**Power BI Assignment**

1. What is Power BI, and how does it differ from Excel?

* Power BI is a Business Analytics Tool developed by Microsoft that allows users to interact with Various sources of data, transform and model the data, and create Interactive dashboards and Reports. It helps the organization to make data-driven Decisions throughout the powerful visualization

HOW POWER BI DIFFERS FROM EXCEL

|  |  |  |
| --- | --- | --- |
| Feature | Power Bi | Excel |
| Purpose | Data Visualization and Business Intelligence | Data Entry, cleaning, calculation, and Analysis |
| Data Handling | Designed to work with large datasets and data models | Slower with the large dataset |
| Visualization | Interactive Dashboards with rich visuals | Basic charts and pivot tables |
| Data Source | We can connect it to many cloud platforms | Mostly file-based and Manual Connection |
| DAX | Uses DAX for advanced calculations | It is also used DAX but limited Scope |

1. Explain the concept of data modeling in Power BI.

* Data Modeling in power BI is the process of Connection multiple tables data and organize it to create a structured , logical and Efficient data model that supprts the analysis and reporting
* It involves Creating Relationships between tables , defining calculated masure columns and using DAX (Data Analysis Expressions) to perform the advance Calculations.

1. **What are the different types of connections available in Power BI?**

* **1) Import Mode**:
  1. Data is imported and stored in Power BI’s memory.
  2. Offers fast performance and full modeling features.
  3. Requires manual or scheduled refresh.

**2) Direct Query Mode**:

* 1. Data is not stored; queries run live against the data source.
  2. Enables real-time reporting but may be slower.
  3. Limited modeling and DAX functionality.

**3) Live Connection**:

* 1. Used with SQL Server Analysis Services (SSAS) or Azure Analysis Services.
  2. No data is imported; the external model is used directly.
  3. No custom modeling in Power BI.

**4) Composite Model**:

* 1. Combines Import and DirectQuery in a single report.
  2. Offers flexibility, partial real-time support, and better performance control.

1. **How do you handle data transformation in Power BI?**

* Data transformation in Power BI is mainly done using **Power Query Editor**, where users can clean, reshape, and prepare data before loading it into the model. Key steps include:

1. **Removing/Filtering Rows** – Eliminate unnecessary or blank rows using filters.
2. **Changing Data Types** – Ensure columns have correct types (e.g., Date, Text, Number).
3. **Splitting or Merging Columns** – Split columns by delimiter or merge multiple columns.
4. **Pivoting/Unpivoting** – Restructure tables to suit analysis needs.
5. **Creating Custom Columns** – Use formulas (M language) to create calculated columns.

After transformation, the clean data is loaded into the Power BI model for analysis and visualization.

1. **What is DAX (Data Analysis Expressions) and why is it important in Power BI?**

* **DAX (Data Analysis Expressions)** is a **formula language** used in Power BI to perform calculations on data models. It is similar to Excel formulas but designed for **relational data** and **data analysis**.

**🔹 Importance of DAX in Power BI:**

1. **Creates Calculated Columns and Measures** – Used to derive new insights like profit, growth %, etc.
2. **Enables Complex Calculations** – Supports functions like CALCULATE, SUMX, FILTER, RELATED, etc.
3. **Improves Interactivity** – Helps create dynamic visuals that respond to filters and slicers.
4. **Enhances Data Modeling** – Allows for time intelligence (e.g., YTD, QTD, MoM), conditional logic, and context-aware calculations.

| **Feature** | **Calculated Column** | **Measure** |
| --- | --- | --- |
| **Definition** | A new column created using DAX and added to a table. | A calculation created using DAX, evaluated at query time. |
| **Storage** | Stored in the data model; consumes memory. | Not stored; computed on-the-fly when used in a visual. |
| **Evaluation Context** | Works on **row context** (evaluated for each row). | Works on **filter/context** (aggregated based on filters). |
| **Use Case** | Used in filters, slicers, and relationships. | Used for KPIs like totals, averages, percentages. |
| **Example** | Profit = Sales[Revenue] - Sales[Cost] | Total Sales = SUM(Sales[Amount]) |

1. **Can you explain the difference between calculated columns and measures in Power BI?**

**7. How do you handle relationships between tables in Power BI?**

* Define relationships in the **Model view** by dragging a field from one table onto the matching field in another.
* Choose **Cardinality** (One-to-Many, Many-to-One, Many-to-Many) based on your data.
* Set **Cross filter direction** (Single or Both) to control how filters flow.
* Mark a table as a **Date table** when using time-intelligence.
* Validate relationships using the **Manage Relationships** dialog and the **Model view** diagram.

**8. What is the purpose of a Power BI Gateway?**

* **Bridges** between on-premises data sources and the Power BI Service in the cloud.
* **Securely** transfers data for **scheduled refresh** or **DirectQuery/Live** connections.
* Two modes:
  + **Personal** (single-user, limited).
  + **Enterprise** (multi-user, high availability).
* Ensures on-prem data never gets stored outside your network except in the Power BI Service.

**9. How can you schedule data refresh in Power BI Service?**

* In the Power BI Service, navigate to the **dataset’s Settings**.
* Under **Scheduled refresh**, enable it and set:
  + **Frequency** (daily, weekly).
  + **Time zone** and **refresh times** (up to 8/day for Pro, 48/day for Premium).
* Provide **credentials** and select the appropriate **gateway** (if on-prem).
* Monitor refresh history and failures in the **Refresh history** pane.

