NoSQL Database

HEALTHCARE DATASET

GROUP 5

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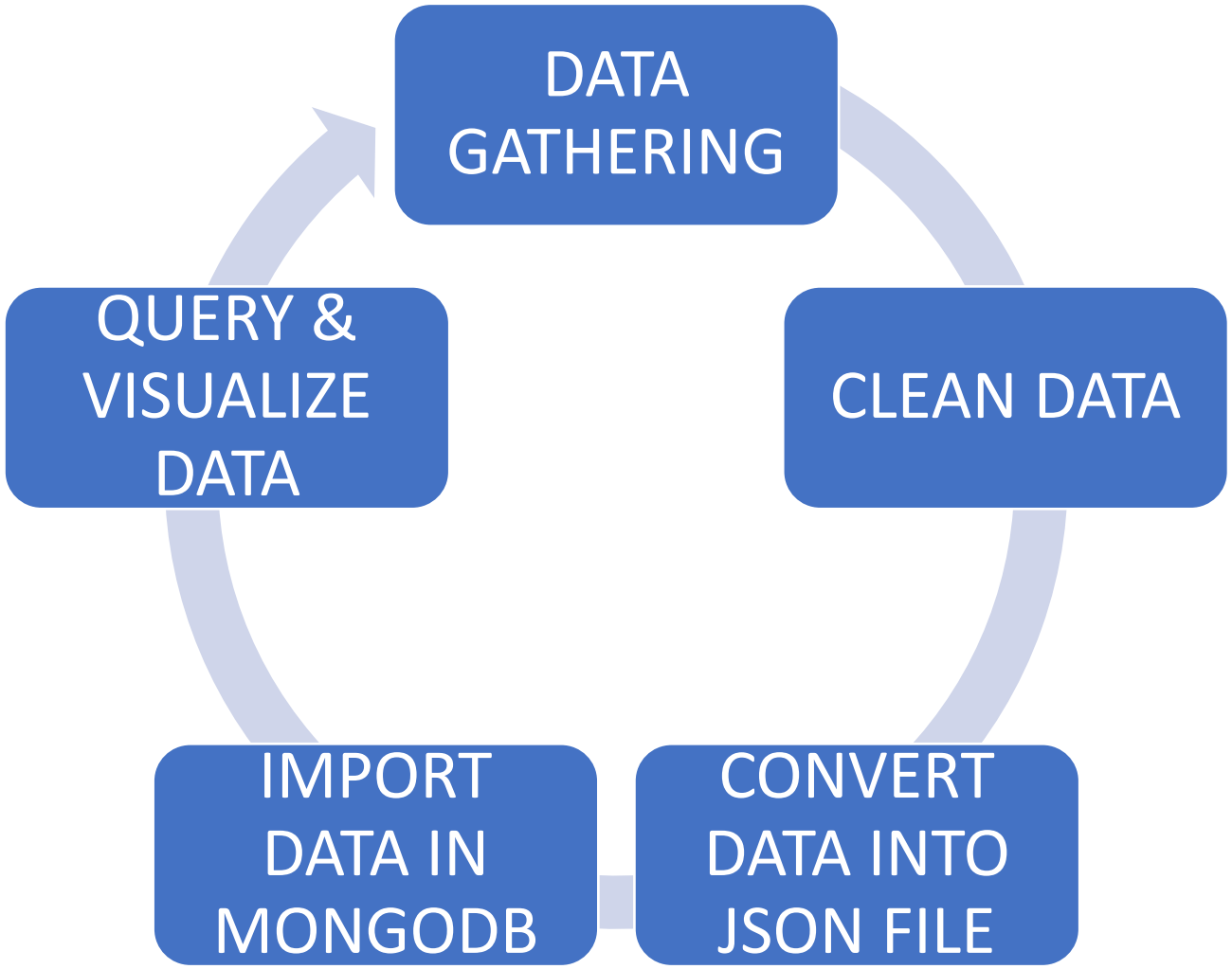
ROLE SPECIFICATION

- JANVI – Data Acquisition, Cleaning Data
- RAMANDEEP SINGH – Conversion of Data , Loading Data into NoSQL DATABASE , Querying Data
- KARMJEET KAUR – Data visualization and predictive analysis
- OBIAKU VALENTINE CHIKE- Queries in pyspark and drawing conclusions.

ANALYSING HEALTHCARE DATASET FROM KAGGLE

Hypothesis: The count of cancer patients has increased over the years as well as cost of treating this medical condition.

Goal : To analyze various aspects of healthcare to induce the cost paid by patients on different ailments.



DATASET OVERVIEW

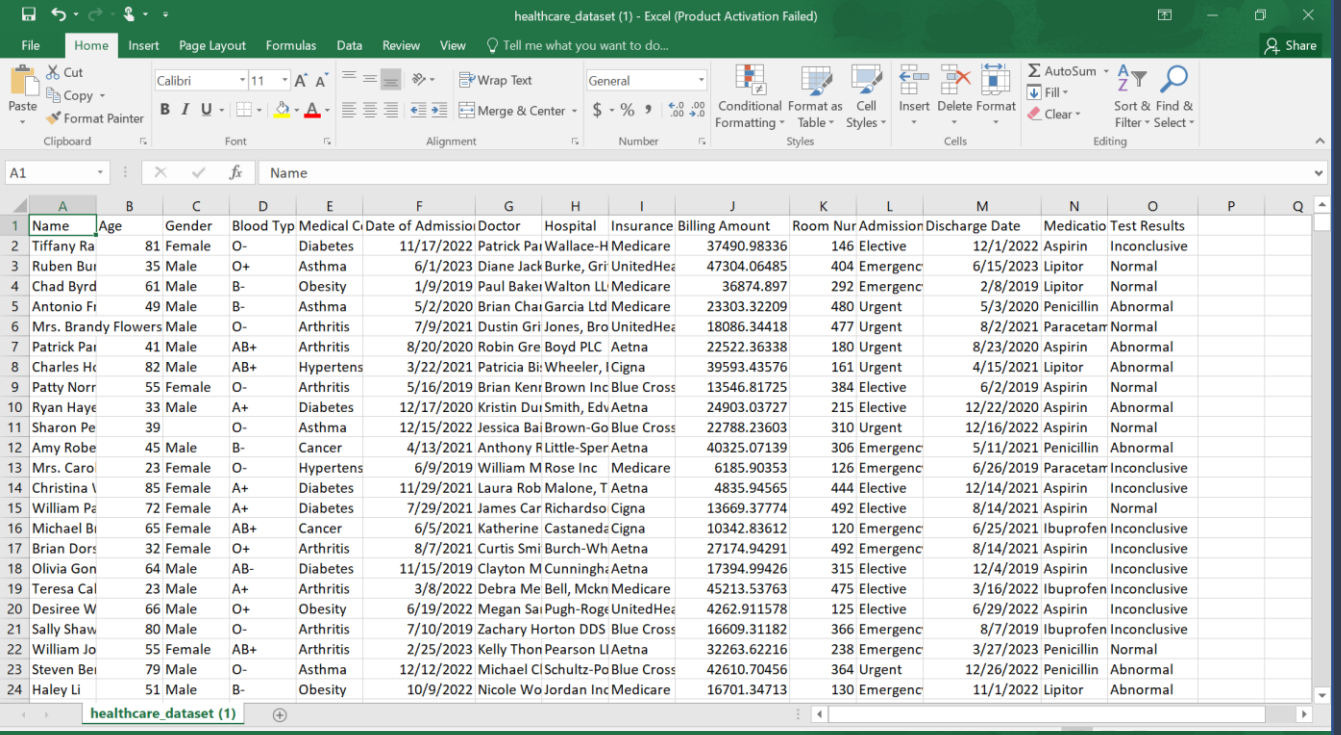
- DATASET IS FROM KAGGLE
- HEALTHCARE DATASET 2023
- DATASET IS IN CSV FILE

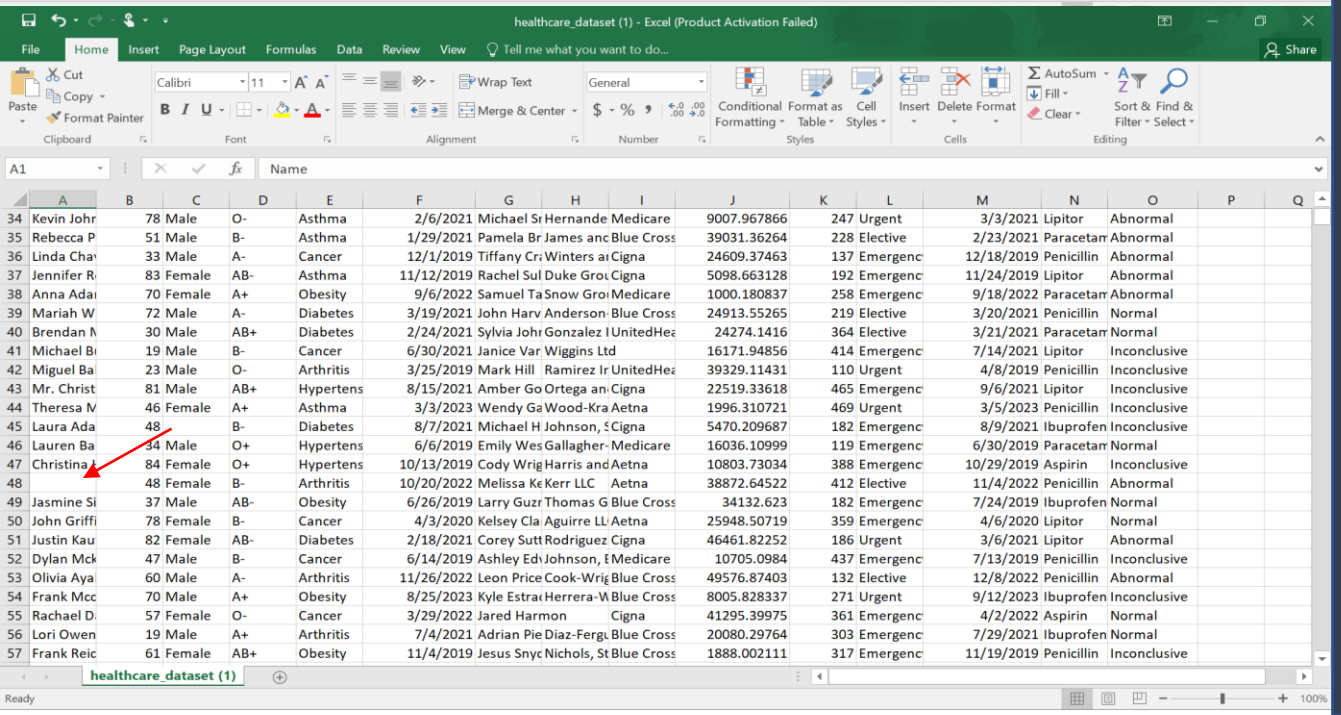
DATASET CONTAINS

- GENDER
- BLOOD TYPE
- BILLING AMOUNT
- ADMISSION
- MEDICATION
- TEST RESULTS etc.

PROJECT TOOLS

- PYTHON
- CLOUD MONGODB
- PYMONGO
- JUPYTER NOTEBOOK
- VISUAL STUDIO CODE
- TABLEAU
- CSV TO JSON CONVERTER
- APACHE SPARK
- MATPLOTLIB
- PANDAS





RAW DATASET FROM KAGGLE

https://www.kaggle.com/datasets/prasad22/healthcare-dataset

- UNCLEANED
- MISSING DATA IN ROWS AND COLUMNS

WHY THERE IS NEED FOR DATA CLEANING

- **Missing Data:**

❑ **Problem:** Missing values can lead to biased or inaccurate analyses.

❑ **Solution:** Options include removing rows with missing values, filling missing values with statistical measures (mean, median, mode), or using sophisticated imputation techniques.

- **Duplicate Data:**

❑ **Problem:** Duplicate entries can skew statistical analyses and lead to incorrect conclusions.

❑ **Solution:** Identify and remove duplicate rows based on certain columns or criteria. Ensure data uniqueness before analysis.

- **Inaccurate Data:**

❑ **Problem:** Errors in data entry or measurement inaccuracies can compromise the quality of analyses.

❑ **Solution:** Review and validate data entries. Utilize external sources or cross-check information to verify accuracy. Correct errors manually or through automation.

- **Outliers:**

❑ **Problem:** Outliers can significantly impact statistical measures and machine learning models.

❑ **Solution:** Identify and handle outliers using statistical methods or visualization tools. Options include removing outliers, transforming data, or using robust statistical measures.

