POWER BI COURSE AGENDA

- **Power BI Introduction**
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Business Intelligence (BI) tools are a set of software applications, platforms, and solutions designed to extract, transform, and present data to support data analysis, trend identification, and strategic decision-making within an organization. These tools enable you to transform raw data into valuable insights, leading to improved decision-making, optimized operations, and the ability to stay competitive in today's data-centric markets.

1. **Data integration:** BI tools can connect to and consolidate data from multiple different sources, such as databases, spreadsheets, and cloud-based applications**.**
2. **Data Cleaning:** Removing duplicate rows, fixing errors, correcting datatypes and handling missing/null values.
3. **Data Filtering:** Filtering irrelevant data or rows based on specified condition or criteria
4. **Data transformation:** It can be as simple as removing a column or filtering rows, or as common as using the first row as a table header. There are also advanced transformation options such as merge, append, group by, pivot, and unpivot.
5. **Data visualization**: the bread- and-butter of business intelligence is its ability to represent large and often complex datasets visually to deliver insights and make trends and patterns more evident.
6. **Reporting:** the final presentation of data in a BI tool is in the form of a report or dashboard that can be delivered to key stakeholders automatically.
7. **Trend analysis:** By visualizing current and historical data, BI tools enable you to identify patterns and trends, which helps you understand market dynamics, customer behaviour, and the impact of business strategies.
8. **Power BI**: is a Business Intelligence tool that helps you to turn multiple unrelated Data source into valuable and interactive sights

OR

Power BI is a Data Visualization and Business Intelligence tool by Microsoft that converts data from different data sources to create various business intelligence reports.

Components of Power BI:

1. **Power Query:** It is one of the most important components of Power BI to transform data. Power Query helps to extract data from different data sources like Oracle, SQL, Text/CSV files, Excel, etc. and even delete data from different sources.
2. **Power Pivot:** It is used for data modelling that uses DAX (Data Analysis Expression) functions for the calculations.
3. **Power View:** You can create 250+ charts which may be like graphs, donut charts, slicers etc., that helps in presentation.
4. **Power BI Desktop:** Power Desktop is an integration tool for Power Query, Power View, and Power Pivot. It helps to create advanced queries, data models, reports and dashboards and helps in developing your BI skills for data analysis.
5. **Power Bi Service:** Used to communicate the users with each other via reports.
6. **Power Bi Mobile:** The Microsoft Power BI mobile app is a mobile version of Microsoft's business intelligence platform that lets you access and interact with your business data on the go.

Advantages of Power Bi:

- It helps build an interactable data visualization in data centres
- It allows users to transform data into visuals and share them with anyone
- It establishes a connection for Excel queries and dashboards for fast analysis
- It provides quick and accurate solutions
- It enables users to perform queries on reports using simple English words

Disadvantages of Power Bi:

- Cost Considerations
- Resource Intensive for Large Datasets
- Limited Customization of Visuals
- Dependency on Internet Connectivity
- Data Security and Compliance
- Limited Direct Data Editing

Building blocks of Power BI

The basic building blocks in Power BI are:

- Visualizations
- Datasets
- Reports
- Dashboards
- Tiles

The flow of Power BI is:

- Connect to data with Power BI Desktop.
- Transform and model data with Power BI Desktop.
- Create visualizations and reports with Power BI Desktop.
- Publish report to Power BI service.
- Distribute and manage reports in the Power BI service.

Views in Power Bi

- **Report:** You can create reports and visuals.
- **Data:** You can see the tables, measures, and other data used in the data model associated with your report, and transform the data.
- **Model:** You can see and manage the relationships among tables in your data model.

Working Principle of Power BI:

- **Data Integration:** 1st step is to extract & integrate the data from different data sources. After integration, data is converted into standard format and stored in common area called as staging area.
- **Data Processing:** Once data is assembled & integrated, it requires cleanup. So, we perform a few transformation & cleaning operations on raw data to remove redundant values etc.
- **Data Presentation:** Now data is transformed & cleaned, it is visually presented on Power BI desktop as reports, dashboards or score cards. These reports can be shared via mobile apps or web to various business users.

