Question 1 : Define Power BI and What are the key components of the Power BI ecosystem? Briefly explain: ● Power BI Desktop ● Power BI Service ● Power BI Mobile ● Power BI Gateway
Ans- **Power BI – Definition**

Power BI is a **business analytics and data visualization tool developed by Microsoft** that helps users **connect to multiple data sources, transform data, create interactive reports and dashboards, and share insights** for better decision-making.

Key Components of the Power BI Ecosystem

1. Power BI Desktop

- A **Windows-based application** used to **create reports**.
- Allows users to:
    - Connect to different data sources (Excel, SQL Server, APIs, etc.)
    - Clean and transform data using **Power Query**
    - Create data models using **DAX**
    - Design interactive visualizations
- Reports created here are published to the Power BI Service.

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2. Power BI Service

- A **cloud-based platform (PowerBI.com)**.
- Used to:
    - Publish, share, and collaborate on reports and dashboards
    - Schedule **data refreshes**
    - Create dashboards from reports
    - Manage workspaces and access permissions
- Enables collaboration across teams and organizations.

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3. Power BI Mobile

- Mobile apps available for **Android, iOS, and Windows**.
- Allows users to:
    - View and interact with reports and dashboards on mobile devices
    - Receive real-time alerts
    - Access insights anytime, anywhere
- Optimized for touch and mobile screens.

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4. Power BI Gateway

- Acts as a **bridge between on-premises data sources and Power BI Service**.
- Enables:
    - Secure data transfer without moving data to the cloud
    - Scheduled and live data refresh from local databases
- Commonly used for SQL Server, Oracle, and other on-prem systems.

Summary

Power BI combines **Desktop (report creation)**, **Service (sharing & collaboration)**, **Mobile (on-the-go access)**, and **Gateway (secure data connectivity)** to form a complete end-to-end business intelligence solution.

Question 2 : Compare the following Power BI visuals: ● Pie Chart vs Donut Chart ● Bar Chart vs Column Chart When would you prefer one over the other? Give one example for each pair.
Ans- **Comparison of Power BI Visuals**

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1. Pie Chart vs Donut Chart

Pie Chart

- Displays data as **slices of a circle**.
- Best for showing **part-to-whole relationships**.
- Works well when there are **few categories (2–5)**.
- Simple and easy to understand.

When to prefer Pie Chart:

- When you want a **quick, straightforward comparison** of proportions.

Example:

- Percentage of total sales by region (North, South, East, West).

Donut Chart

- Similar to a pie chart but with a **hole in the center**.
- Can display **additional information** (like total value) in the center.

- Visually more modern and attractive.

When to prefer Donut Chart:

- When you want to show **proportions along with a key metric** (total, KPI).

Example:

- Market share of different brands with total market size shown in the center.

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2. Bar Chart vs Column Chart

Bar Chart

- Displays data using **horizontal bars**.
- Best for **long category names**.
- Easier to compare values across many categories.

When to prefer Bar Chart:

- When category labels are long or when ranking data.

Example:

- Sales by product category with long names.

Column Chart

- Displays data using **vertical bars**.
- Best for showing **trends over time**.
- Commonly used for chronological data.

When to prefer Column Chart:

- When comparing values across **time periods** (months, years).

Example:

- Monthly revenue for a year.

Summary Table

Visual Type	Best Use Case	Example
Pie Chart	Simple part-to-whole	Sales % by region
Donut Chart	Part-to-whole with KPI	Brand market share
Bar Chart	Many/long categories	Sales by product
Column Chart	Time-based comparison	Monthly revenue

Question 3 : Explain the significance of: ● Star schema vs Snowflake schema ● Primary key vs Foreign key in relationships (Power BI) Why is cardinality important
Ans-

1. Star Schema vs Snowflake Schema

Star Schema

- Consists of a **central fact table** connected directly to **dimension tables**.
- Structure looks like a **star**.
- Dimension tables are **denormalized**.

Significance / Advantages:

- Simple and easy to understand
- Better **query performance** in Power BI
- Easier to create relationships and write DAX
- Preferred and **recommended schema in Power BI**

Example:

- FactSales connected to DimCustomer, DimProduct, DimDate

Snowflake Schema

- Dimension tables are **normalized** into multiple related tables.
- Structure looks like a **snowflake**.