C: > Users > DELL > Downloads > No SQL project > project nosql - Copy (2).ipynb > import pandas as pd # Import the pandas library and alias it as 'pd'

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```
import pandas as pd          # Import the pandas library and alias it as 'pd'
dataset=pd.read_csv(r"C:\Users\shuba\Desktop\healthcare_dataset (1).csv")      # Read the CSV file into a pandas DataFrame
```

[5]

```
dataset.head()       # Display the first 5 rows of the DataFrame
```

[6]

	Name	Age	Gender	Blood Type	Medical Condition	Date of Admission	Doctor	Hospital	Insurance Provider	Billing Amount	Room Number	Admission Type	Discharge Date	Medication
0	Tiffany Ramirez	81.0	Female	O-	Diabetes	2022-11-17	Patrick Parker	Wallace-Hamilton	Medicare	37490.98336	146	Elective	2022-12-01	Aspirin
1	Ruben Burns	35.0	Male	O+	Asthma	2023-06-01	Diane Jackson	Burke, Griffin and Cooper	UnitedHealthcare	47304.06485	404	Emergency	2023-06-15	Lipitor
2	Chad Byrd	61.0	Male	B-	Obesity	2019-01-09	Paul Baker	Walton LLC	Medicare	36874.89700	292	Emergency	2019-02-08	Lipitor
3	Antonio Frederick	49.0	Male	B-	Asthma	2020-05-02	Brian Chandler	Garcia Ltd	Medicare	23303.32209	480	Urgent	2020-05-03	Penicillin
4	Mrs. Brandy Flowers	NaN	Male	O-	Arthritis	2021-07-09	Dustin Griffin	Jones, Brown and Murray	UnitedHealthcare	18086.34418	477	Urgent	2021-08-02	Paracetamol

```
dataset.info()       # Display information about the DataFrame
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 10000 entries, 0 to 9999
Data columns (total 15 columns):
 #   Column              Non-Null Count  Dtype
---  ------              --------------  -----
 0   Name                9975 non-null   object
 1   Age                 9972 non-null   float64
 2   Gender              9977 non-null   object
 3   Blood Type          9981 non-null   object
 4   Medical Condition   10000 non-null  object
 5   Date of Admission   10000 non-null  object
 6   Doctor              10000 non-null  object
 7   Hospital            9983 non-null   object
 8   Insurance Provider  9991 non-null   object
 9   Billing Amount      10000 non-null  float64
 10  Room Number         10000 non-null  int64
 11  Admission Type      9998 non-null   object
 12  Discharge Date      10000 non-null  object
 13  Medication          10000 non-null  object
 14  Test Results        9990 non-null   object
dtypes: float64(2), int64(1), object(12)
```

DATA CLEANING

- USING VISUAL STUDIO CODE
- IMPORT THE PANDAS LIBRARY AS “pd”
- LOAD THE HEALTHCARE DATASET INTO THE PANDAS DATAFRAME
- DISPLAY THE FIRST 5 ROWS
- DISPLAY INFORMATION ABOUT THE DATA

```python
dataset.describe()          # Display summary statistics of the numerical columns in the DataFrame
```

	Age	Billing Amount	Room Number
count	9972.000000	10000.000000	10000.000000
mean	51.444444	25516.806778	300.082000
std	19.588112	14067.292709	115.806027
min	18.000000	1000.180837	101.000000
25%	35.000000	13506.523967	199.000000
50%	52.000000	25258.112565	299.000000
75%	68.000000	37733.913725	400.000000
max	85.000000	49995.902280	500.000000

```python
missing_values=dataset.isnull().sum()       # Check for missing values in each column
print("Columns with missing values:")       # Print columns with missing values and the count of missing values
print(missing_values)
```

```
Columns with missing values:
Name                  25
Age                   28
Gender                23
Blood Type            19
Medical Condition      0
```

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C: > Users > DELL > Downloads > No SQL project > project nosql - Copy (2).ipynb > # Fill missing values in the 'Admission Type' column with the mode

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```python
# filling missing values of age column with mean
dataset['Age'].fillna(dataset['Age'].mean(),inplace=True)
```

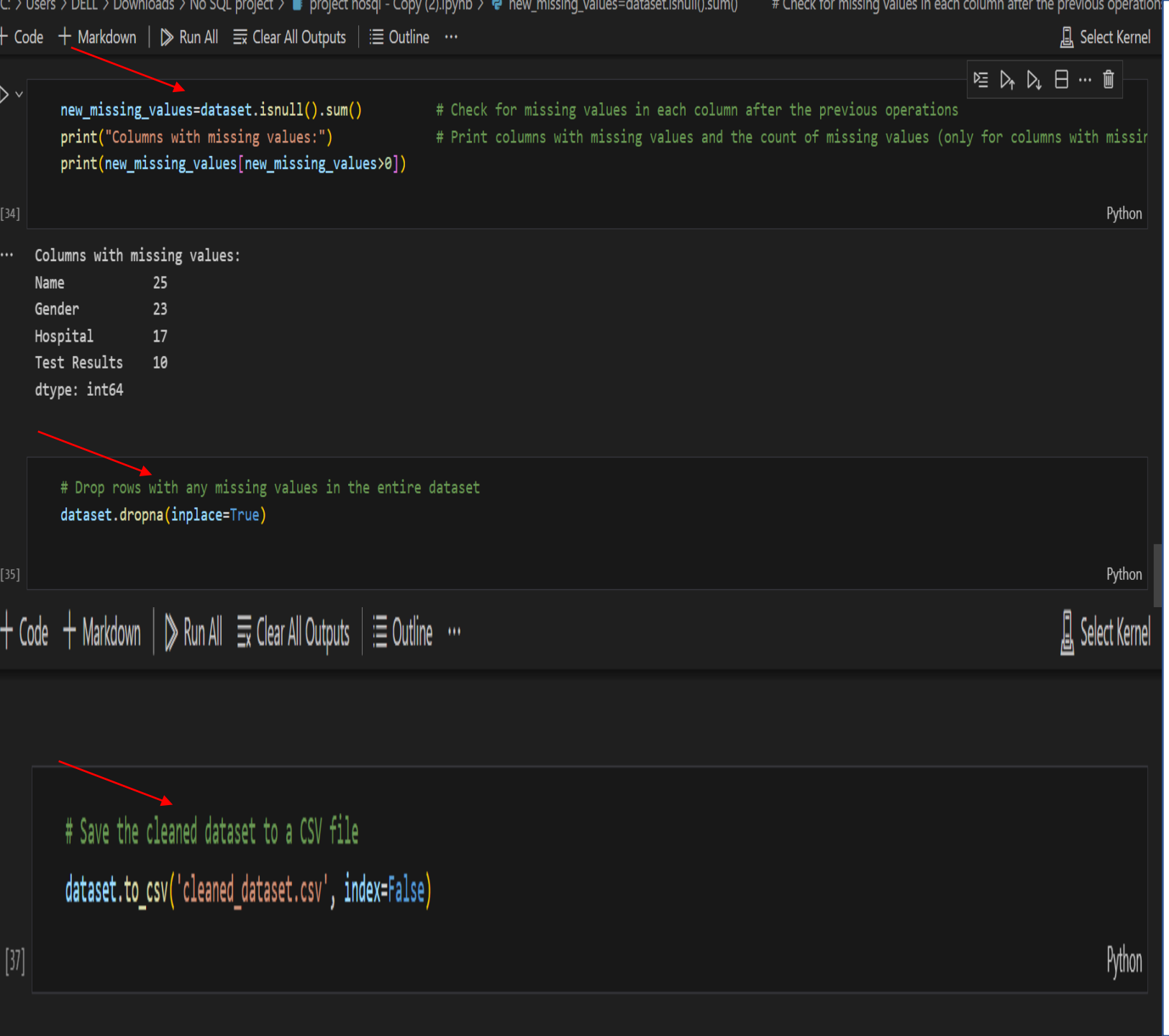
```python
# Fill missing values in the 'Blood Type' column with 'O+'
dataset['Blood Type'].fillna('O+', inplace=True)
```

```python
missing_values=dataset.isnull().sum()       # Check for missing values in each column after filling missing values in 'Blood Type'
print("Columns with missing values:")       # Print columns with missing values and the count of missing values
print(missing_values)
```

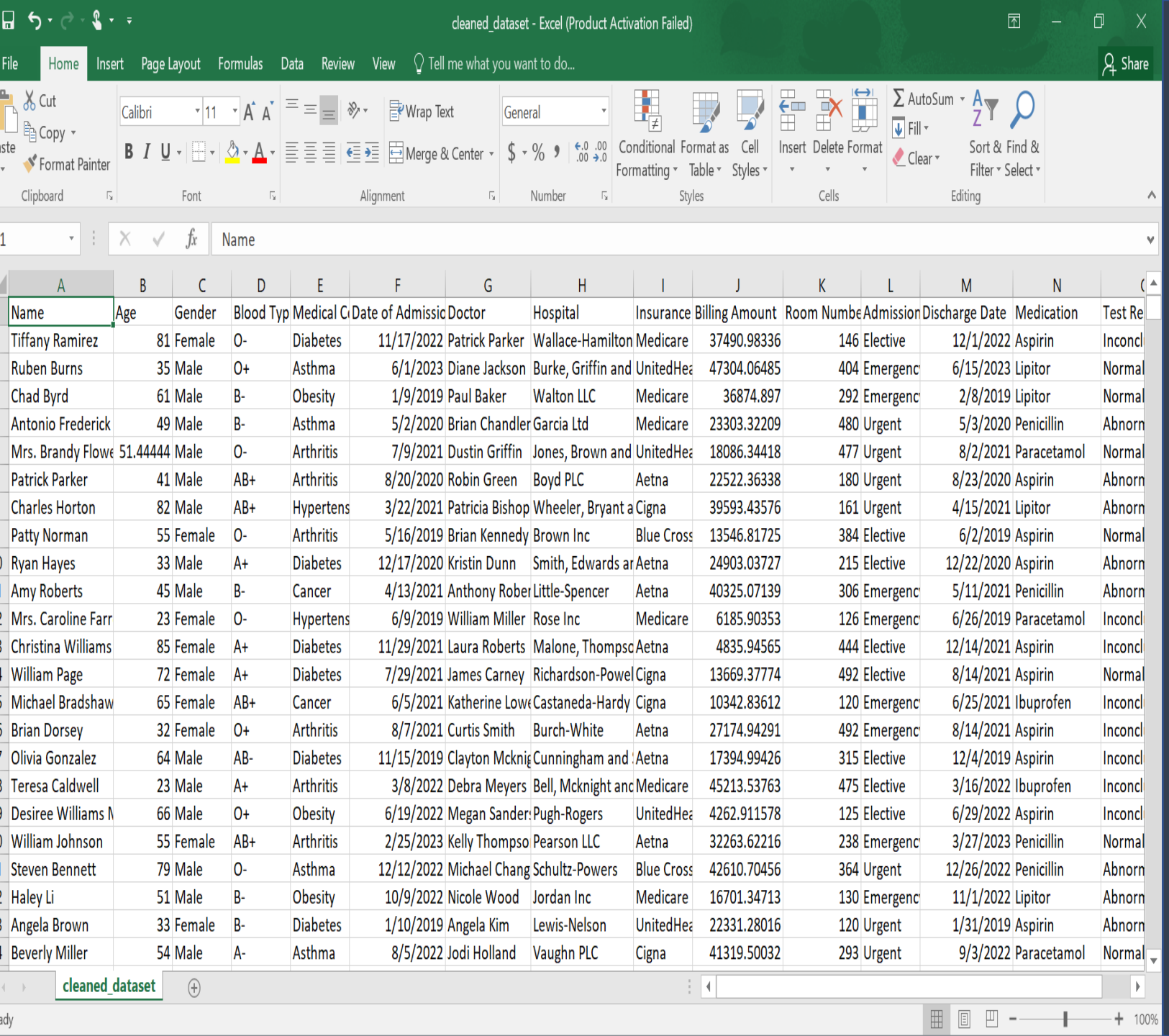
```python
# Fill missing values in the 'Admission Type' column with the mode
dataset['Admission Type'].fillna(dataset['Admission Type'].mode().iloc[0], inplace=True)
```

```python
# Fill missing values in the 'Insurance Provider' column using forward fill (pad)
dataset['Insurance Provider'].fillna(dataset['Insurance Provider'].interpolate(method='pad'), inplace=True)
```

- DISPLAY THE SUMMARY OF THE DATA
- CHECK FOR MISSING VALUES IN EACH COLUMNS
- FILL MISSING VALUES OF “AGE” COLUMN WITH MEAN VALUES
- FILL MISSING VALUES OF “BLOOD TYPE” COLUMN WITH “O+”
- FILL MISSING VALUES OF “ADMISSION TYPE” COLUMN WITH MODE VALUES
- FILL MISSING VALUES OF “INSURANCE PROVIDER” COLUMN USING FORWARD FILL (PAD)