Different Types of Connectivity Modes:

1.Import Mode: The data is imported into Power BI and stored in a compressed in-memory column store. This method is useful when dealing with smaller data sets or when the data is updated infrequently. With Import, users can create complex data models, perform advanced calculations using the Data Analysis Expressions (DAX) language, and create reports and visualizations based on the imported data.

Note: Supports data up to 1 GB.

How Is It Used?
In Power BI, import is used to load the data from various sources such as Excel files, CSV files, databases, and cloud-based services like Microsoft Dynamics, Salesforce, and Azure. The Import method extracts data from the data source and loads it into Power BI for analysis**.**

Pros of Import

- High Performance.
- Supports All data sources
- Advanced modelling and transformation

Cons of Import

- Limited scalability
- Limited data freshness
- Limited flexibility

2.Direct Query Mode: The data stays in the source system and is queried directly by Power BI. This method is useful when dealing with large data sets or when the data is frequently updated. With Direct Query, users can create data models that span multiple tables or even multiple data sources and perform real time analysis of the data sources Since the data is not imported into Power BI, there is no need to refresh the data manually, as the data is always up to date.

Supports only few data sources like SQL Database, MySQL, Oracle, etc.,

Note: Supports data more than 1 GB

Pros of Direct Query

- Access to real-time data
- No data duplication
- More scalability

Cons of Direct Query

- Slower performance
- Complexity
- No offline access

3.Composite Mode: (Import + Direct Query) {Analysis Services}

It's a combination of Import and Direct Query Mode.

When we want high performance and have data of more than 1 GB we opt for Composite Mode.

4.Live Connection Mode: {SSAS Tabular, SSAS multi-dimensional, Azure Analysis Services, and Power BI dataset.}

- When Business Analysts collaborate with each other they go for live connection.
- Semantic Models are used to establish live connection
- Based on the Semantic Model we create our own report and publish.

Power Query Editor

- Power Query is a data transformation and data preparation engine.
- Using Power Query, you can perform the extract, transform, and load (ETL) processing of data from various sources before loading it into Power Bi.
- It allows users to clean, reshape & combine data from different sources using a user-friendly interface, helping to ensure data quality & consistency in Power Bi reports.

Handling Errors

- Proper data validation and cleaning Techniques can help to prevent errors from occurring.
- Errors can be handled by using conditional statements in DAX, such as IFERROR (), to handle possible errors in calculations or data loading.

DAX function

DAX (Data Analysis Expressions) is a formula language used in Power BI, Power Pivot, and Analysis Services to perform data manipulation and create custom calculations. It is similar to Excel formulas but designed for relational data. DAX allows you to work with tables, perform aggregation, and create calculated columns, measures, and tables that help analyse data more effectively.

- A DAX function can contain numerical and non-numerical values.
- DAX may also contain nested functions. If a DAX expression consists of nested functions, then the innermost function is evaluated first.
- Values of any data type are supported by DAX expression. The conversion of one data type to the other is implicitly done by the DAX.
- DAX enables us to perform very complex calculations on the data.

Measure: Calculations performed on your data at the aggregation level, such as sums, averages, or percentages.

- These are used for aggregations, ratios, and key performance indicators (KPIs).
- Measures do not physically add data to the table; they only exist as a formula.

Calculated Columns: Calculated columns add new data to the existing table by creating values row by row based on a formula.

- Evaluated independently for each row in the table.
- These are used to create new fields for categorization, segmentation, or row-level calculations.
- The new column is stored in the data model and increases the dataset's size.

Why DAX is used?

- It allows users to perform complex calculations for analysis on their data.

When to Use:

- Use Measures for calculations needed only in visualizations (e.g., total sales, average profit).
- Use Calculated Columns for creating categories, flags, or row-level calculations that you need to filter or group data.

Key Difference

Calculated Column	Measures
1. Works on row-level data. 2. Stored as part of the table. 3. Static unless data is refreshed 4. Can increase data model size. 5. New fields for rows in a table	1. Works on aggregated data 2. No additional storage in the table 3. Responds to filter/slicer changes. 4. Lightweight, computed dynamically 5. Aggregations and calculations in visuals

Where does Data Analyst & Power Bi developers use DAX?