**10. Explain the concept of row-level security in Power BI.**

* RLS **restricts data** at the row level based on user roles.
* Define **roles** in Power BI Desktop with **DAX filter expressions** (e.g., [Region] = "APAC").
* Publish the model and **assign users** or groups to each role in the Power BI Service.
* At runtime, users only see data rows that match their role’s filter.

**11. What is the Power BI Desktop and how does it differ from Power BI Service?**

* **Power BI Desktop**:
  + A **Windows application** for **data preparation**, modeling, DAX calculations, and report authoring.
  + Free to install; used by report authors.
* **Power BI Service**:
  + The **cloud platform** (app.powerbi.com) for **sharing**, collaboration, dashboards, app workspaces, and refresh scheduling.
  + Requires a Pro or Premium license for sharing.

**12. Explain the concept of DirectQuery in Power BI.**

* **No data imported**; Power BI sends **live queries** to the source every time you interact.
* Data remains in the source system—ideal for **real-time** reporting.
* Performance depends on the source’s query capabilities.
* Supports limited transformations and DAX; some features (e.g., Quick measures) are restricted.

**13. What are Power BI templates and how are they useful?**

* **.PBIT files** that include:
  + **Report layout**, **queries**, **model**, and **measures**, but **no data**.
* Users open a template and **point it to their own data**, then Power BI imports and applies the prebuilt model.
* Speeds up report standardization across projects and teams.

**14. How do you handle incremental data refresh in Power BI?**

* Configure in **Power BI Desktop** under **Table Properties** by specifying:
  + **RangeStart** and **RangeEnd** parameters (date/time).
  + **Incremental refresh policy**: how many periods to keep and refresh.
* Publish to a **Premium** or **Premium per User** workspace.
* Power BI only loads new or changed data partitions, improving performance for large datasets.

**15. What is the role of Power Query in Power BI?**

* **Power Query Editor** is where you **connect**, **cleanse**, **transform**, and **shape** raw data.
* Uses the **M language** under the hood.
* Steps are recorded as a **query**, which runs each time you refresh.
* Ensures your model contains **well-structured** and **consistent** data for analysis.

**16. Explain the difference between calculated columns and calculated tables in Power BI.**

* **Calculated Column**:
  + Defined in an existing table with a DAX expression.
  + Computed row-by-row and stored in the model.
  + Used for filtering, relationships, or slicers.
* **Calculated Table**:
  + Defined by a DAX query that returns a table.
  + Materializes a new table in the model.
  + Useful for dimensional tables, summarizations, or disconnected tables for slicers.

**17. How do you create custom visuals in Power BI?**

* Use the **Power BI Visuals SDK** with **TypeScript** and **D3.js**.
* Create a visual project with the **pbiviz** command-line tool.
* Develop your visual code, define capabilities (data roles, properties).
* Package as a **.pbiviz** file and import into Power BI Desktop.
* Alternatively, use **AppSource** for prebuilt community visuals.

**18. What are the best practices for optimizing performance in Power BI?**

* **Modeling**:
  + Star schema design.
  + Hide unused columns, disable auto date/time.
* **Data volume**:
  + Import only necessary columns and rows.
  + Use incremental refresh.
* **DAX**:
  + Prefer measures over calculated columns.
  + Use variables, avoid row-by-row functions like FILTER inside SUMX.
* **Visuals**:
  + Limit the number of visuals per page.
  + Avoid complex custom visuals on every report page.
* **Storage mode**:
  + Use Import for heavy aggregation; DirectQuery for real-time needs.

**19. How can you integrate Power BI with other Microsoft products like Azure and Office 365?**

* **Azure Synapse / SQL Data Warehouse**: Connect via Import or DirectQuery for enterprise data.
* **Azure Analysis Services / SSAS**: Use Live Connection for corporate models.
* **Power Automate**: Trigger workflows from Power BI alerts.
* **Teams & SharePoint**: Embed reports in channels or pages.
* **Office 365**: Export to Excel, embed in PowerPoint, or use Power BI Publisher for Excel.

**20. Explain the concept of aggregations in Power BI.**

* Pre-aggregated tables that store summarized data at a higher grain.
* Power BI automatically routes queries for summarized visuals to the aggregation table.
* Reduces query time on large fact tables.
* Defined in the **Manage Aggregations** dialog and requires a **composite model**.

**21. How do you handle error handling and data quality in Power BI?**

* In Power Query:
  + Use **“Replace Errors”**, **“Keep Errors”**, and **conditional columns** for invalid data.
  + Apply **data profiling** (column quality, distribution) to identify issues.
* In the model:
  + Use DAX functions like IFERROR, ISBLANK, and ERROR() in measures.
* Validate source data with **queries** and **unit tests** (sample checks).

**22. What is the purpose of Power BI Embedded and when would you use it?**

* A set of **APIs and Azure services** to embed Power BI reports and dashboards into **custom applications**.
* Use when you need to provide analytics to **external customers** without requiring them to have Power BI licenses.
* Supports **white-labeling**, row-level security per user, and full **REST API** control over reports.