Anomaly Detection in Credit Card Transactions using Power BI

Objective:

- Develop a Power BI dashboard to analyze credit card transactions, detect anomalies, and visualize transaction patterns.

Data Sources:

1. Dataset:

- Source: Newton School Platform
- Features: step, type, amount, nameOrig, oldbalanceOrg, newbalanceOrig, nameDest, oldbalanceDest, newbalanceDest, isFraud

Data Preprocessing:

1. Data Cleaning:

- Handled missing values, duplicates, and ensured data integrity.

2. Data Transformation:

- Transformed the dataset into a format suitable for Power BI, addressing proper data types and structure.

Power BI Dashboard:

1. Overview Section:

- Transaction statistics, total transactions, average transaction amount, and frequency.

2. DAX Functions:

- Calculated average transaction amount for normal and fraudulent transactions.
- Counted total credit card transactions and fraudulent transactions.
- Determined the highest fraud transaction amount.
- Compared maximum transaction amounts for normal and fraudulent transactions.
- Calculated the percentage of fraudulent transactions.
- Created a clustered column chart for the distribution of transaction amounts.

DAX Formulas Explanation:

DAX Function 1: Average Transaction Amount for Normal vs. Fraudulent Transactions

```
Average Amount Normal = CALCULATE(AVERAGE('YourTableName'[amount]), 'YourTableName'[isFraud] = 0)

Average Amount Fraudulent = CALCULATE(AVERAGE('YourTableName'[amount]), 'YourTableName'[isFraud] = 1)
```

DAX Function 2: Count of Total and Fraudulent Transactions

```
Total Transactions = COUNTROWS('YourTableName')

Fraudulent Transactions = CALCULATE(COUNTROWS('YourTableName'), 'YourTableName'[isFraud] = 1)
```

DAX Function 3: Highest Fraud Transaction Amount

```
Highest Fraud Amount = MAXX(FILTER('YourTableName', 'YourTableName'[isFraud] = 1), 'YourTableName'[amount])
```

DAX Function 4: Maximum Transaction Amounts for Normal vs. Fraudulent Transactions

```
Max Amount Normal = MAX('YourTableName'[amount])

Max Amount Fraudulent = MAXX(FILTER('YourTableName', 'YourTableName'[isFraud] = 1), 'YourTableName'[amount])
```

DAX Function 5: Percentage of Fraudulent Transactions

```
Percentage Fraudulent Transactions = DIVIDE([Fraudulent Transactions], [Total Transactions])
```

DAX Function 6: Distribution of Transaction Amounts (Clustered Column Chart)

```
Transaction Amount Bins = ROUNDUP('YourTableName'[amount]/100, 0)*100

Transaction Amount Distribution = COUNTROWS(FILTER(ALL('YourTableName'), 'YourTableName'[Transaction Amount Bins] = EARLIER('YourTableName'[Transaction Amount Bins])))
```

These DAX formulas provide calculations for the specified questions in the Power BI dashboard, enabling the generation of insightful visualizations and metrics. Adjust the table and column names in the formulas based on your actual dataset structure.

3. Anomaly Visualization:

- Implemented visualizations (line charts, scatter plots, heat maps) to highlight potential anomalies and outliers in credit card transactions.

Key Insights:

Merchant Transactions:

- Identified top 10 merchants with the highest number of transactions in which two transactions are the highest for all top 10 merchants.

Scatter Plot (oldbalanceOrg vs. amount):

- Explored the relationship between original balance and transaction amount.

Line Chart (Transaction Amount Over Time):

- Investigated unusual spikes or drops in transaction amounts over time.

Fraudulent Merchants:

- Explored merchants with a high occurrence of fraudulent transactions in which there were no merchants found.

Deployment:

1. Power BI Deployment:

- Deployed the Power BI dashboard on GitHub.

2. Access Control:

- Implemented user authentication for secure access.

Documentation:

1. Project Details:

- Defined project objectives, scope, and stakeholders.

2. Data Dictionary:

- Described data features and their meanings.

3. Code Documentation:

- Documented data preprocessing steps, DAX functions, and visualization logic.

4. Deployment Instructions:

- Provided a step-by-step guide for accessing and using the Power BI dashboard.

5. Future Recommendations:

- Suggested potential improvements and future iterations.

Conclusion:

This documentation serves as a comprehensive guide to the credit card transaction analysis project, covering data preprocessing, Power BI dashboard creation, DAX functions, anomaly visualizations, and deployment details. It provides valuable insights into the transaction patterns, potential anomalies, and merchant behaviors for stakeholders and future development.