**ASSIGNMENT**

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

Power BI is a business intelligence tool by Microsoft used for data visualization, reporting, and analytics.  
Key differences from Excel:

* Power BI is designed for handling large datasets more efficiently.
* It supports advanced interactive visualizations and dashboards.
* Power BI has built-in data modeling and relationships, while Excel requires more manual effort.
* Power BI automates data refresh and supports real-time dashboards.

**2. Explain the concept of data modeling in Power BI.**

Data modeling involves structuring your data by creating relationships between tables using primary and foreign keys, defining calculated columns/measures, and using normalization principles. This enables accurate aggregations, relationships, and better performance in report visuals.

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

* Import Mode: Loads data into Power BI; faster performance.
* DirectQuery: Queries data directly from the source without importing it; suitable for large datasets.
* Live Connection: Similar to DirectQuery but used for SSAS (SQL Server Analysis Services) models.
* Hybrid Mode: Combination of Import and DirectQuery for different tables in one model.

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

Data transformation is handled in Power Query Editor using:

* Removing/renaming columns
* Filtering rows
* Merging/appending tables
* Changing data types
* Pivoting/unpivoting
* Creating custom columns using M language

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

DAX is a formula language used to create custom calculations like measures and calculated columns. It is essential for:

* Building dynamic aggregations
* Implementing time intelligence (e.g., YTD, MTD)
* Creating custom KPIs and advanced calculations

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

| **Feature** | **Calculated Column** | **Measure** |
| --- | --- | --- |
| Row-level or Aggregate | Row-level; created per row in a table | Aggregate-level; evaluated on the fly |
| Storage | Stored in the model; consumes memory | Not stored; calculated at runtime |
| Use Case | Used for filtering/slicing | Used in visuals for calculations |

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

* Relationships are created via Manage Relationships in the model view.
* They are typically one-to-many (1:\*), many-to-one, or many-to-many.
* You can define cross-filtering direction (single or both).
* Use composite models for mixed storage types.

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

Power BI Gateway enables secure data transfer between on-premises data sources and Power BI cloud services. It allows:

* Scheduled refreshes
* Live queries to on-prem databases (e.g., SQL Server)

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

* Go to Datasets in Power BI Service.
* Click on Scheduled Refresh.
* Configure refresh frequency (daily, hourly, etc.) and credentials.
* Requires Power BI Gateway for on-prem sources.

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

Row-Level Security (RLS) restricts data access based on user roles. You define DAX filters on tables to control what data a user can see:

* Create roles and rules in Model View
* Assign roles in Power BI Service for user-specific filtering.

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

**Power BI Service?**

| **Feature** | **Power BI Desktop** | **Power BI Service** |
| --- | --- | --- |
| Type | Windows Application | Cloud-based Service |
| Usage | Data import, modeling, report building | Sharing, collaboration, and dashboards |
| Data  Transformation | Yes (Power Query) | No |
| Data Refresh | Manual | Scheduled (with Gateway support) |
| Cost | Free | Paid Pro/Premium plans available |

**12. Explain the concept of Direct Query in Power BI.**

DirectQuery allows Power BI to fetch data directly from the source in real-time, rather than importing it.

* Data is not stored in Power BI.
* Useful for large datasets.
* Slower than Import mode due to live querying.
* Limited DAX functions and transformations.

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

Power BI templates (.PBIT) are files that save the report layout, queries, and model structure without the data.  
They are useful for:

* Reusing report structures across projects.
* Sharing models without exposing data.
* Creating standardized reporting formats.

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

Incremental refresh updates only the new or changed data instead of reloading the full dataset.  
Steps:

1. Define parameters for RangeStart and RangeEnd.
2. Apply filters in Power Query.
3. Enable incremental refresh in Table settings (Power BI Desktop > Model View > Table > Incremental Refresh).

Requires Power BI Pro or Premium license and published to Power BI Service.

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

Power Query is the data transformation engine in Power BI.  
Used for:

* Connecting to multiple data sources.
* Cleaning, shaping, and combining data.
* Applying logic using M Language.
* Creating repeatable transformation steps (ETL).

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

| **Feature** | **Calculated Column** | **Calculated Table** |
| --- | --- | --- |
| Output | A new column in an existing table | A new table derived from DAX expression |
| Use Case | Row-level calculations | Filtering, summarizing, or creating new datasets |
| Storage | Takes up memory | Also consumes memory, especially for large tables |

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

1. Use existing visuals from AppSource (Marketplace).
2. Develop your own with Power BI Developer Tools (using TypeScript + D3.js).
3. Import .pbiviz file via Visualizations > Import from file.

Use custom visuals when built-in ones can't meet specific visualization needs.

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

* Use Import Mode when possible.
* Reduce column cardinality (distinct values).
* Avoid unnecessary calculated columns—prefer measures.
* Use aggregation tables for large datasets.
* Filter data early in Power Query.
* Limit visuals and complex interactions on a single page.
* Use performance analyzer and DAX Studio to monitor bottlenecks.

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

* Azure SQL / Synapse / Data Lake: Connect data sources.
* Azure ML / Cognitive Services: Embed ML insights.
* Power Automate: Automate workflows based on report triggers.
* Teams / SharePoint / Excel Online: Embed dashboards and collaborate.
* Microsoft Fabric: Unified platform integration for data and BI.

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

Aggregations optimize large datasets by summarizing data at a higher level (e.g., monthly totals instead of daily).  
:\_Power BI can automatically use aggregated tables when querying, reducing load time.  
:\_Set up in Model view by creating aggregation tables and mapping them to the detail table.

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

* Power Query: Use steps like Remove Errors, Replace Errors, or conditional columns to clean data.
* Validate data types, nulls, and duplicates.
* Log and flag unexpected values.
* Use Data Profiling (in Power Query) to analyze column distributions and quality.

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

Power BI Embedded allows developers to embed Power BI reports into custom apps or web portals.  
Use cases:

* Deliver interactive reports to external users without Power BI accounts.
* Provide analytics within SaaS apps (multi-tenant support).
* Control access via APIs and token-based authentication.