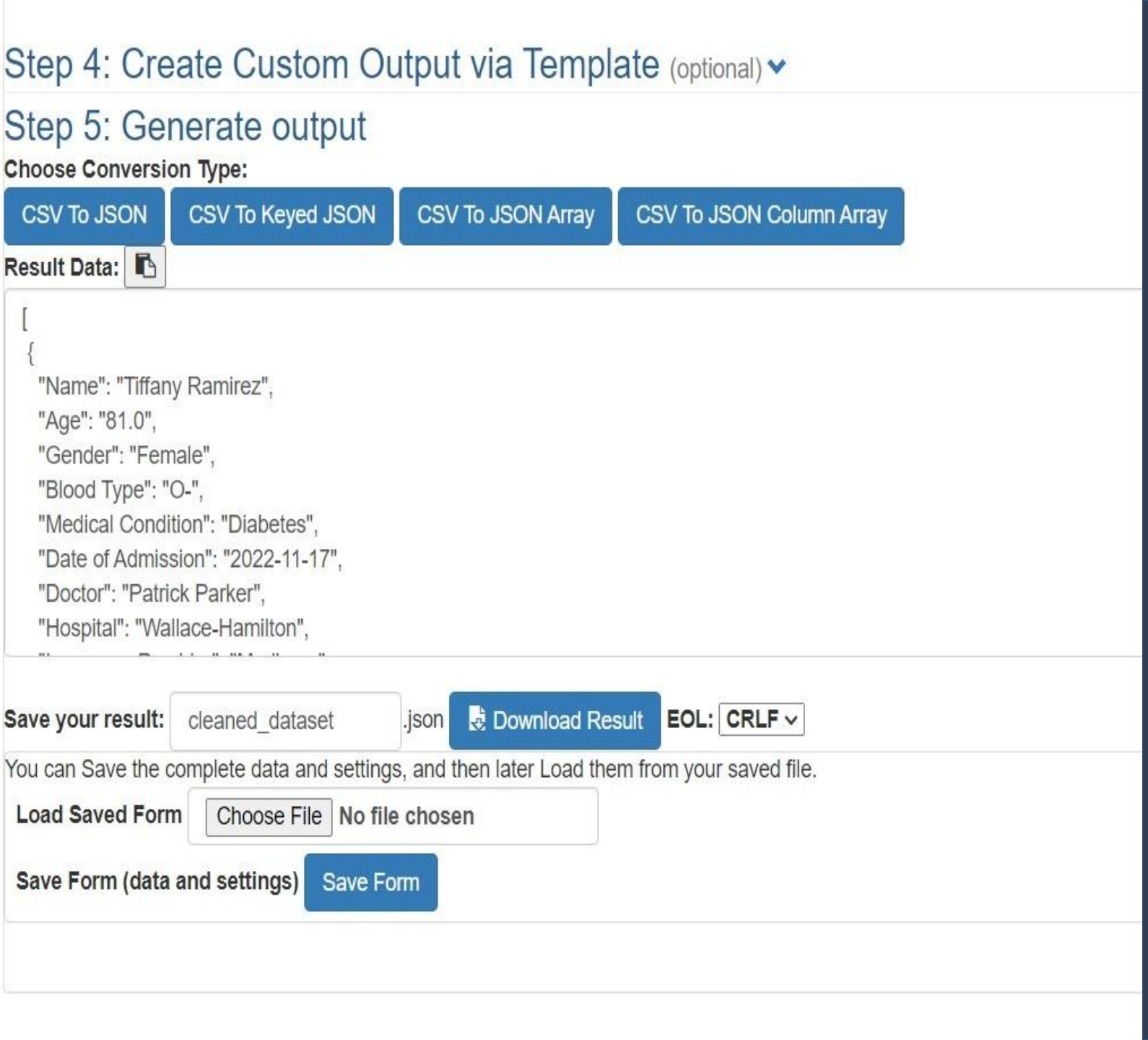
- CHECK MISSING VALUES IN EACH COLUMN AFTER THE PREVIOUS OPERATIONS
- DROP ROWS WITH ANY MISSING VALUES IN THE ENTIRE DATASET
- FINALLY, SAVE THE CLEANED DATASET TO A CSV FILE



Name	Age	Gender	Blood Typ	Medical C	Date of Admissic	Doctor	Hospital	Insurance	Billing Amount	Room Numbe	Admission	Discharge Date	Medication	Test Re
Tiffany Ramirez	81	Female	O-	Diabetes	11/17/2022	Patrick Parker	Wallace-Hamilton	Medicare	37490.98336	146	Elective	12/1/2022	Aspirin	Inconcl
Ruben Burns	35	Male	O+	Asthma	6/1/2023	Diane Jackson	Burke, Griffin and	UnitedHea	47304.06485	404	Emergenc	6/15/2023	Lipitor	Normal
Chad Byrd	61	Male	B-	Obesity	1/9/2019	Paul Baker	Walton LLC	Medicare	36874.897	292	Emergenc	2/8/2019	Lipitor	Normal
Antonio Frederick	49	Male	B-	Asthma	5/2/2020	Brian Chandler	Garcia Ltd	Medicare	23303.32209	480	Urgent	5/3/2020	Penicillin	Abnorn
Mrs. Brandy Flowe	51.44444	Male	O-	Arthritis	7/9/2021	Dustin Griffin	Jones, Brown and	UnitedHea	18086.34418	477	Urgent	8/2/2021	Paracetamol	Normal
Patrick Parker	41	Male	AB+	Arthritis	8/20/2020	Robin Green	Boyd PLC	Aetna	22522.36338	180	Urgent	8/23/2020	Aspirin	Abnorn
Charles Horton	82	Male	AB+	Hypertens	3/22/2021	Patricia Bishop	Wheeler, Bryant a	Cigna	39593.43576	161	Urgent	4/15/2021	Lipitor	Abnorn
Patty Norman	55	Female	O-	Arthritis	5/16/2019	Brian Kennedy	Brown Inc	Blue Cross	13546.81725	384	Elective	6/2/2019	Aspirin	Normal
Ryan Hayes	33	Male	A+	Diabetes	12/17/2020	Kristin Dunn	Smith, Edwards ar	Aetna	24903.03727	215	Elective	12/22/2020	Aspirin	Abnorn
Amy Roberts	45	Male	B-	Cancer	4/13/2021	Anthony Rober	Little-Spencer	Aetna	40325.07139	306	Emergenc	5/11/2021	Penicillin	Abnorn
Mrs. Caroline Farr	23	Female	O-	Hypertens	6/9/2019	William Miller	Rose Inc	Medicare	6185.90353	126	Emergenc	6/26/2019	Paracetamol	Inconcl
Christina Williams	85	Female	A+	Diabetes	11/29/2021	Laura Roberts	Malone, Thompsc	Aetna	4835.94565	444	Elective	12/14/2021	Aspirin	Inconcl
William Page	72	Female	A+	Diabetes	7/29/2021	James Carney	Richardson-Powel	Cigna	13669.37774	492	Elective	8/14/2021	Aspirin	Normal
Michael Bradshaw	65	Female	AB+	Cancer	6/5/2021	Katherine Lowe	Castaneda-Hardy	Cigna	10342.83612	120	Emergenc	6/25/2021	Ibuprofen	Inconcl
Brian Dorsey	32	Female	O+	Arthritis	8/7/2021	Curtis Smith	Burch-White	Aetna	27174.94291	492	Emergenc	8/14/2021	Aspirin	Inconcl
Olivia Gonzalez	64	Male	AB-	Diabetes	11/15/2019	Clayton Mcknig	Cunningham and	Aetna	17394.99426	315	Elective	12/4/2019	Aspirin	Inconcl
Teresa Caldwell	23	Male	A+	Arthritis	3/8/2022	Debra Meyers	Bell, Mcknight anc	Medicare	45213.53763	475	Elective	3/16/2022	Ibuprofen	Inconcl
Desiree Williams M	66	Male	O+	Obesity	6/19/2022	Megan Sander	Pugh-Rogers	UnitedHea	4262.911578	125	Elective	6/29/2022	Aspirin	Inconcl
William Johnson	55	Female	AB+	Arthritis	2/25/2023	Kelly Thompso	Pearson LLC	Aetna	32263.62216	238	Emergenc	3/27/2023	Penicillin	Normal
Steven Bennett	79	Male	O-	Asthma	12/12/2022	Michael Chang	Schultz-Powers	Blue Cross	42610.70456	364	Urgent	12/26/2022	Penicillin	Abnorn
Haley Li	51	Male	B-	Obesity	10/9/2022	Nicole Wood	Jordan Inc	Medicare	16701.34713	130	Emergenc	11/1/2022	Lipitor	Abnorn
Angela Brown	33	Female	B-	Diabetes	1/10/2019	Angela Kim	Lewis-Nelson	UnitedHea	22331.28016	120	Urgent	1/31/2019	Aspirin	Abnorn
Beverly Miller	54	Male	A-	Asthma	8/5/2022	Jodi Holland	Vaughn PLC	Cigna	41319.50032	293	Urgent	9/3/2022	Paracetamol	Normal

CLEANED DATASET FROM KAGGLE

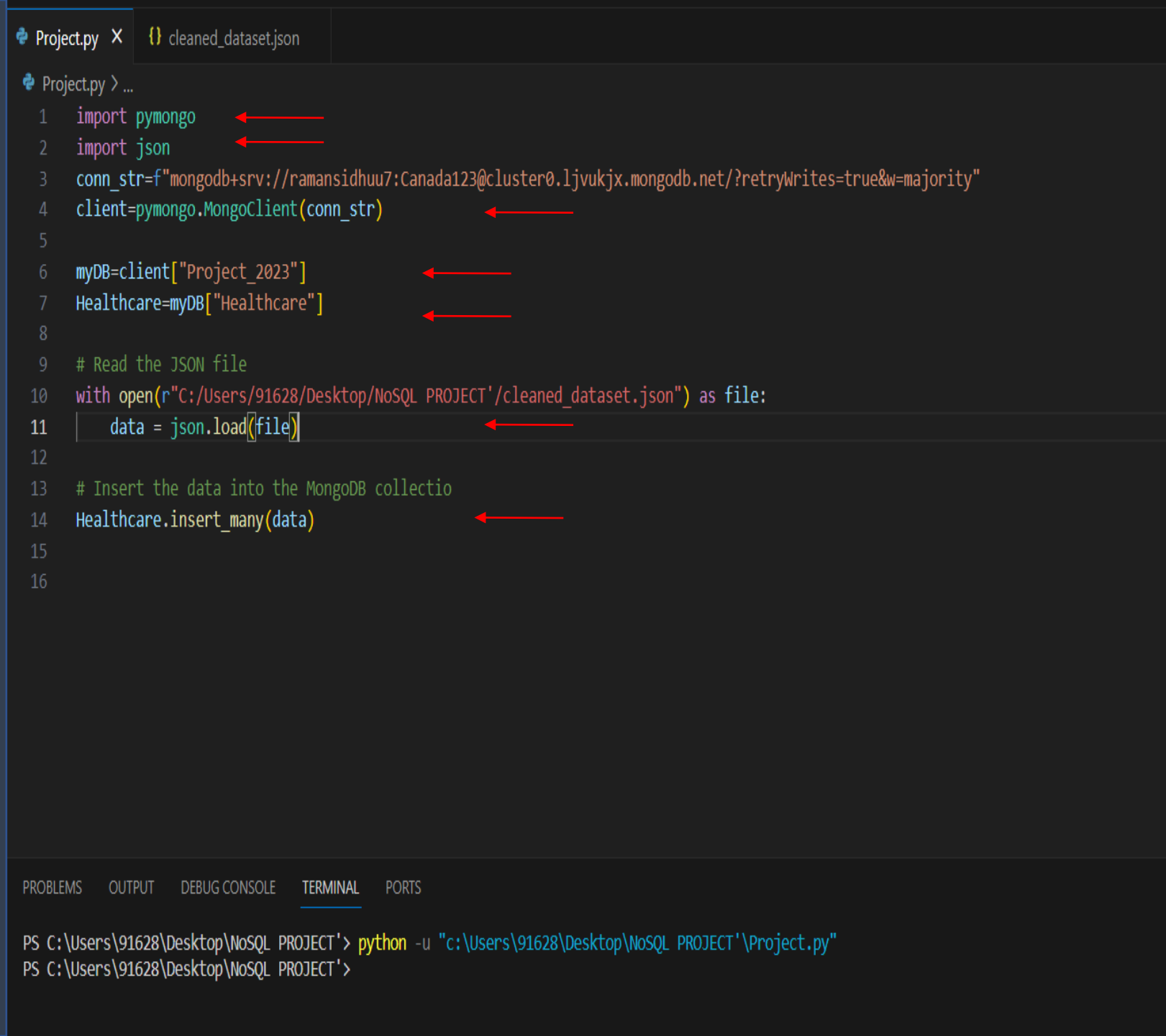
- CLEANED
- NO MISSING ROWS
- NO MISSING COLUMNS etc



SOFTWARE TO TRANSFORM CSV FILE TO JSON FILE

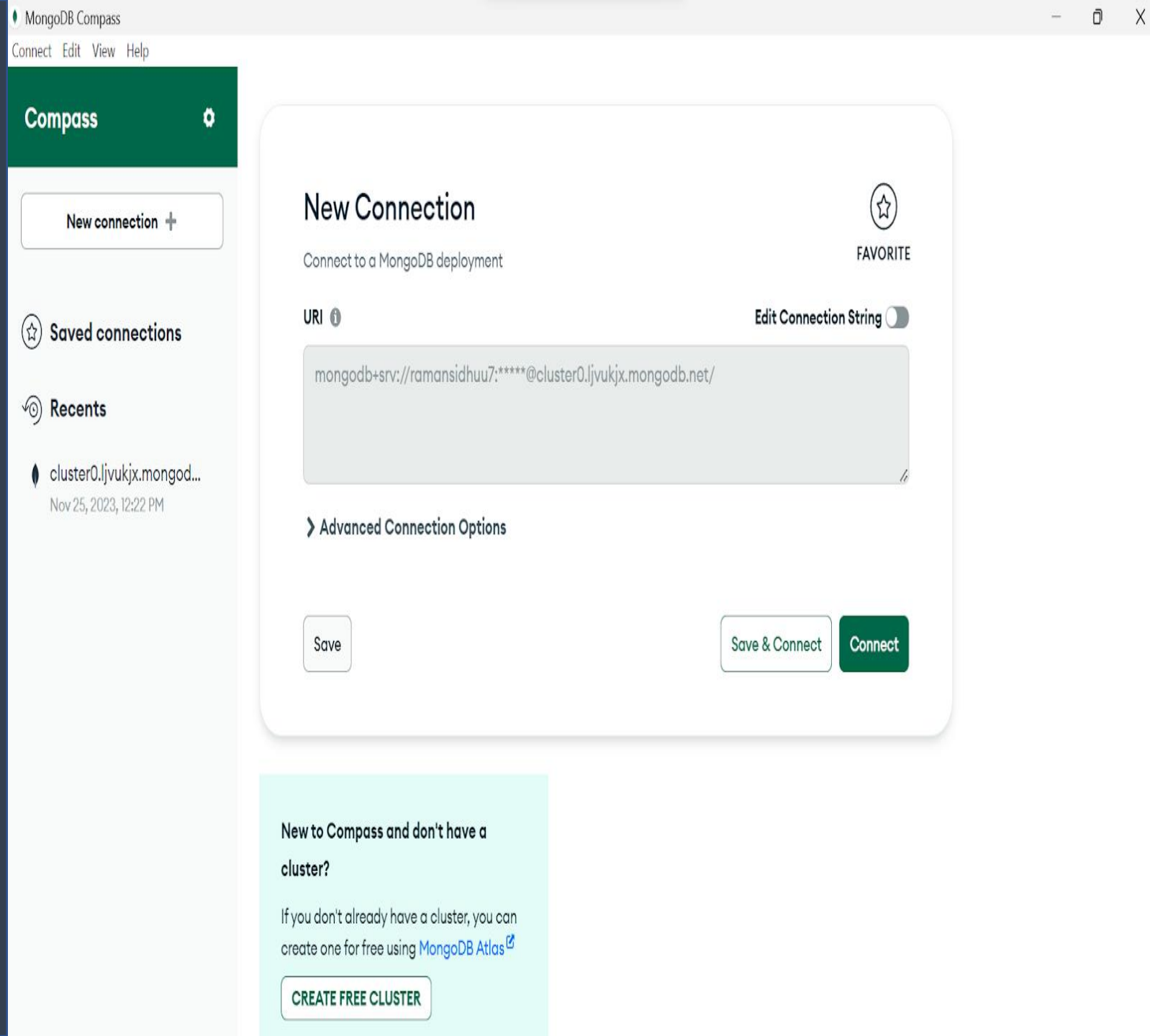
IMPORT DATASET FROM JSON FILE INTO MONGODB