Significance / Advantages:

- Reduces data redundancy
- Useful when dimensions are very large or complex

Disadvantages in Power BI:

- More relationships → complex model
- Slower performance
- Harder to maintain and write DAX

Example:

- DimProduct split into Product → Category → Subcategory tables

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2. Primary Key vs Foreign Key (in Power BI Relationships)

Primary Key

- A column that **uniquely identifies each record** in a table.
- Must contain **unique and non-null values**.
- Usually present in **dimension tables**.

Example:

- CustomerID in DimCustomer

Foreign Key

- A column that **references the primary key** of another table.
- Used to **create relationships** between tables.
- Usually present in **fact tables**.

Example:

- CustomerID in FactSales referencing DimCustomer

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3. Why Is Cardinality Important?

Cardinality defines the **type of relationship** between tables:

- One-to-One (1:1)
- One-to-Many (1:*)
- Many-to-One (*:1)
- Many-to-Many (:)

Importance of Cardinality:

- Determines **how filters flow** between tables
- Affects **accuracy of calculations**
- Impacts **model performance**
- Prevents incorrect aggregations and duplicate values

Best Practice in Power BI:

- Use **One-to-Many** relationships
  (Dimension = One, Fact = Many)

Example:

- One customer → many sales transactions

Summary

- **Star schema** is simpler and faster than snowflake schema in Power BI.
- **Primary keys** uniquely identify records; **foreign keys** connect tables.
- **Correct cardinality** ensures accurate filtering, relationships, and report results.

Question 4 : Differentiate between: ● Calculated column vs Measure Also, define Row context and Filter context with simple examples

Ans-1. Calculated Column vs Measure

Calculated Column

- Calculated **row by row**.

- Stored physically in the data model.

- Calculated **during data refresh**.

- Uses **row context**.

- Increases model size.

When to use:

- When you need a value at **row level** (e.g., category, flag, or grouping).

Example (Calculated Column):

```
Total Price = Sales[Quantity] * Sales[Unit Price]
```

Measure

- Calculated **on the fly**.

- Not stored in the data model.

- Calculated **at query time**.

- Uses **filter context**.

- More memory-efficient.

When to use:

- When you need **aggregated values** (totals, averages, KPIs).

Example (Measure):

```
Total Sales = SUM(Sales[Total Price])
```

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2. Row Context

Definition:

Row context means Power BI evaluates a formula **one row at a time**.

Where it applies:

- Calculated columns

- Iterators (SUMX, AVERAGEX)

Example:
For a calculated column:

```
Discounted Price = Sales[Price] * 0.9
```

Each row's price is evaluated independently.

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3. Filter Context

Definition:

Filter context refers to **filters applied to data** due to:

- Report filters

- Slicers

- Rows/columns in visuals

Where it applies:

- Measures

Example:

```
Total Sales = SUM(Sales[SalesAmount])
```

If a slicer filters **Year = 2024**, the measure returns total sales **only for 2024**.

Simple Comparison Table

Feature	Calculated Column	Measure
Evaluation	Row by row	Aggregated
Storage	Stored in model	Not stored
Context	Row context	Filter context
Performance	Uses memory	Faster & efficient
Best for	Row-level logic	KPIs & totals

Question 5: What is the difference between a report and a dashboard in Power BI?

Ans- Power BI Report

- A **report** is a **collection of pages** containing visuals such as charts, tables, and maps.

- Created using **Power BI Desktop**.

- Based on **one dataset**.

- Highly **interactive** (filters, slicers, drill-down, drill-through).

- Used for **detailed analysis**.

Example:

- A sales performance report with multiple pages showing region-wise, product-wise, and time-based analysis.

Power BI Dashboard

- A **dashboard** is a **single-page canvas**.

- Created only in the **Power BI Service**.

- Can combine visuals (tiles) from **multiple reports and datasets**.

- Less interactive compared to reports.

- Used for **high-level monitoring** and KPIs.

Example:

- An executive dashboard showing total sales, profit, and key KPIs at a glance.