Data Analyst	Power Bi developers
1. Create custom calculations i.e. Calculated columns and measures. 2. Perform complex calculation, filters & analyse data. 3. Create dynamic reports & dashboards.	1. Extend the capabilities of Power BI 2. Improve performance of Power BI reports. 3. Make Power BI reports more interactive.

Row-Level Security: Row level security is a feature that restricts data access at the row level based on user's roles. By defining roles & rules, you can ensure that users only see the specific data they are permitted to view, enhancing data privacy and control within reports and dashboards.

What is the difference between Power BI query and DAX: DAX is primarily used for data modeling and creating calculated columns and measures, whereas Power Query (M) is used for data transformation and loading data from external sources

Aggregation functions

Function	Description
AVERAGE	**Returns the average (arithmetic mean) of all the numbers in a column.**
AVERAGEA	**Returns the average (arithmetic mean) of the values in a column.**
AVERAGEX	**Calculates the average (arithmetic mean) of a set of expressions evaluated over a table.**
COUNT	**Counts the number of rows in the specified column that contain non-blank values.**
COUNTA	**Counts the number of rows in the specified column that contain non-blank values.**
COUNTAX	**Counts non-blank results when evaluating the result of an expression over a table.**
COUNTBLANK	**Counts the number of blank cells in a column.**
COUNTROWS	**Counts the number of rows in the specified table, or in a table defined by an expression.**
COUNTX	**Counts the number of rows that contain a number or an expression that evaluates to a number, when evaluating an expression over a table.**
DISTINCTCOUNT	**Counts the number of distinct values in a column.**
DISTINCTCOUNTNOBLANK	**Counts the number of distinct values in a column.**
MAX	**Returns the largest numeric value in a column, or between two scalar expressions.**
MIN	**Returns the smallest numeric value in a column, or between two scalar expressions.**
SUM	**Adds all the numbers in a column.**
SUMX	**Returns the sum of an expression evaluated for each row in a table.**

Date and time functions

Function	Description
CALENDAR	Returns a table with a single column named "Date" that contains a contiguous set of dates.
CALENDARAUTO	Returns a table with a single column named "Date" that contains a contiguous set of dates.
DATE	Returns the specified date in datetime format.
DATEDIFF	Returns the number of interval boundaries between two dates.
DATEVALUE	Converts a date in the form of text to a date in datetime format.
DAY	Returns the day of the month, a number from 1 to 31.
EDATE	Returns the date that is the indicated number of months before or after the start date.
EOMONTH	Returns the date in datetime format of the last day of the month, before or after a specified number of months.
HOUR	Returns the hour as a number from 0 (12:00 A.M.) to 23 (11:00 P.M.).
MINUTE	Returns the minute as a number from 0 to 59, given a date and time value.
MONTH	Returns the month as a number from 1 (January) to 12 (December).
NETWORKDAYS	Returns the number of whole workdays between two dates.
NOW	Returns the current date and time in datetime format.
Year	Returns the year of a date as a four-digit integer in the range 1900-9999.
TODAY	Returns the current date.
TIME	Converts hours, minutes, and seconds given as numbers to a time in datetime format.

Types of operators

There are four different types of calculation operators: arithmetic, comparison, text concatenation, and logical.

1. **Arithmetic operators**

To perform basic mathematical operations such as addition, subtraction, or multiplication; combine numbers; and produce numeric results, use the following arithmetic operators.

Arithmetic operator	Meaning	Example
+ (plus sign)	Addition	3+3
– (minus sign)	Subtraction or sign	3–1–1
* (asterisk)	Multiplication	3*3
/ (forward slash)	Division	3/3
^ (caret)	Exponentiation	16^4

2. **Comparison operators**

You can compare two values with the following operators. When two values are compared by using these operators, the result is a logical value, either TRUE or FALSE.

Comparison operator	Meaning	Example
=	Equal to	[Region] = "USA"
==	Strict equal to	[Region] == "USA"
>	Greater than	[Sales Date] > "Jan 2009"
<	Less than	[Sales Date] < "Jan 1 2009"
>=	Greater than or equal to	[Amount] >= 20000
<=	Less than or equal to	[Amount] <= 100
<>	Not equal to	[Region] <> "USA"

3. Text concatenation operator

Use the ampersand (&) to join, or concatenate, two or more text strings to produce a single piece of text.