- USING VISUAL STUDIO CODE
- IMPORT THE PYMONGO LIBRARY
- IMPORT THE JSON MODULE
- CONNECT TO THE MONGODB CLOUD SERVER
- CREATE DATABASE IN MONGODB “PROJECT 2023”
- CREATE COLLECTION “HEALTHCARE”
- INSERT THE DATASET IN JSON FILE IN THE MONGODB COLLECTION “HEALTCARE”

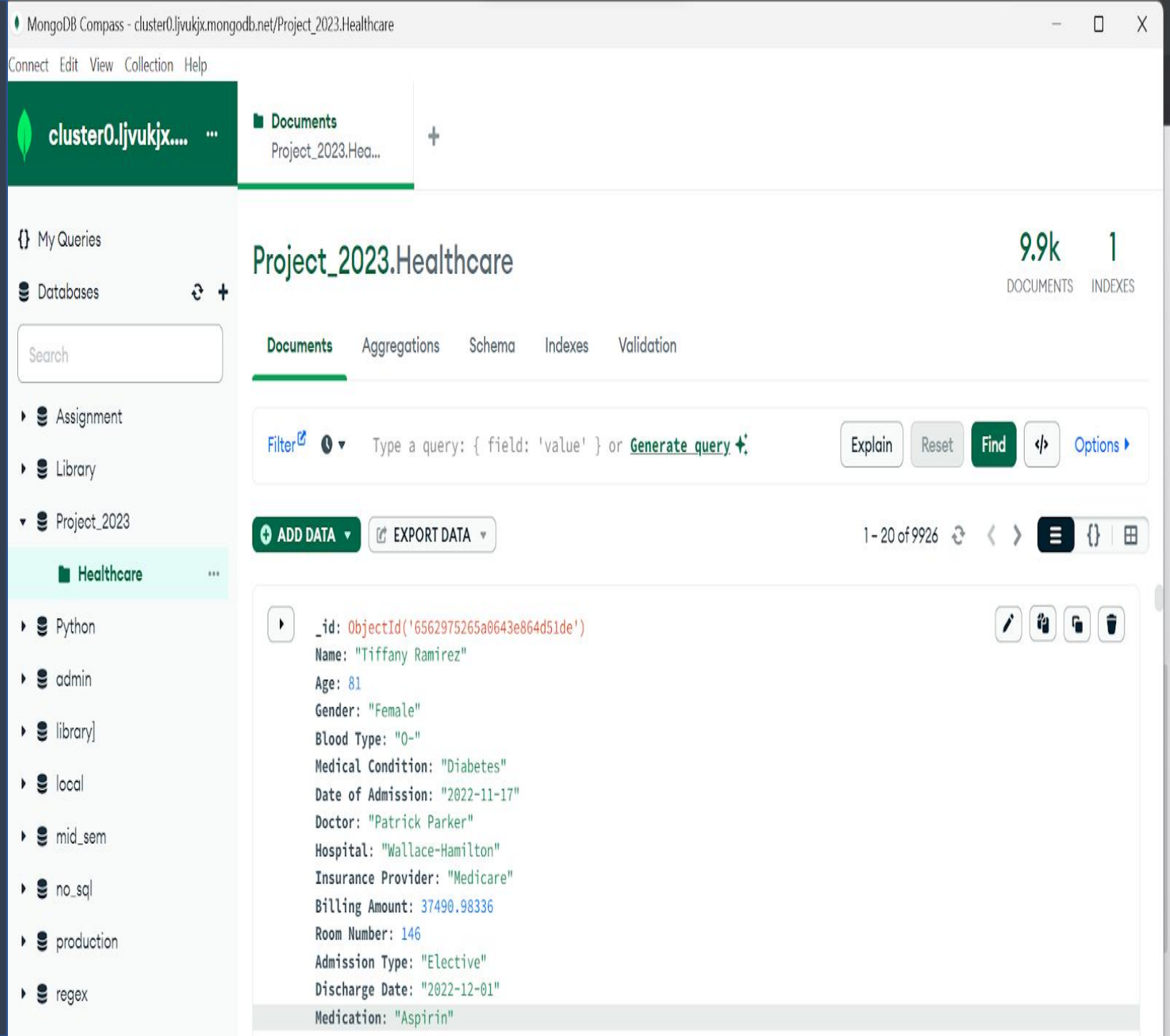


MONGODB CONNECTION USING MONGODB COMPASS

MongoDB Compass is the official graphical user interface (GUI) for MongoDB, a popular NoSQL database. It is designed to provide a visual representation and interaction with MongoDB databases, making it easier for developers, database administrators, and other users to work with MongoDB.



HEALTHCARE DATASET IMPORTED INTO MONGODB COMPASS



WHY MONGO DB ?

As Mongo db is an open source software which is used to query and store NoSQL data in flexible environment. Thus Jason files can be easily operated on closed services with help of cloud Mongo db . We have queried the NoSQL data in pymongo to derive feasible insights from the data.

MONGODB QUERIES

HOW MANY PATIENTS ARE AFFECTED BY ASTHMA

```
22    count=Healthcare.count_documents({"Medical Condition":"Asthma"})
23    print("Number of patients effected by Asthma=",count)
```

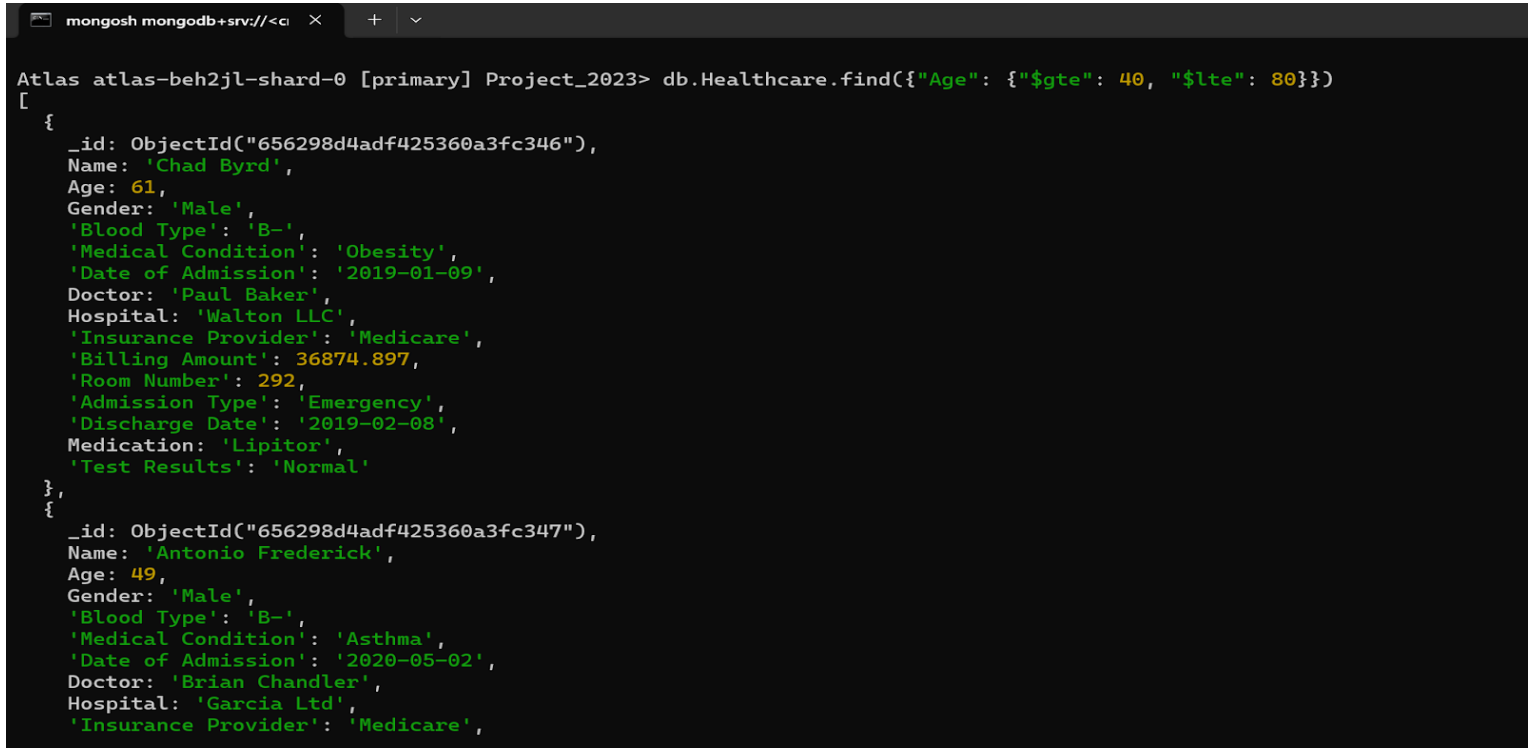
PROBLEMS OUTPUT DEBUG CONSOLE TERMINAL PORTS

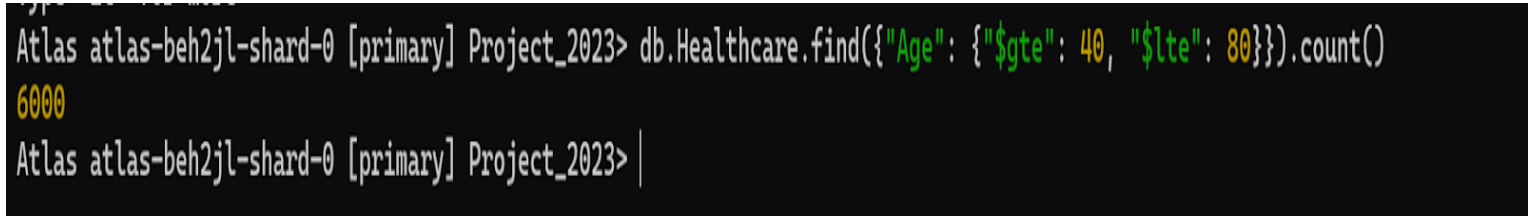
```
PS C:\Users\91628> python -u "c:\Users\91628\Desktop\NoSQL PROJECT'\Project.py"
Number of patients effected by Asthma= 1695
PS C:\Users\91628>
```

WHAT IS THE AVERAGE BILLING AMOUNT SPENT BY CANCER PATIENTS

```
Atlas atlas-beh2jl-shard-0 [primary] Project_2023> db.Healthcare.aggregate([ { $match: { "Medical Condition": "Cancer" } }, { $group:
 { _id: null, averageBillingAmount: { $avg: "$Billing Amount" } } }])
[ { _id: null, averageBillingAmount: 25512.55250590592 } ]
Atlas atlas-beh2jl-shard-0 [primary] Project_2023>
```

RETRIEVE PATIENTS WHO'S AGE LIES BETWEEN 40 -80 AND FIND THE COUNT OF THOSE PATIENTS.





