Intelligent Systems Engineering Department
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Advanced DataBase Labs
Third Year Semester 6
Lab 7

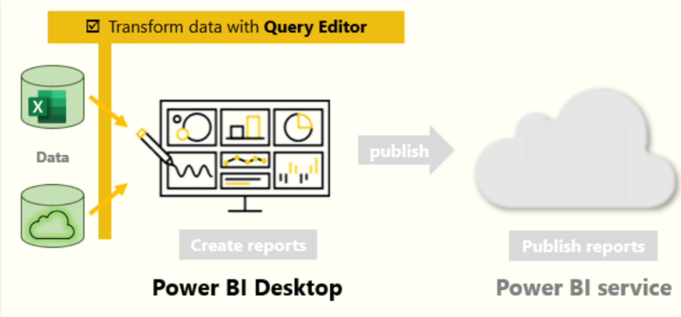
Power BI: Integration, ETL, Queries, Building Blocks

In *PowerBI* data *integration* means the authorization given to users to *bring* together various data sources, *transform* and *prepare* the data for *analysis*, and create insightful *visualizations* and *reports* to conduct better decision-making. In this lab, we will focus on *ETL* and *Queries*, as well as *Building blocks (i.e., visuals, reports, and dashboards)*.
More information about those elements on: https://bit.ly/3JKDJT8.

1 Useful Notions

(a) ETL

i) *PowerBI* proposes two main methods for performing data *integration and ETL (Extract, Transform, Load)*, which are: *Power Query* (A built-in *ETL* tool within *PowerBI Desktop* and the *PowerBI service*), and *Dataflows*(the newer feature, that enables to construct reusable dataflow, essentially created and managed in the *PowerBI service*);

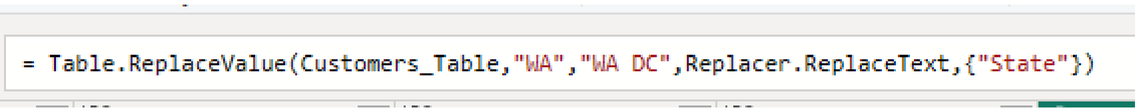


ii) The known workflow for using *Power Query for ETL* is the following:

1- **Get data source.** *Power Query* supports a wide range of data sources (The work of the previous Lab);

2- **Extract the data**. Select the tables or data to be imported (The work of the previous Lab);

3- **Transform the data.** At this phase, the data will be cleaned, shaped, and manipulated to meet the analysis needs. Power Query offers a variety of transformation functions, such as filtering, renaming columns, splitting columns, merging tables, and creating calculations. To reach *Power Query Editor*, select *Transform data* from the *Home tab.* Once *Power Query Editor* loads information about the data, that can be shaped.
Example.
Method I: *Replace Values Function*, **(1)** Select the Column to choose the type, **(2)** Go to Transform Tab, **(3)** Replace Values, **(4)** Value To Find, **(5)**Replace With, and Click "OK"to apply the replacement.
Method II. As the following code:



```
= Table.ReplaceValue(Customers_Table,"WA","WA DC",Replacer.ReplaceText,{"State"})
```

Advanced Editor. To set up the advanced editor: select *View* from the ribbon, then select *Advanced Editor*. A window emerges, showing the code generated for the selected query. the code editing can be performed directly in the *Advanced Editor window*. To close the window, select the *Done* or *Cancel* button.

4- Load the data. Once the transformations are completed, the data can be loaded into *PowerBI* model. This creates the dataset to be used to build reports and visualizations. Within the *Power Query Editor*, select *Close & Apply* to apply the changes and close the editor.

(b) **Queries**

i) **Write an SQL statement**. In *PowerBI*, writing *SQL queries* directly within the tool to retrieve data from different sources is unattainable. Instead, *PowerBI* uses *SQL* to establish connections in the databases and import the necessary data. An overview of how this process generally works is as follows:

1- *Get Data.* It opens a window to connect to different data sources;

2- *SQL Server and Specifying Connection Details;*

3- *Build the SQL Query.* Options will appear *Basic Mode (Recommended for Beginners)* or Advanced Mode.

On the other hand, *SQL* itself is not presently used to *query local XLSX files*, therefore, *PowerBI* offers different ways to achieve similar functionality in *Power Query.*

ii) **DAX Queries**. Is *Data Analysis Expressions (DAX).* It was introduced in *November 2023.* It is a formula language employed in Power BI. Which is a *business analytics* tool created by *Microsoft.* DAX allows users to build powerful *calculations and expressions* to *manipulate and analyze* data. Some of the benefits of Using the *DAX Query View*: Improved Efficiency, Reduced Errors, Easier Debugging, Centralized Management,...

