Lab Work 4: Extraction, Cleansing, Loading and Transformation of Excel Data from Website in Local SQL Server in Monthly Basis

Objective:

This lab aims to implement an ETL pipeline for extracting, cleaning, and loading monthly banking statistics from Excel into a SQL Server database, followed by data validation using SQL queries in SSMS. The objectives include ensuring data accuracy and establishing a reliable process for monthly financial reporting.

Steps:

1. Download the Excel File

- The provided URL was visited and the Excel file was manually downloaded for the latest monthly statistics.
  https://www.nrb.org.np/category/monthly-statistics/?department=bfr

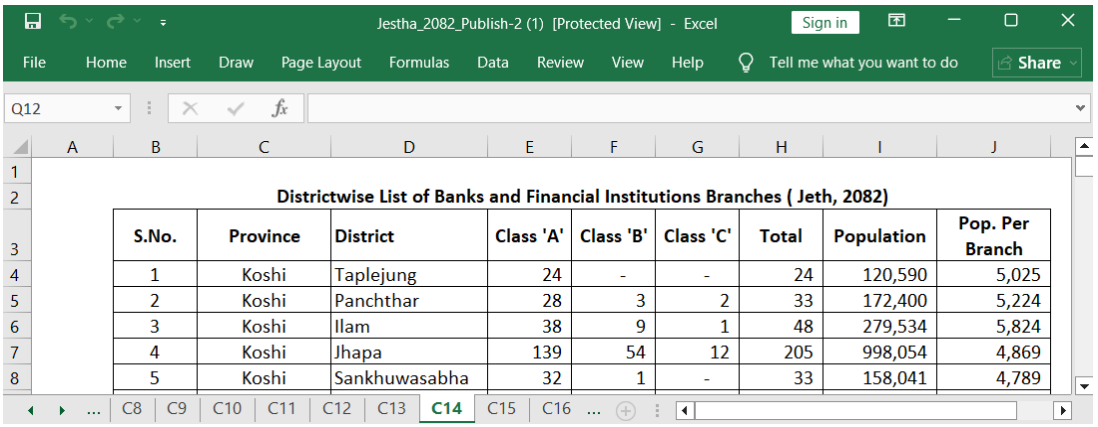
2. Install Required Python Libraries

- The following libraries were installed in the python environment:
  `pip install pandas sqlalchemy pyodbc openpyxl`

```
PS D:\Aarchi_022bim003> pip install pandas sqlalchemy pyodbc openpyxl
Defaulting to user installation because normal site-packages is not writeable
Requirement already satisfied: pandas in c:\users\dell's\appdata\local\packages\pythonsoftwarefoundation.python.3.13
ocal-packages\python313\site-packages (2.3.0)
Collecting sqlalchemy
  Downloading sqlalchemy-2.0.41-cp313-cp313-win_amd64.whl.metadata (9.8 kB)
Collecting pyodbc
  Downloading pyodbc-5.2.0-cp313-cp313-win_amd64.whl.metadata (2.8 kB)
Collecting openpyxl
  Downloading openpyxl-3.1.5-py2.py3-none-any.whl.metadata (2.5 kB)
```

3. Extract the Excel file and Perform Data Cleansing

- The **C14** Sheet of the 'Jestha_2082_Publish-2.xlsx' file was extracted into a new 'Monthly_statistics.xlsx' file.