WHAT IS THE NUMBER OF FEMALES ADMITTED FOR EMERGENCY

```
Atlas atlas-beh2jl-shard-0 [primary] Project_2023> db.Healthcare.countDocuments({ "Admission Type": "Emergency", "Gender": "Female" }
)
1687
Atlas atlas-beh2jl-shard-0 [primary] Project_2023>
```

HOW MANY PATIENTS HAVE TEST RESULTS AS NORMAL

```
Atlas atlas-beh2jl-shard-0 [primary] Project_2023> db.Healthcare.find({"Test Results":"Normal"}).count()
3238
Atlas atlas-beh2jl-shard-0 [primary] Project_2023>
```

Retrieve the medication prescribed to the highest number of patients also retrieve the number of patients.

```
Atlas atlas-beh2jl-shard-0 [primary] Project_2023> db.Healthcare.aggregate([ { $group: { _id: "$Medication", count: { $sum: 1 } } },
{ $sort: { count: -1 } }, { $limit: 1 }] )
[ { _id: 'Penicillin', count: 2060 } ]
Atlas atlas-beh2jl-shard-0 [primary] Project_2023>
```

Give the name of recent 5 patients which are discharged and mention there billing amount?

```
Atlas atlas-beh2jl-shard-0 [primary] Project_2023> db.Healthcare.find( { "Discharge Date": { $ne: null } }, { "Name": 1, "Billing Amo
unt": 1, "_id": 0 } ).sort({ "Discharge Date": -1 }).limit(5)
[
  { Name: 'Angela Thomas', 'Billing Amount': 43047.41106 },
  { Name: 'Amanda Stein DVM', 'Billing Amount': 18904.7382 },
  { Name: 'Margaret Hayes', 'Billing Amount': 45192.47844 },
  { Name: 'Stephanie Simpson', 'Billing Amount': 35678.11313 },
  { Name: 'Ruth Mason', 'Billing Amount': 45390.91588 }
]
Atlas atlas-beh2jl-shard-0 [primary] Project_2023>
```

TOOLS FOR DATA VISUALIZATION :

MATPLOTLIB:

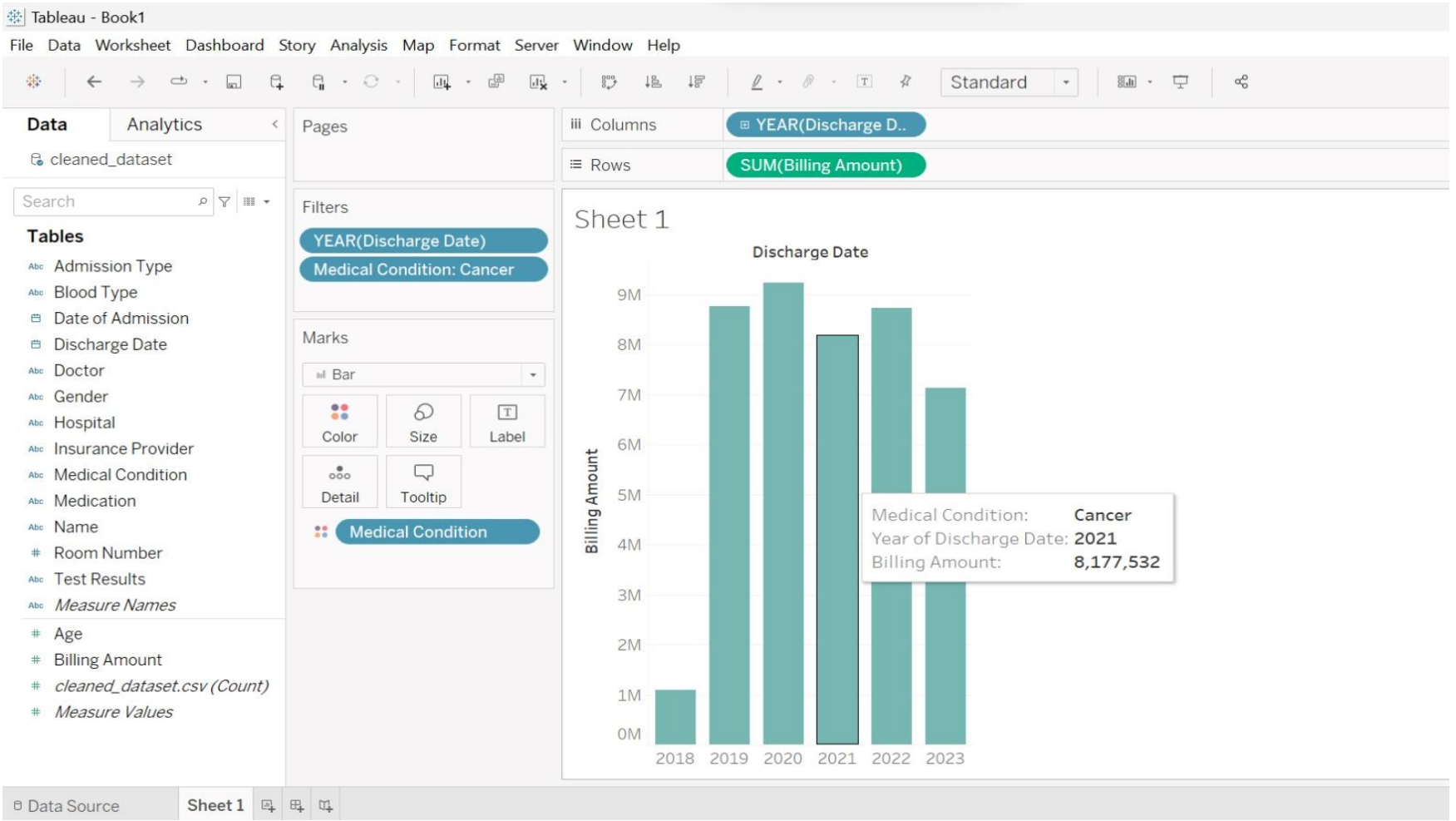
- Purpose: Matplotlib is a widely-used plotting library in Python that provides a variety of plotting functionalities for creating static, interactive, and publication-quality visualizations.
- Usage: It offers a wide range of plot types such as line plots, bar charts, histograms, scatter plots, 3D plots, etc.
- Matplotlib allows users to customize nearly every aspect of a plot, including colors, labels, markers, titles, axes, grids, and more. It can be used within Jupyter Notebooks, scripts, or any Python environment.
- Features: Flexible and granular control over plot elements. Integration with other Python libraries like Pandas for seamless data visualization.
- Matplotlib can be combined with other libraries like Seaborn for enhanced aesthetics.

TABLEAU:

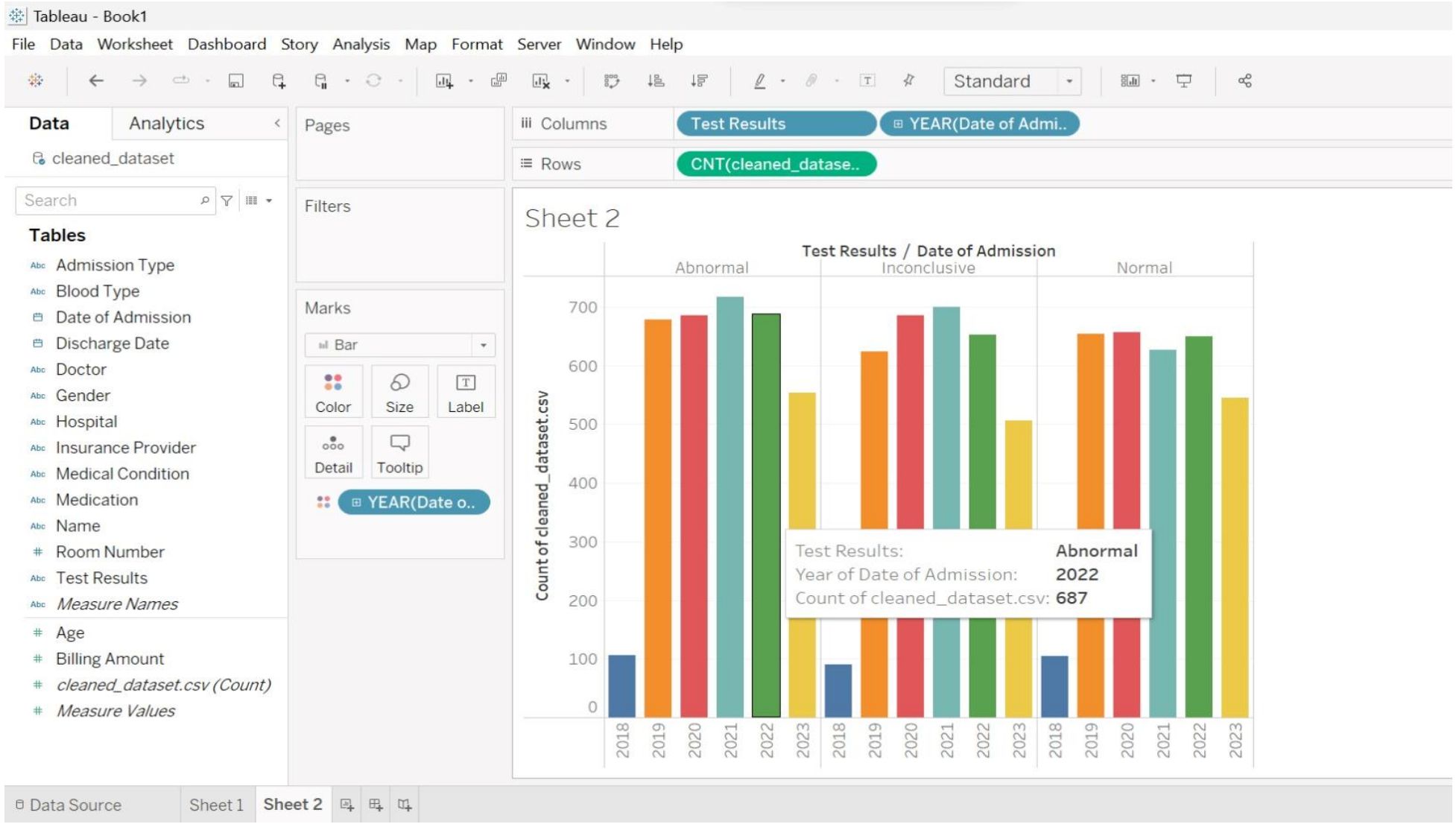
- Purpose: Tableau is a powerful and user-friendly data visualization tool that allows users to create interactive and shareable dashboards without requiring extensive programming knowledge.
- Usage: Offers a drag-and-drop interface for creating visualizations and dashboards. Connects to various data sources directly to create visualizations from real-time or static data.
- Tableau's strength lies in its ability to quickly generate interactive and visually appealing dashboards without coding.

DATA VISUALIZATION USING TABLEAU

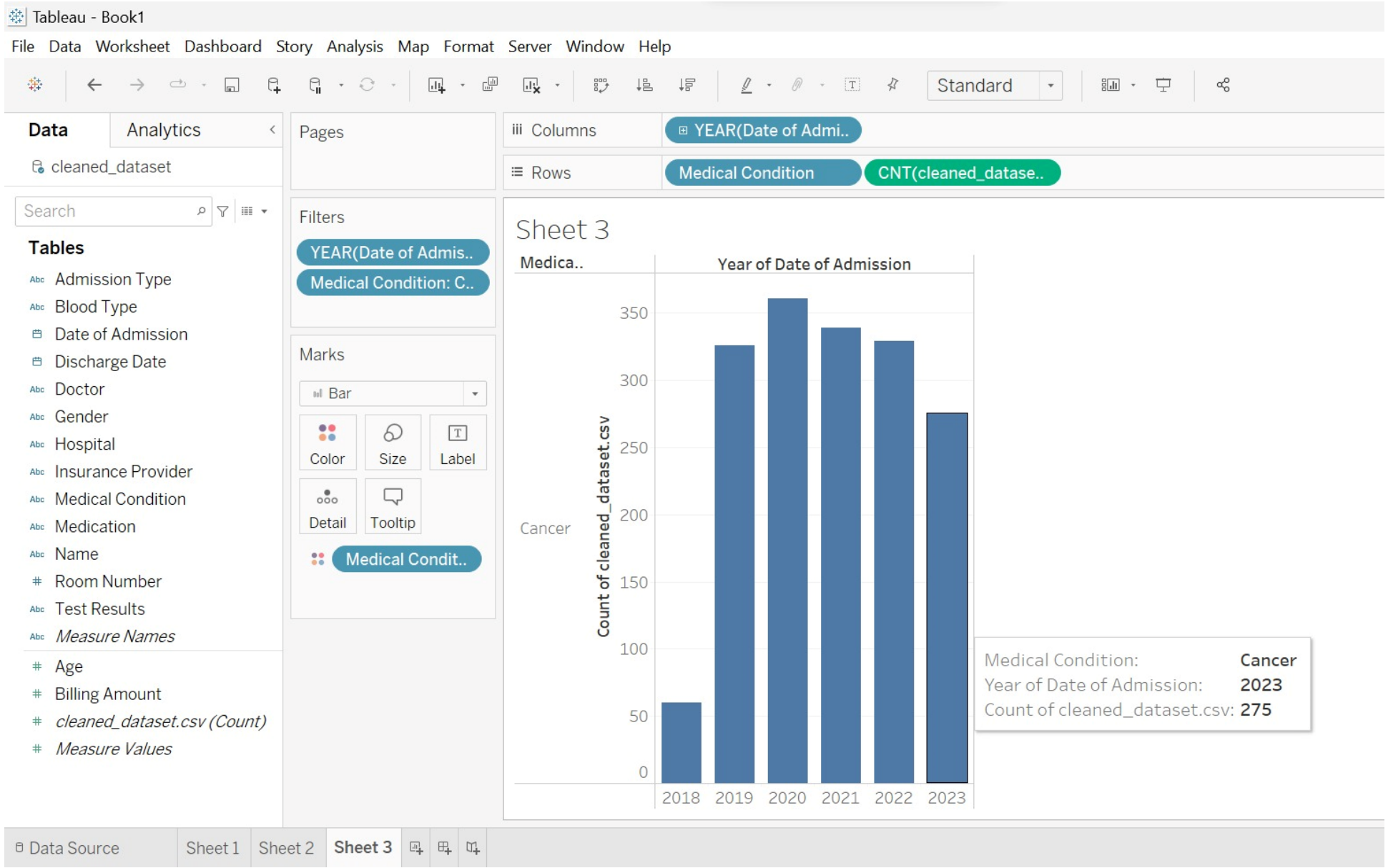
COST OF MEDICATION ON TREATMENT OF CANCER FOR ALL YEAR