Text operator	Meaning	Example
& (ampersand)	Connects, or concatenates, two values to produce one continuous text value	[Region] & ", " & [City]

4. Logical operators

Use logical operators (&&) and (||) to combine expressions to produce a single result.

Text operator	Meaning	Examples
&& (double ampersand)	Creates an AND condition between two expressions that each have a Boolean result. If both expressions return TRUE, the combination of the expressions also returns TRUE; otherwise the combination returns FALSE.	([Region] = "France") && ([BikeBuyer] = "yes"))
|| (double pipe symbol)	Creates an OR condition between two logical expressions. If either expression returns TRUE, the result is TRUE; only when both expressions are FALSE is the result FALSE.	(([Region] = "France") || ([BikeBuyer] = "yes"))
IN	Creates a logical OR condition between each row being compared to a table. Note: the table constructor syntax uses curly braces.	'Product'[Color] IN { "Red", "Blue", "Black" }

Charts and their usage

When to use Donut Chart: A donut chart in Power BI is a good choice when you want to show proportional data and compare a section to the whole.

When to use Column charts: Column charts are useful for showing data changes over a period of time or for illustrating comparisons among items

When to use Bar charts: Bar graphs are used to compare things between different groups or to track changes over time.

When to use Heatmaps: Heatmaps in Power BI are particularly useful for visually identifying patterns, trends, or relationships within datasets

When to use a Card Visual: It can be used to display aggregate metrics such as count, the maximum number of leads, the first, the last, and so on.

When should you use an area chart: to show differing trends over time.

When to use a Scatter charts: Scatter charts are useful for showing relationships between two measures.

When to use Tree Map visual: Tree maps are useful for showing patterns of high and low values.

When to use Line chart: Line charts are useful for showing trends over time and comparing many data series.

Line charts plot data at regular points connected by lines.

What is a KPI in Power BI: It stands for **Key Performance Indicator (KPI),** in Power BI is a visual that tracks the performance of a key business metric or goal over time. It provides an at-a-glance view of whether a specific target is being met and how the performance compares to the target value.

A KPI in Power BI typically includes:

1. Indicator: The current value of the metric being tracked.
2. Goal/Target: The desired value for the metric.
3. Trend: A visual representation (e.g., a line or bar) showing performance over time.

When to Use a KPI in Power BI

You should use KPIs in Power BI under the following circumstances:

1. Tracking Key Business Goals

- When you need to monitor progress toward achieving strategic goals, such as: Increasing sales by a specific percentage, Reducing customer churn rate.

2. Comparing Actuals to Targets

- When you need to measure current performance against predefined targets. For example: Current revenue vs. monthly target revenue, Actual employee attendance vs. planned attendance.

3. Monitoring Performance Trends

- When you want to visualize trends over time to determine if the performance is improving or declining like Sales trends for the past quarter, Weekly website traffic compared to a baseline.

4. Highlighting Success or Failure

- When you want to show whether a metric is meeting or missing its target, often using color-coded indicators like: Green for on-target or above, Yellow for close to target, Red for below target.

5. Real-Time Monitoring

- In dashboards where real-time performance metrics are critical, such as: Monitoring website uptime, Live tracking of sales during a campaign.

6. Simplifying Complex Data

- When you want to condense large amounts of data into a single, actionable metric that is easy to interpret.

Examples of KPIs in Power BI

1. Financial KPIs: Revenue, profit margin, cost savings.
2. Customer KPIs: Net Promoter Score (NPS), customer retention rate.
3. Operational KPIs: Production uptime, project completion percentage.
4. Marketing KPIs: Conversion rates, campaign ROI.

Types of charts and purpose

Purpose of the chart	Type of chart to use
Show trends over time.	Column chart, line chart, point chart
Compare data.	Bar chart, column chart
Show the relationship of parts to the whole or highlight proportions.	Pie chart
Show the parts that contribute to the total and compare change over time.	Stacked column chart
Show groups of related data.	Bar chart, column chart
Emphasize the magnitude of change over time.	Area chart
Show the relationship between two measures.	Scatter chart
Show the relationships between three measures.	Bubble chart
Show trends over time or compare data with two measures.	Combination chart
Identify patterns of high and low values.	Tree map