DAX formulas include *functions, operators, and values* to perform advanced calculations and queries on data in related tables and columns in tabular data models.

Important Remark

While SQL and DAX do not directly interact with each other, they can be used together in the data analysis process. For example, SQL is used to extract data from a database and then import it into a tool like PowerBI. Once the data is in PowerBI, it is possible to employ DAX to analyze the data, perform calculations, and create visualizations. This allows for a seamless integration of both SQL and DAX in the data analysis workflow.

(c) **Building blocks**

i) **Report**.We can add Visuals and text From the ribbon *Inset*, where we can find: Visual, AI Visual, Elements (Text),...;

ii) **Visuals.** After adding a visual, we can navigate to the right pane, where we will find more options like: *Format Visual* if we want to make some changes on the graphs regarding scaling,...

iii) **Buttons.** In *PowerBI* buttons can be added for simple operations and options from the ribbon *Inset.* We can choose the type of button to use. On the right pan, we will find *Format Button* if we want to explore more functions. To make the button clickable, we can turn *on* the *Action* feature. From the same ribbon, we can add *Images.*

iv) **Sharing a Report.** We can share *PowerBI Desktop* to the *PowerBI service.* On the *Home tab* on the ribbon, select *Publish.*

v) **Dashboards.** We can add several objects to the dashboard as well, like images, videos,...

vi) **Publish.** Once everything is well organized, the work is ready to publish to the Power BI service. On the *Home ribbon*on the Power BI Desktop, select *Publish.*

vii) **Key differences between a Report and a Dashboard in PowerBI**. A *report* is a more in-depth analysis, with multiple pages, and interactive visuals between each other. A dashboard is a bit different since it is a high-level sort of report, a one-page format on *PowerBI service*, with non-interactive visuals, only important metrics.

② Lab Work

i) Apply ETL using Power Query on the DB.

ii) Make sure that relationships of the model are created.

iii) Within the report part, create an *Introduction* page by presenting some information such as *Your Name, and description of the db*.... Rename the other pages (Introduction, Graphes,...)

iv) Using a Map create the following visual: Cookie shipped by State, **add a title**, and a use a Pie chart, **add a title**. What do you notice between the Map and the Pie chart, **Explain.**

v) Add more visuals to be able to give more insights on the organization activities: Number of customers by state (Pie), Cookie shipped by customers, Date of order (*Use each item of date from the hierarchy in an independent chart*) by customers & Orders (Histogram / Bar chart), what do you notice with this one. The revenue by city (Histogram / Bar chart),**add a title**.

vi) Navigate more in the Visualization section within the Axes pane. In a new page named *Other Calculations*, Do some modifications regarding the calculations within the previous visuals by calculating the *Average, Min, Max, Counts.* For Pie chart (Cookie shipped by State), and Bar chart (revenue by city).

vii) Create another bar chart with Cookie shipped, cost, and revenue By state on an independent page named *Measures Calculation*, and try the following measures: *Sum, Average, Min, Max, Counts*, in dependent bar charts.

viii) Navigate in *DAX* part. What do you see? **Try the quick queries. What do you notice? Try to understand and explain it.**

ix) Explain from *DAX* code how to calculate: Totale, Average.

x) Using the builtin *Order by* function in *DAX* : Order the table *Order* by Revenue and by Cost, in two different queries. **Rename the queries.**

xi) Using the builtin *Filter()* function in*DAX* : Filter Data Based on the Condition: Minimum value of the *Ruevnue* from table *Order* is less than (750 $). **Rename the query.**

xii) Using *DAX* : Calculate a discount of (10%) on the column *Cost* in the table *order*, and add the new columns called *"Discount"*, and *"Discounted Cost"* within theold table.**Rename the query.**

xiii) Add buttons, go left, go right, where needed. Add some images.

xiv) Create an interactive *Q & A* on a new page and name it, for: Number of States and cities, Max/ Min/ Avr/ Sum Cost, Revenue,....

③ Homework

By the end of each Lab, a report should be done, that contains all the details of the elaborate work during the Lab session. The report is going to be submitted later on. **You can work in groups of three maximum**. **Adding more features to your final report is considered.**