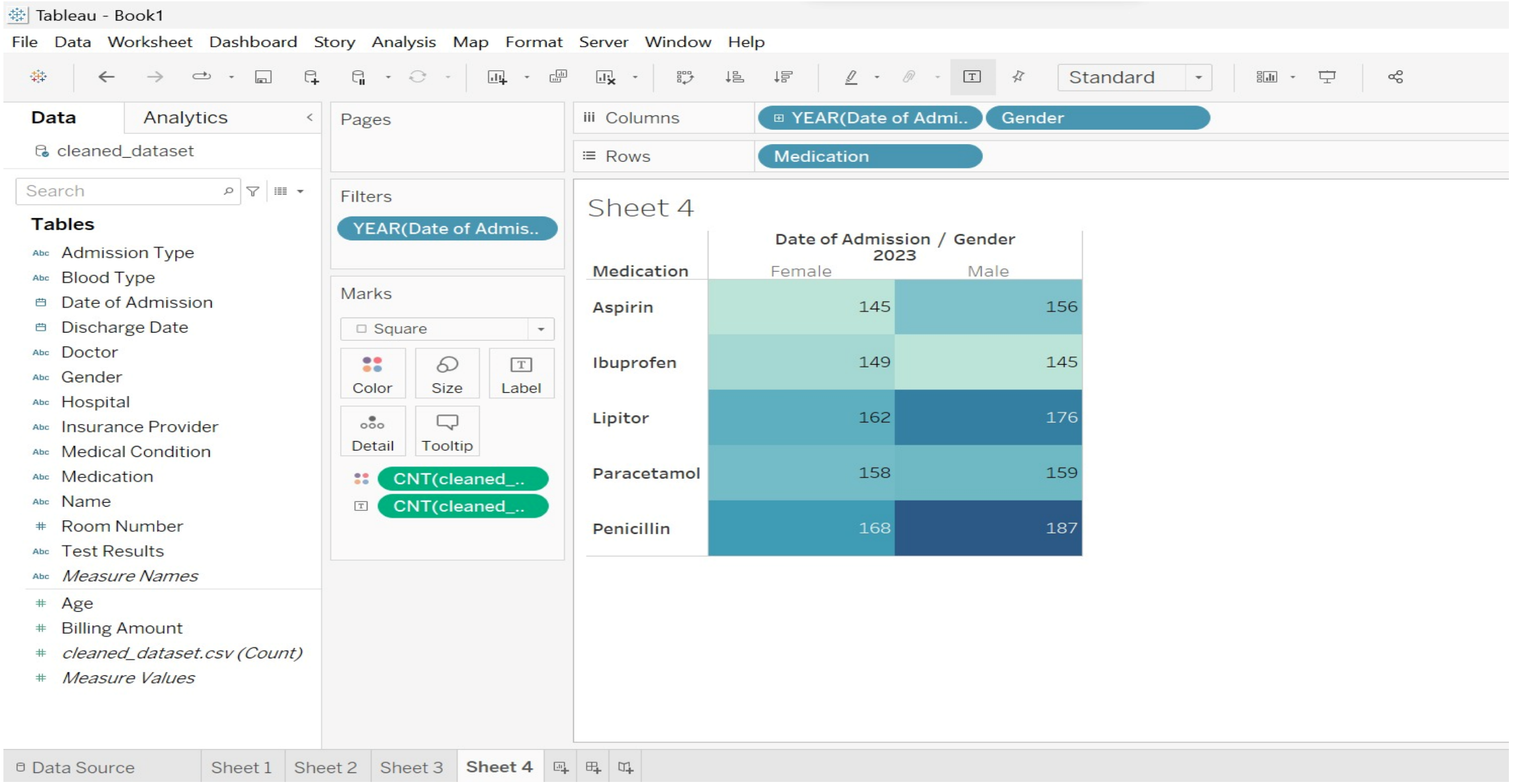
COUNT OF THE PATIENTS FOR THE TEST RESULT FOR DIFFERENT YEARS



COUNT OF PATIENTS OF CANCER FOR ALL YEARS



COUNT OF MEDICINES CONSUMED BY MALES AND FEMALES IN DIFFERENT YEAR



Tools for predictive analysis

Pandas:

- Purpose: Used for data manipulation and analysis.
- Usage in the Code: import pandas as pd - Importing the Pandas library.
- Role in the Code: Loading the dataset from a CSV file, manipulating dataframes, dropping unnecessary columns, and converting categorical variables to dummy/indicator variables.

Scikit-learn (sklearn):

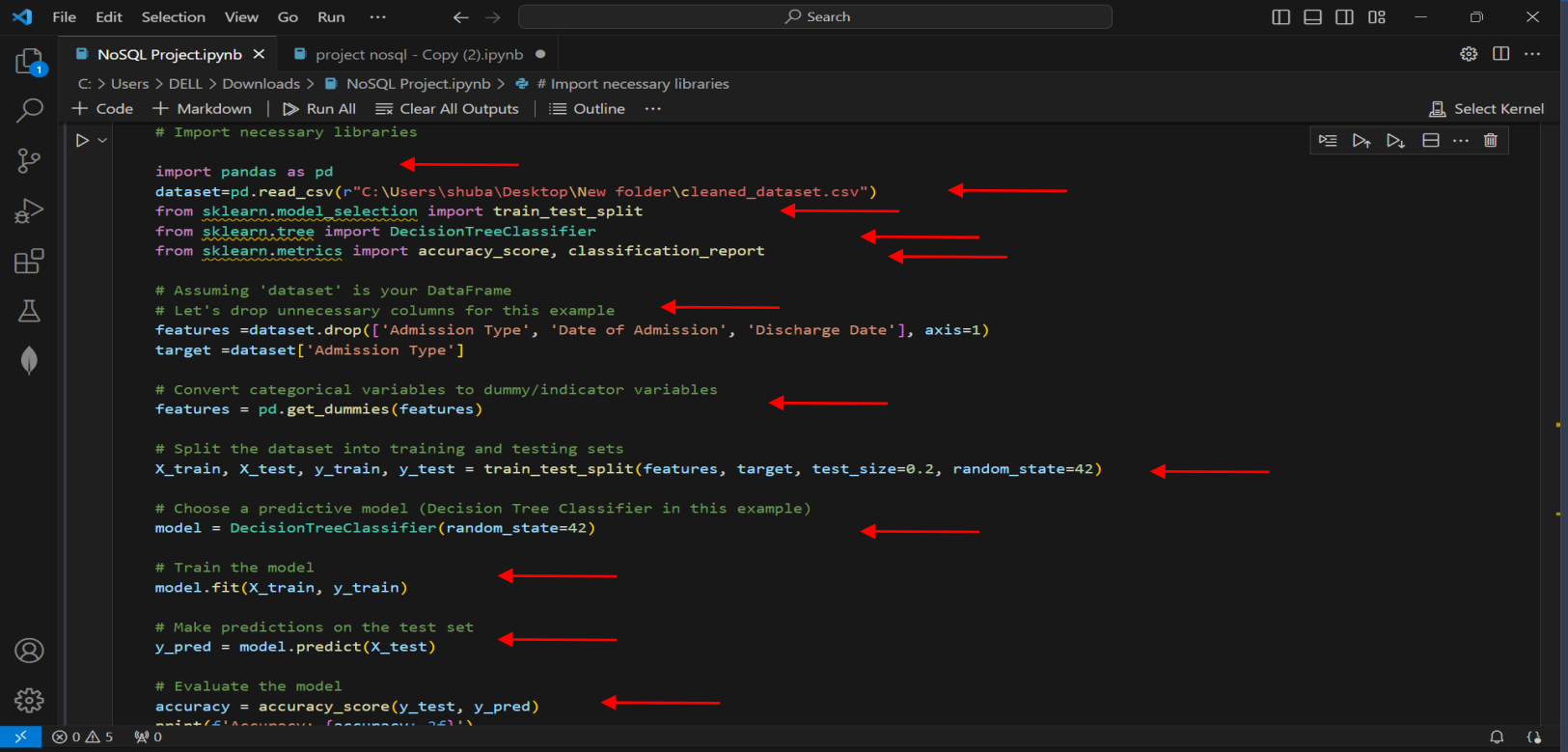
- Purpose: A machine learning library providing various algorithms and tools for data mining and analysis.
- Usage in the Code: from sklearn.model_selection import train_test_split, from sklearn.tree import **DecisionTreeClassifier, from sklearn.metrics import accuracy_score, classification_report:**
- Role in the Code: Used for splitting the dataset into training and testing sets (train_test_split), implementing the Decision Tree Classifier (DecisionTreeClassifier), evaluating model accuracy and generating a classification report (accuracy_score, classification_report).

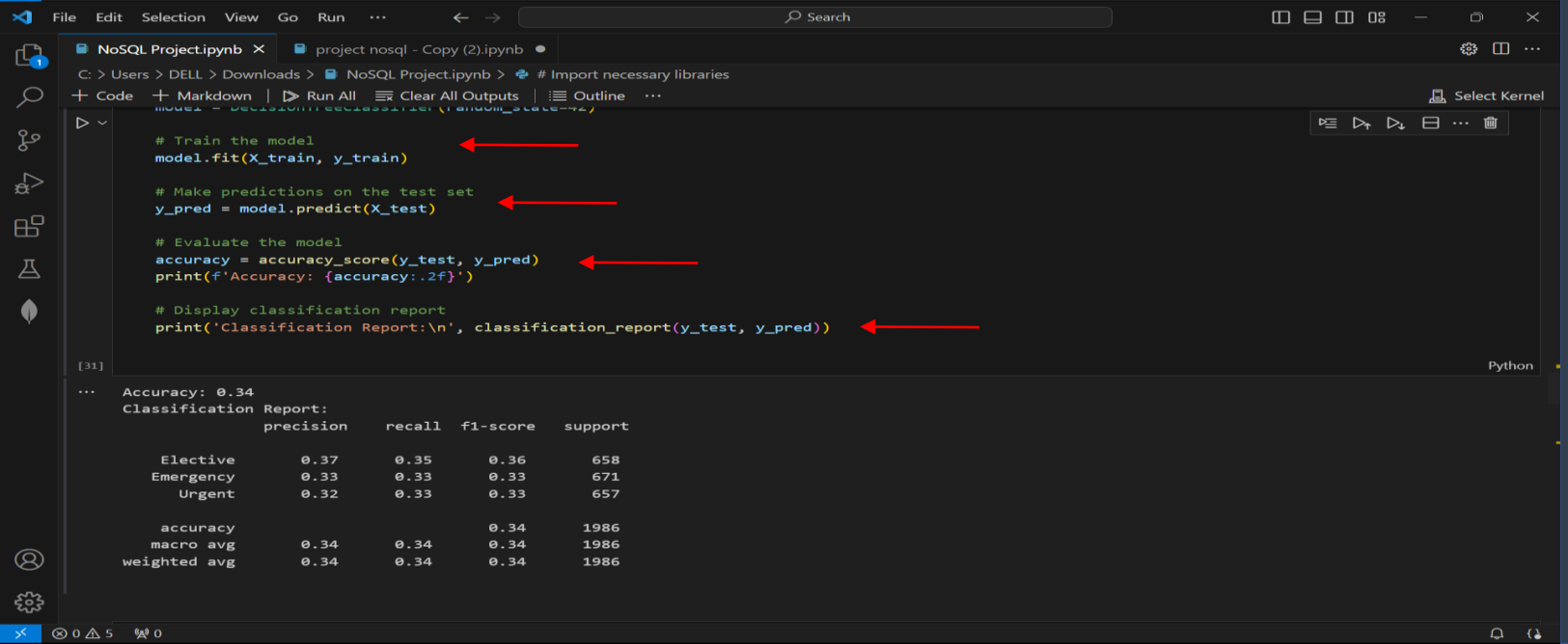
NumPy:

- Purpose: Provides support for arrays, matrices, and mathematical functions for numerical computing.
- Usage in the Code: NumPy is not explicitly used in this specific code snippet but is often used internally by Pandas and Scikit-learn for numerical computations.

Python:

- Purpose: General-purpose programming language used for scripting, data analysis, machine learning, and more.
- Usage in the Code: The entire code is written in Python, utilizing its syntax and libraries for data handling and machine learning.





PREDICTIVE ANALYSIS OF DATASET

1. IMPORT NECESSARY LIBRARIES, PANDAS, TRAIN_TEST_SPLIT, DECISIONTREE CLASSIFIER, ACCURACY SCORE, CLASSIFICATION REPORT
2. DROP UNNECESSARY COLUMNS
3. CONVERT CATERGORICAL VARIABLES TO DUMY INDICATORS
4. SPLIT DATASET INTO TRAINING AND TESTING SETS
5. CHOSE A PREDICTIVE MODEL (DECISION TREE)
6. TRAIN THE MODEL
7. MAKE PREDICTION ON THE TEST SET
8. EVALUATE THE MODEL
9. DISPLAY CLASSIFICATION REPORT

```python
# Create a DataFrame to compare actual and predicted values
predictions_df = pd.DataFrame({'Actual': y_test, 'Predicted': y_pred})
print(predictions_df.head(9927))
```

[32]

```
         Actual  Predicted
4407  Emergency   Elective
2769  Emergency   Elective
388   Emergency     Urgent
6586   Elective   Elective
6769  Emergency  Emergency
...         ...        ...
8565     Urgent     Urgent
6391     Urgent  Emergency
6720     Urgent     Urgent
7871     Urgent   Elective
3903  Emergency  Emergency

[1986 rows x 2 columns]
```