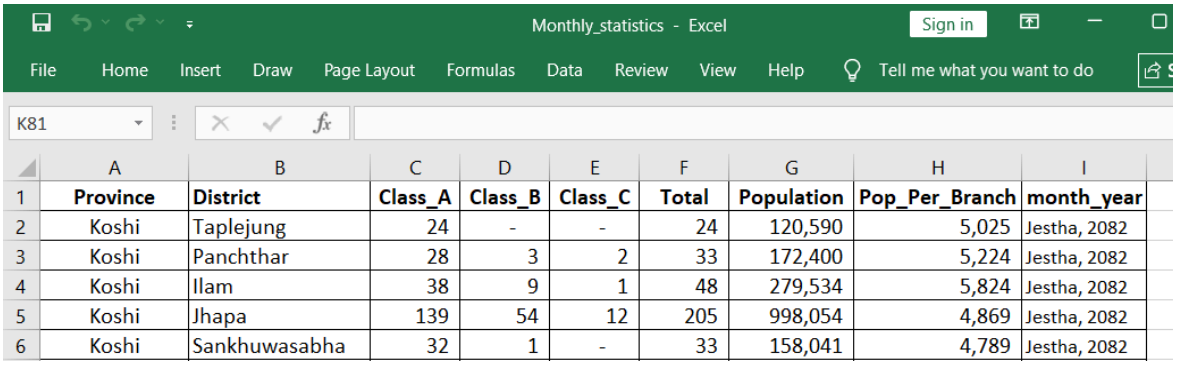


Jestha_2082_Publish-2 (1) [Protected View] - Excel

Districtwise List of Banks and Financial Institutions Branches (Jeth, 2082)

S.No.	Province	District	Class 'A'	Class 'B'	Class 'C'	Total	Population	Pop. Per Branch
1	Koshi	Taplejung	24	-	-	24	120,590	5,025
2	Koshi	Panchthar	28	3	2	33	172,400	5,224
3	Koshi	Ilam	38	9	1	48	279,534	5,824
4	Koshi	Jhapa	139	54	12	205	998,054	4,869
5	Koshi	Sankhuwasabha	32	1	-	33	158,041	4,789

- The data cleaning process was performed by first removing the redundant 'S.No.' column and eliminating the summary 'Total' rows to focus solely on district-level data. The column names were standardized by replacing special characters and whitespaces with underscores (e.g., 'Class 'A'' was converted to 'class_a') to ensure SQL compatibility. Additionally, the dataset was enriched by adding a 'month_year' column containing 'Jestha, 2082' for each record, enabling proper temporal tracking of the banking statistics.



Monthly_statistics - Excel

Province	District	Class_A	Class_B	Class_C	Total	Population	Pop_Per_Branch	month_year
Koshi	Taplejung	24	-	-	24	120,590	5,025	Jestha, 2082
Koshi	Panchthar	28	3	2	33	172,400	5,224	Jestha, 2082
Koshi	Ilam	38	9	1	48	279,534	5,824	Jestha, 2082
Koshi	Jhapa	139	54	12	205	998,054	4,869	Jestha, 2082
Koshi	Sankhuwasabha	32	1	-	33	158,041	4,789	Jestha, 2082

4. Code Execution & Database Upload Process

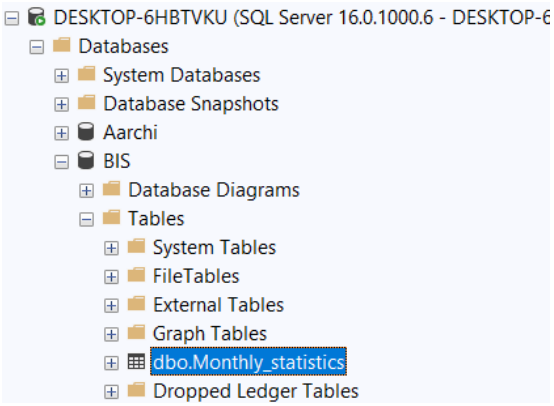
- **Script Execution:** The Python script connects to the BIS database in SQL Server using SQLAlchemy and pyodbc, then processes all Excel/CSV files in the specified directory. It reads each file into a Pandas DataFrame, cleanses the data by removing commas from numerical values, and prepares it for database insertion.

- **Database Loading:** Using df.to_sql(), the script dynamically uploads each file's data to a corresponding table in SQL Server (named after the source file). The if_exists='append' parameter ensures monthly data accumulates in the same table, while the script logs successful uploads for verification.

