FROM
    (
    SELECT
        DISTINCT COUNTRY,
        ITEM ,
        COUNT(DISTINCT ORDER_ID) AS PURCAHSES,
        MAX(COUNT(DISTINCT ORDER_ID))OVER(PARTITION BY COUNTRY) AS MAX_PURCHASE
    FROM
        EXA_DM.CUSTOMERS_TEST C
    JOIN EXA_DM.ORDERS_TEST O ON
        C.CUSTOMER_ID = O.CUSTOMER_ID
    JOIN EXA_DM.SHIPPING_TEST S ON
        C. CUSTOMER_ID = S.CUSTOMER_ID
    GROUP BY
        1 ,
        2 )
WHERE PURCAHSES=MAX_PURCHASE
;
```

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COUNTRY,ITEM,PURCAHSES FROM ( SELECT DISTINCT COUNTRY, Enter a SQL expression to filter results (use

| COUNTRY | ITEM | PURCAHSES |
|---|---|---|
| UK | Keyboard | 13 |
| USA | Mousepad | 10 |
| UAE | Keyboard | 11 |
| UK | Mousepad | 13 |

4. *the most purchased product based on the age category less than 30 and above 30.*

```sql
SELECT
    ITEM,AGE_CATEGORY,PURCAHSES
FROM
    (
    SELECT
        DISTINCT ITEM ,
        CASE WHEN AGE<=30 THEN 'LESS THAN 30'
        WHEN AGE>=30 THEN'GREATER THAN 30' END AS AGE_CATEGORY,
        COUNT(DISTINCT ORDER_ID) AS PURCAHSES,
        MAX(COUNT(DISTINCT ORDER_ID))OVER(PARTITION BY ITEM,CASE WHEN AGE<=30 THEN 'LESS THAN 30'
        WHEN AGE>=30 THEN'GREATER THAN 30' END) AS MAX_PURCHASE
    FROM
        EXA_DM.CUSTOMERS_TEST C
    JOIN EXA_DM.ORDERS_TEST O ON
        C.CUSTOMER_ID = O.CUSTOMER_ID
    JOIN EXA_DM.SHIPPING_TEST S ON
        C. CUSTOMER_ID = S.CUSTOMER_ID
    GROUP BY
        1 ,2)
WHERE PURCAHSES=MAX_PURCHASE
;
```

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T ITEM,AGE_CATEGORY,PURCAHSES FROM ( SELECT DISTINCT ITEM | Enter a SQL expression to filter results (use Ctrl+Space)

| A-Z ITEM | A-Z AGE_CATEGORY | 123 PURCAHSES |
|---|---|---|
| Webcam | GREATER THAN 30 | 13 |
| Mousepad | GREATER THAN 30 | 20 |
| Headset | LESS THAN 30 | 5 |
| Harddisk | LESS THAN 30 | 2 |
| Headset | GREATER THAN 30 | 12 |
| Monitor | GREATER THAN 30 | 9 |
| Webcam | LESS THAN 30 | 4 |
| Mouse | GREATER THAN 30 | 10 |
| Mouse | LESS THAN 30 | 5 |
| DDR RAM | LESS THAN 30 | 5 |
| DDR RAM | GREATER THAN 30 | 12 |
| Keyboard | LESS THAN 30 | 14 |
| Mousepad | LESS THAN 30 | 9 |
| Keyboard | GREATER THAN 30 | 17 |
| Monitor | LESS THAN 30 | 6 |
| Harddisk | GREATER THAN 30 | 13 |

5. *the country that had minimum transactions and sales amount.*

```sql
SELECT
    COUNTRY,PURCAHSES,AMT
FROM
    (
    SELECT ROW_NUMBER()OVER (ORDER BY sUM(AMOUNT)  ) AS RN,
         COUNTRY ,
        COUNT(DISTINCT ORDER_ID) AS PURCAHSES,
        MIN(COUNT(DISTINCT ORDER_ID))OVER(PARTITION BY COUNTRY) AS MIN_PURCHASE,
        sUM(AMOUNT) AS AMT
    FROM
        EXA_DM.CUSTOMERS_TEST C
    JOIN EXA_DM.ORDERS_TEST O ON
        C.CUSTOMER_ID = O.CUSTOMER_ID
    JOIN EXA_DM.SHIPPING_TEST S ON
        C. CUSTOMER_ID = S.CUSTOMER_ID
    GROUP BY
        2
        ORDER BY AMT ASC)
WHERE PURCAHSES=MIN_PURCHASE AND RN=1
;
```

1 ×

COUNTRY,PURCAHSES,AMT FROM ( SELECT ROW_NUMBER()OVEF | Enter a SQL expression to filter results (use

| A-Z COUNTRY | 123 PURCAHSES | 123 AMT |
|---|---|---|
| UAE | 30 | 67,400 |