DATA FRAME CREATED TO COMPARE ACTUAL AND PREDICTED VALUES

File Edit Selection View Go Run ··· Search

NoSQL Project.ipynb X | project nosql - Copy (2).ipynb

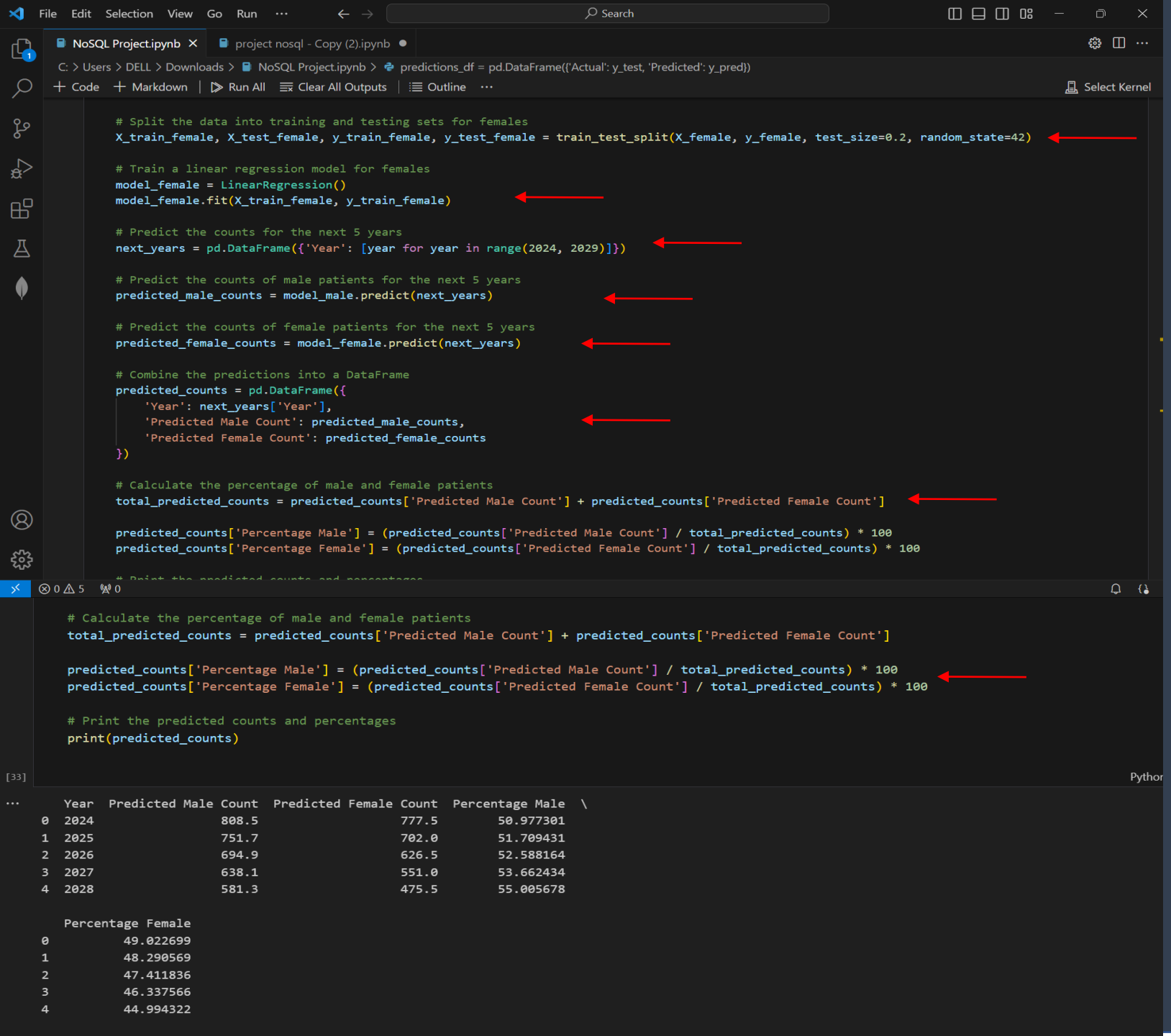
C: > Users > DELL > Downloads > NoSQL Project.ipynb > predictions_df = pd.DataFrame({'Actual': y_test, 'Predicted': y_pred})

+ Code + Markdown | Run All | Clear All Outputs | Outline ··· | Select Kernel

```
# Assuming 'dataset' is your DataFrame
from sklearn.model_selection import train_test_split
from sklearn.linear_model import LinearRegression
import pandas as pd

# Convert 'Date of Admission' to datetime format
dataset['Date of Admission'] = pd.to_datetime(dataset['Date of Admission'])

# Extract year from 'Date of Admission'
dataset['Year'] = dataset['Date of Admission'].dt.year

# Count the number of male and female patients for each year
gender_counts = dataset.groupby(['Year', 'Gender']).size().reset_index(name='Patient Count')

# Prepare the features and target for the regression model (predicting male count)
X_male = gender_counts[gender_counts['Gender'] == 'Male'][['Year']]
y_male = gender_counts[gender_counts['Gender'] == 'Male']['Patient Count']

# Split the data into training and testing sets for males
X_train_male, X_test_male, y_train_male, y_test_male = train_test_split(X_male, y_male, test_size=0.2, random_state=42)

# Train a linear regression model for males
model_male = LinearRegression()
model_male.fit(X_train_male, y_train_male)

# Prepare the features and target for the regression model (predicting female count)
X_female = gender_counts[gender_counts['Gender'] == 'Female'][['Year']]
y_female = gender_counts[gender_counts['Gender'] == 'Female']['Patient Count']

# Split the data into training and testing sets for females
```

⊗0 ⚠5 0

- CONVERT “DATE OF ADMISSION” TO DATETIME FORMAT
- EXTRACT YEAR FROM “DATE OF ADMISSION”
- COUNT THE NUMBER OF MALE AND FEMALE PATIENTS FOR EACH YEAR
- PREPARE THE FEATURES AND TARGET FOR THE REGRESSION MODEL (PREDICTING MALE COUNT)
- SPLIT THE DATA INTO TRAINING AND TESTING SETS FOR MALES
- TRAIN THE LINEAR REGRESSION FOR MALES
- PREPARE THE FEATURES AND TARGET THE REGRESSIO MODEL (PREDICTING FEMALE COUNT)
- SPLIT THE DATA INTO TRAINING AND TESTING SETS FOR FEMALES



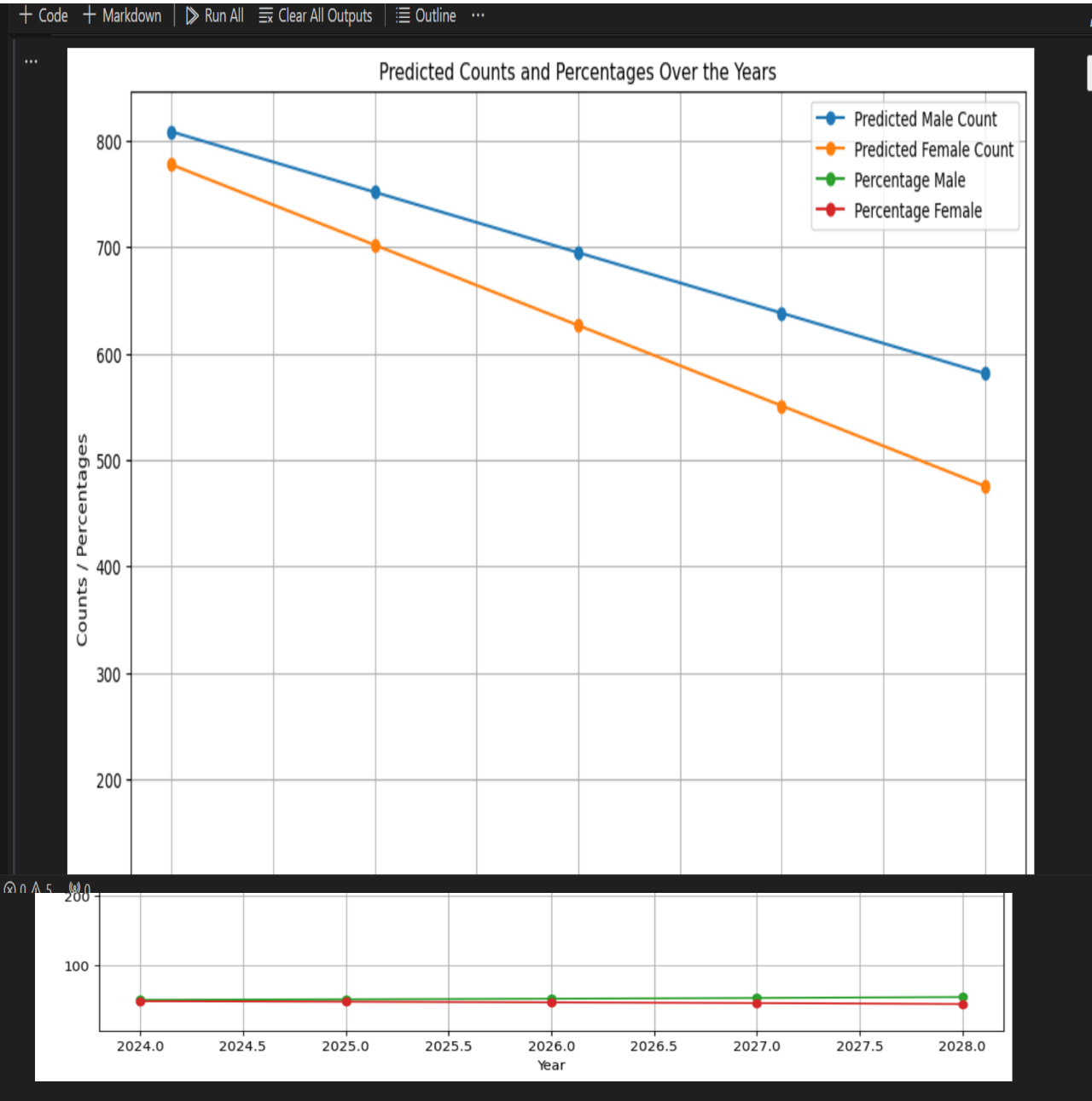
PREDICTING DATA FOR NEXT 5 YEARS

- TRAIN A LINEAR REGRESSION FOR FEMALES
- PREDICT THE COUNTS FOR THE NEXT 5 YEARS
- PREDICT THE COUNTS OF MALE PATIENTS FOR THE NEXT 5 YEARS
- PREDICT THE COUNTS OF FEMALE PATIENTS FOR THE NEXT 5 YEARS
- COMBINE THE PREDICTIONS INTO A DATAFRAME
- CALCULATE THE PERCENTAGE OF MALE AND FEMALES PATIENTS

DATA VISUALIZATION FOR PREDICTIVE ANALYSIS FOR HEALTHCARE KAGGLE DATASET USING MATPLOTLIB

+ Code + Markdown | Run All | Clear All Outputs | Outline ··· Select Kernel

```python
import matplotlib.pyplot as plt

# Assuming 'result' is your DataFrame with the provided data
# Modify this with your actual data
result_data = {
    'Year': [2024, 2025, 2026, 2027, 2028],
    'Predicted Male Count': [808.5, 751.7, 694.9, 638.1, 581.3],
    'Predicted Female Count': [777.5, 702.0, 626.5, 551.0, 475.5],
    'Percentage Male': [50.977301, 51.709431, 52.588164, 53.662434, 55.005678],
    'Percentage Female': [49.022699, 48.290569, 47.411836, 46.337566, 44.994322]
}

result = pd.DataFrame(result_data)

# Plotting
plt.figure(figsize=(12, 8))

# Plot Predicted Male and Female Counts
plt.plot(result['Year'], result['Predicted Male Count'], label='Predicted Male Count', marker='o')
plt.plot(result['Year'], result['Predicted Female Count'], label='Predicted Female Count', marker='o')

# Plot Percentage Male and Female
plt.plot(result['Year'], result['Percentage Male'], label='Percentage Male', marker='o')
plt.plot(result['Year'], result['Percentage Female'], label='Percentage Female', marker='o')

# Adding labels and title
plt.xlabel('Year')
plt.ylabel('Counts / Percentages')
plt.title('Predicted Counts and Percentages Over the Years')
plt.legend()
```



WHY PYSPARK ?

PySpark is used for queries because it enables distributed processing across clusters, ensuring efficiency with large datasets. Its scalability, integration with NoSQL databases, Python compatibility, and unified data processing platform make it a versatile choice. Additionally, the active Apache Spark community provides valuable support for optimizing and enhancing queries.

USING PYSPARK TO QUERY AND ANALYSE DATASET

- IMPORT THE LIBRARY "SPARKSESSION"
- CREATE A SPARKSESSION
- LOAD THE DATASET INTO PYSPARK
- SHOW THE DETAILS OF THE DATASET

```python
# Inside the PySpark shell
from pyspark.sql import SparkSession

# Create a Spark session
spark = SparkSession.builder.appName("CSVFileLoader").getOrCreate()

# Specify the path to the CSV file
csv_file_path = "C:/Users/91628/Desktop/NoSQL PROJECT'/cleaned_dataset.csv"

# Read the CSV file into a DataFrame
csv_data_frame = spark.read.csv(csv_file_path, header=True, inferSchema=True)

# Perform operations on the DataFrame as needed
csv_data_frame.show()
```