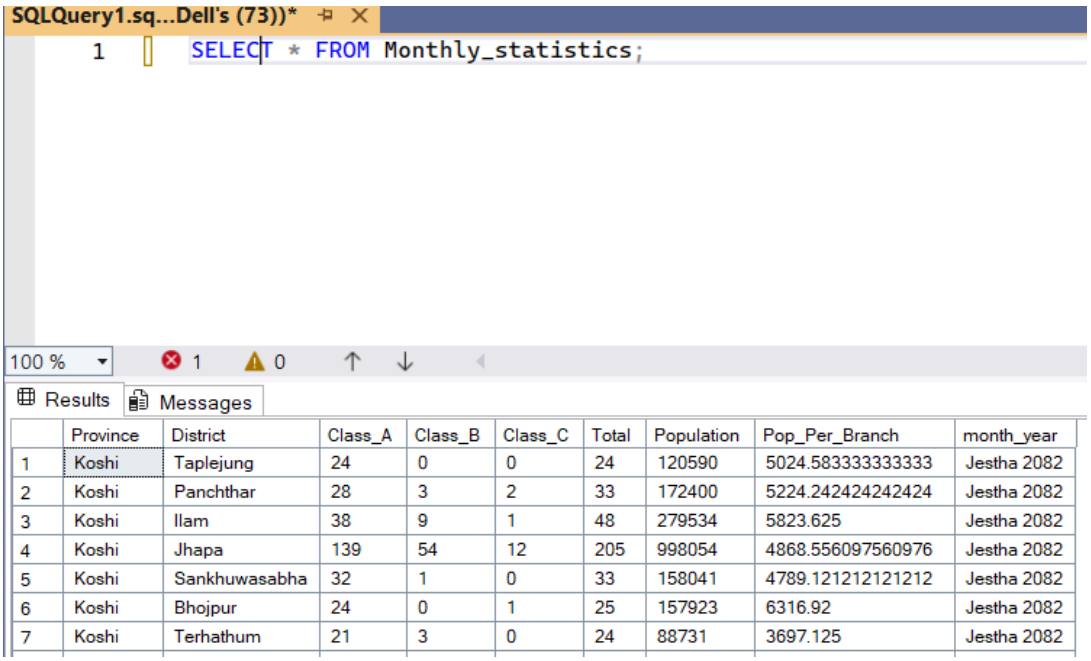
```
PS D:\Aarchi_022bim003\Lab_4> python -u "d:\Aarchi_022bim003\Lab_4\Lab_4.py"
==========================
CONNECTION SUCCESSFUL
==========================
Importing file: D:\Aarchi_022bim003\Lab_4\Monthly_statistics.xlsx
Number of records: 77
First few rows:
  Province       District Class_A Class_B Class_C Total Population     Pop_Per_Branch   month_year
0    Koshi      Taplejung      24       0       0    24     120590  5024.583333333333  Jestha 2082
1    Koshi      Panchthar      28       3       2    33     172400  5224.242424242424  Jestha 2082
2    Koshi           Ilam      38       9       1    48     279534          5823.625  Jestha 2082
3    Koshi          Jhapa     139      54      12   205     998054  4868.556097560976  Jestha 2082
4    Koshi  Sankhuwasabha      32       1       0    33     158041  4789.121212121212  Jestha 2082
File Monthly_statistics.xlsx imported successfully into table 'Monthly_statistics'.
==========================
FILES IMPORTED SUCCESSFULLY
==========================
```

5. Verify Database Upload

- The successful upload of the cleaned data to the monthly_statistics table in the 'BIS' database in Microsoft SQL Server Management Studio (SSMS) was verified through SQL query validation after executing the ETL process, ensuring data integrity and completeness.



- The following image shows the successfully executed result of the SQL query mentioned above Microsoft SQL Server Management Studio (SSMS), displaying data from the monthly_statistics table.



	Province	District	Class_A	Class_B	Class_C	Total	Population	Pop_Per_Branch	month_year
1	Koshi	Taplejung	24	0	0	24	120590	5024.583333333333	Jestha 2082
2	Koshi	Panchthar	28	3	2	33	172400	5224.242424242424	Jestha 2082
3	Koshi	Ilam	38	9	1	48	279534	5823.625	Jestha 2082
4	Koshi	Jhapa	139	54	12	205	998054	4868.556097560976	Jestha 2082
5	Koshi	Sankhuwasabha	32	1	0	33	158041	4789.121212121212	Jestha 2082
6	Koshi	Bhojpur	24	0	1	25	157923	6316.92	Jestha 2082
7	Koshi	Terhathum	21	3	0	24	88731	3697.125	Jestha 2082

Conclusion:

The key takeaways from this lab include the following important aspects:

1. **Data Integration**: Extract, clean, and upload Excel data into SQL Server efficiently using Python.
2. **Automation & Scheduling**: Automate monthly data import tasks with dynamic scripting and scheduling tools.
3. **ETL Proficiency**: Develop foundational ETL skills for structured data handling, storage, and analysis.