PROBLEMS OUTPUT DEBUG CONSOLE TERMINAL PORTS Code

```
PS C:\Users\91628> python -u "c:\Users\91628\Desktop\NoSQL PROJECT'\Project.py"
Setting default log level to "WARN".
To adjust logging level use sc.setLogLevel(newLevel). For SparkR, use setLogLevel(newLevel).
+--------------------+---+------+----------+-----------------+-----------------+------------------+--------------------+------------------+--------------+-----------+--------------+--------------+-------
----+------------+
|                Name|Age|Gender|Blood Type|Medical Condition|Date of Admission|            Doctor|            Hospital|Insurance Provider|Billing Amount|Room Number|Admission Type|Discharge Date| Medica
tion|Test Results|
+--------------------+---+------+----------+-----------------+-----------------+------------------+--------------------+------------------+--------------+-----------+--------------+--------------+-------
----+------------+
|     Tiffany Ramirez| 81|Female|        O-|         Diabetes|       2022-11-17|    Patrick Parker|    Wallace-Hamilton|          Medicare|   37490.98336|        146|      Elective|    2022-12-01|    Asp
irin|Inconclusive|
|         Ruben Burns| 35|  Male|        O+|           Asthma|       2023-06-01|     Diane Jackson|Burke, Griffin an...|  UnitedHealthcare|   47304.06485|        404|     Emergency|    2023-06-15|    Lip
itor|      Normal|
|           Chad Byrd| 61|  Male|        B-|          Obesity|       2019-01-09|        Paul Baker|          Walton LLC|          Medicare|     36874.897|        292|     Emergency|    2019-02-08|    Lip
itor|      Normal|
|   Antonio Frederick| 49|  Male|        B-|           Asthma|       2020-05-02|    Brian Chandler|          Garcia Ltd|          Medicare|   23303.32209|        480|        Urgent|    2020-05-03| Penici
llin|    Abnormal|
| Mrs. Brandy Flowers| 51|  Male|        O-|        Arthritis|       2021-07-09|    Dustin Griffin|Jones, Brown and ...|  UnitedHealthcare|   18086.34418|        477|        Urgent|    2021-08-02|Paracet
amol|      Normal|
|      Patrick Parker| 41|  Male|       AB+|        Arthritis|       2020-08-20|       Robin Green|            Boyd PLC|             Aetna|   22522.36338|        180|        Urgent|    2020-08-23|    Asp
irin|    Abnormal|
|      Charles Horton| 82|  Male|       AB+|     Hypertension|       2021-03-22|   Patricia Bishop|Wheeler, Bryant a...|             Cigna|   39593.43576|        161|        Urgent|    2021-04-15|    Lip
itor|    Abnormal|
|        Patty Norman| 55|Female|        O-|        Arthritis|       2019-05-16|     Brian Kennedy|           Brown Inc|        Blue Cross|   13546.81725|        384|      Elective|    2019-06-02|    Asp
irin|      Normal|
|          Ryan Hayes| 33|  Male|        A+|         Diabetes|       2020-12-17|      Kristin Dunn|Smith, Edwards an...|             Aetna|   24903.03727|        215|      Elective|    2020-12-22|    Asp
irin|    Abnormal|
|         Amy Roberts| 45|  Male|        B-|           Cancer|       2021-04-13|   Anthony Roberts|       Little-Spencer|             Aetna|   40325.07139|        306|     Emergency|    2021-05-11| Penici
llin|    Abnormal|
|Mrs. Caroline Far...| 23|Female|        O-|     Hypertension|       2019-06-09|    William Miller|            Rose Inc|          Medicare|    6185.90353|        126|     Emergency|    2019-06-26|Paracet
amol|Inconclusive|
|  Christina Williams| 85|Female|        A+|         Diabetes|       2021-11-29|     Laura Roberts|Malone, Thompson ...|             Aetna|    4835.94565|        444|      Elective|    2021-12-14|    Asp
irin|Inconclusive|
|        William Page| 72|Female|        A+|         Diabetes|       2021-07-29|      James Carney|   Richardson-Powell|             Cigna|   13669.37774|        492|      Elective|    2021-08-14|    Asp
irin|      Normal|
|    Michael Bradshaw| 65|Female|       AB+|           Cancer|       2021-06-05|    Katherine Lowe|     Castaneda-Hardy|             Cigna|   10342.83612|        120|     Emergency|    2021-06-25|  Ibupr
ofen|Inconclusive|
|        Brian Dorsey| 32|Female|        O+|        Arthritis|       2021-08-07|      Curtis Smith|          Burch-White|             Aetna|   27174.94291|        492|     Emergency|    2021-08-14|    Asp
irin|Inconclusive|
```

QUERY THE AVERAGE BILLING AMOUNT FOR EACH ADMISSION TYPE

- INITIALIZE A “SPARKSESSION”
- LOAD THE DATASET INTO PYSPARK
- REGISTER THE DATAFRAME AS A TEMPORARY SQL TABLE
- SHOW OUPUT OF QUERY

```python
from pyspark.sql import SparkSession

# Initialize a Spark session
spark = SparkSession.builder.getOrCreate()

# Assuming 'healthcare_data.csv' is your CSV file
csv_file_path = "C:/Users/91628/Desktop/NoSQL PROJECT'/cleaned_dataset.csv"

# Read CSV data into a PySpark DataFrame
csv_data_frame = spark.read.csv(csv_file_path, header=True, inferSchema=True)

# Register the DataFrame as a temporary SQL table
csv_data_frame.createOrReplaceTempView("healthcare_table")

# SQL Query to find the average billing amount for each admission type
query = """
    SELECT `Admission Type`, AVG(`Billing Amount`) AS avg_billing_amount
    FROM healthcare_table
    GROUP BY `Admission Type`
"""
result = spark.sql(query)
result.show()
```

PROBLEMS OUTPUT DEBUG CONSOLE TERMINAL PORTS

```
Setting default log level to "WARN".
To adjust logging level use sc.setLogLevel(newLevel). For SparkR, use setLogLevel(newLevel).
+--------------+------------------+
|Admission Type|avg_billing_amount|
+--------------+------------------+
|      Elective| 25878.63010234268|
|     Emergency|24703.655081673987|
|        Urgent| 25987.10712893025|
+--------------+------------------+

PS C:\Users\91628\Desktop\NoSQL PROJECT'> SUCCESS: The process with PID 25920 (child process of PID 27000) has been terminated.
SUCCESS: The process with PID 27000 (child process of PID 23936) has been terminated.
SUCCESS: The process with PID 23936 (child process of PID 12716) has been terminated.
```

QUERY TO ANALYZE THE COST PAID BY PATIENTS FOR DIFFERENT AILMENTS

- INITIALIZE A “SPARKSESSION”
- LOAD THE DATASET INTO PYSPARK
- REGISTER THE DATAFRAME AS A TEMPORARY SQL TABLE
- SHOW OUPUT OF QUERY

```
from pyspark.sql import SparkSession

# Initialize a Spark session
spark = SparkSession.builder.getOrCreate()

# Assuming 'healthcare_data.csv' is your CSV file
csv_file_path = "C:/Users/91628/Desktop/NoSQL PROJECT'/cleaned_dataset.csv"

# Read CSV data into a PySpark DataFrame
csv_data_frame = spark.read.csv(csv_file_path, header=True, inferSchema=True)

# Register the DataFrame as a temporary SQL table
csv_data_frame.createOrReplaceTempView("healthcare_table")

query="""
SELECT
    `Medical Condition`,
    COUNT(*) AS total_patients,
    AVG(`Billing Amount`) AS avg_billing_amount,
    MAX(`Billing Amount`) AS max_billing_amount,
    MIN(`Billing Amount`) AS min_billing_amount,
    PERCENTILE_CONT(0.5) WITHIN GROUP (ORDER BY `Billing Amount`) AS median_billing_amount
FROM
    healthcare_table
WHERE
    `Medical Condition` IS NOT NULL -- Filter out rows without medical condition information
GROUP BY
    `Medical Condition`
ORDER BY
    avg_billing_amount DESC; -- Order by average billing amount in descending order
"""
Result = spark.sql(query)
Result.show()
```

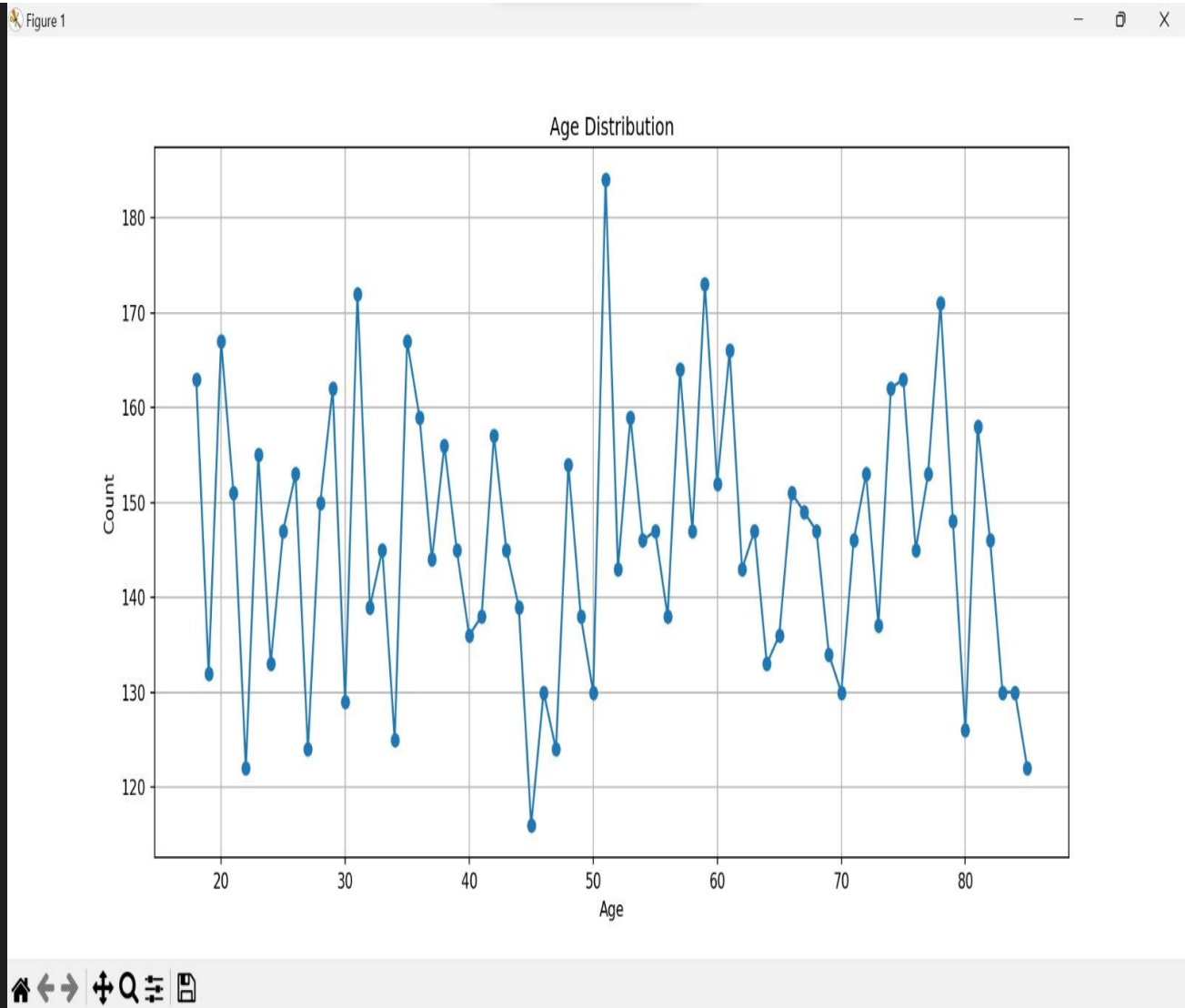
PROBLEMS OUTPUT DEBUG CONSOLE TERMINAL PORTS

```
PS C:\Users\91628\Desktop\NoSQL PROJECT'> python -u "c:\Users\91628\Desktop\NoSQL PROJECT'\Project.py"
Setting default log level to "WARN".
To adjust logging level use sc.setLogLevel(newLevel). For SparkR, use setLogLevel(newLevel).
+-----------------+--------------+------------------+------------------+------------------+--------------------+
|Medical Condition|total_patients|avg_billing_amount|max_billing_amount|min_billing_amount|median_billing_amount|
+-----------------+--------------+------------------+------------------+------------------+--------------------+
|         Diabetes|          1608| 26068.46606168724|       49954.96833|       1071.456127|         26141.25889|
|          Obesity|          1621| 25739.19701777179|       49974.16046|       1000.180837|         25369.47637|
|           Cancer|          1690|25512.552505905907|       49994.98474|        1020.33779|          25474.1011|
|           Asthma|          1695|25416.424132660733|       49974.29914|       1032.263087|         25084.61065|
|        Arthritis|          1636|25234.245521301942|       49985.97307|       1009.417327|   24760.975010000002|
|     Hypertension|          1676|25175.053821493417|       49995.90228|       1084.422303|         24920.455175|
+-----------------+--------------+------------------+------------------+------------------+--------------------+

PS C:\Users\91628\Desktop\NoSQL PROJECT'> SUCCESS: The process with PID 10708 (child process of PID 27160) has been terminated.
SUCCESS: The process with PID 27160 (child process of PID 9756) has been terminated.
SUCCESS: The process with PID 9756 (child process of PID 29028) has been terminated.
```

DATA VISUALIZATION USING PYSPARK

CALCULATE THE AGE DISTRIBUTION

```python
import matplotlib.pyplot as plt
from pyspark.sql import SparkSession
from pyspark.sql.functions import col

# Calculate the age distribution
age_distribution = csv_data_frame.groupBy("age").count().orderBy("age")

# Show the results
age_distribution.show(truncate=False)

# Convert PySpark DataFrame to Pandas DataFrame for plotting
age_distribution_pandas = age_distribution.toPandas()

# Plot the line graph
plt.figure(figsize=(10, 6))
plt.plot(age_distribution_pandas['age'], age_distribution_pandas['count'], marker='o')
plt.title('Age Distribution')
plt.xlabel('Age')
plt.ylabel('Count')
plt.grid(True)
plt.show()
```



DATA INSIGHTS FOR FUTURE

From predictive analysis, it can be seen that count of males and females is declining towards 2028. Also it is predicted that in next 5 year percent of male patients will be more as compared to female patients.

INSIGHTS ON HYPOTHESIS

After analysis we concluded that we have to reject our hypothesis discussed earlier as data shows that count of cancer patients has decreased over years as well as expenses had also declined.

CONCLUSION

- People dealing with hypertension (high blood pressure), end up spending the most on hospital bills, while those with obesity end up spending the least.
- Urgent medical cases turn out to be the most expensive on average, while surprisingly, emergency situations results in the lowest average cost of patients.
- Furthermore, our research extends beyond expenses, revealing that penicillin medication is widely prescribed by doctors.
- Notably, there is a correlation between individuals with AB- blood group exhibit the highest number of medical condition, as inferred from our test results.

THANK YOU

FOR LISTENING AND YOUR PATIENCE