Introduction to Business Intelligence with Tableau

Fall 2020

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About the Instructor

- Final Semester Student of Bachelor's Degree in Industrial Engineering Sharif University of Technology
- Instructor of "Data Mining and BI Fundamentals" Course at Entrepreneurship Center of Sharif University
- Digital Transformation and Information Systems Specialist at Lunawood Business Inc.
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Course Outline

Part I) Business Intelligence Introduction

What is Business Intelligence?
- BI Architecture and Functionalities
- Dashboards

Introducing KPIs
- KPIs in Business Functions
- Financial KPIs : Net Profit Margin – Gross Profit Margin

BI Careers and Tools

Part II) Tableau Software Tutorial

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Part I) Business Intelligence Introduction

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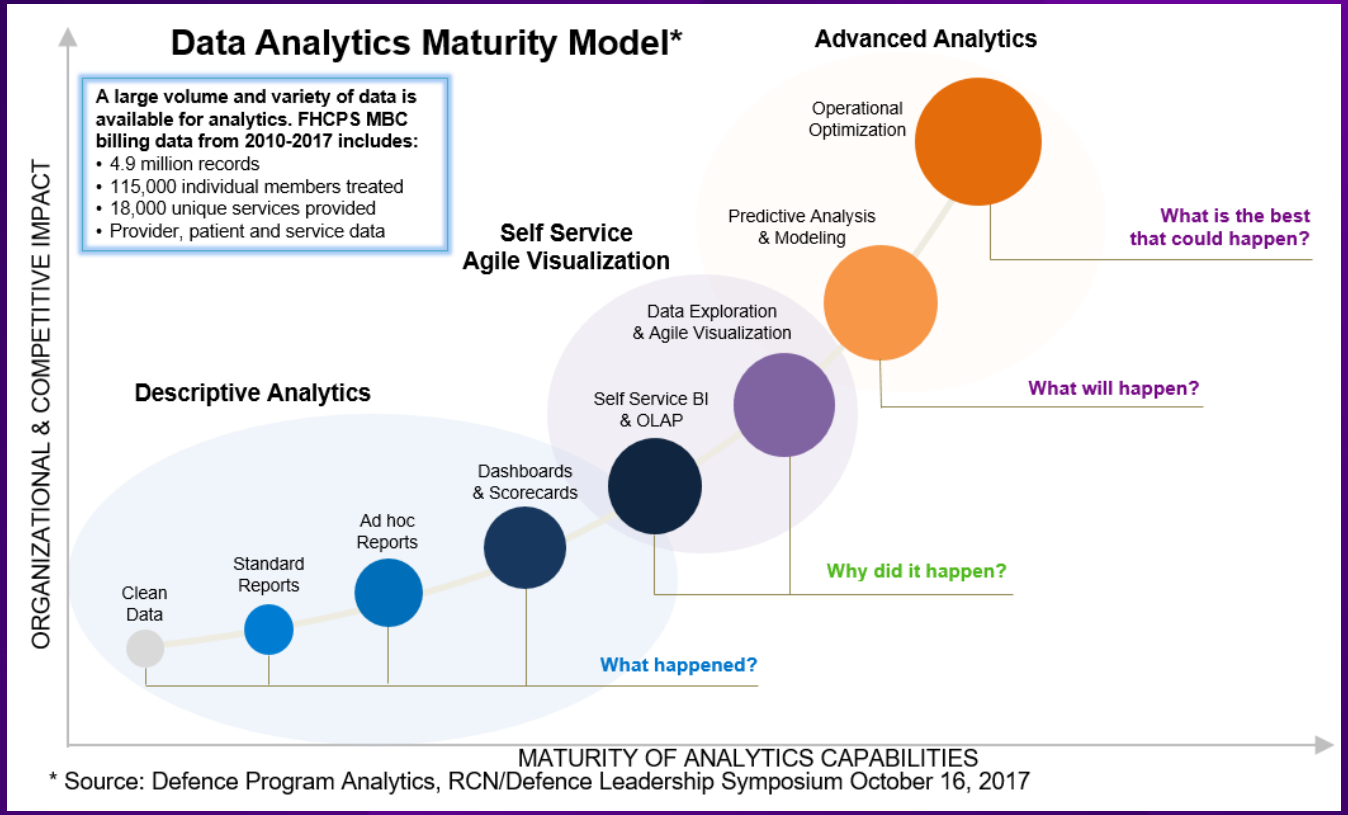
Business Intelligence

Business Intelligence or BI is a set of Technologies and Techniques which helps Managers analyze raw Datasets and make Appropriate Decisions at the Right time.

BI is the key to competitive advantage.

- Leveraged across all industry sectors in all size enterprises
- Used in all business functions: Operations, Finance, Marketing, HR, ...
- Provides insights to make the decision-making process informed
- Unites Data, Technology, Analytics and Human Knowledge to optimize decision

Maturity of Analytics Capabilities



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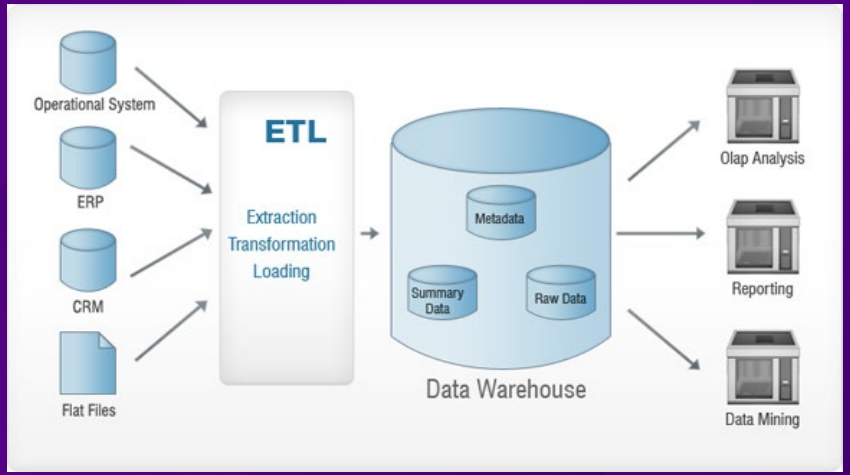
Business Intelligence Architecture

1. Identifying Data Sources
2. Extract-Transform-Load (ETL)
3. Data Warehousing
4. Data Analysis Reporting
5. Informed Decision Making



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Business Intelligence Functionalities

BI provides 5 analytic functionalities:

- Production Reports: Predefined reports based on industry-specific requirements.
- Parameterized Reports: Reports with user-entered parameters as in a pivot table to filter data and isolate impacts of parameters.
- Dashboards: Visual tools for presenting performance data defined by users.
- Ad hoc Reporting: Reports created by users for a one-time use to answer a specific business question in a visual format.
- Forecasts, scenarios, models: Ability to perform linear forecasting, what-if scenario analysis, and analyze data using standard statistical tools.

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Dashboards

A business intelligence dashboard is an information management tool that is used to track KPIs, metrics, and other key data points relevant to a business, department, or specific process.

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Dashboards

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Introducing KPIs

KPI or Key Performance Indicator is a measurable value that demonstrates how effectively a company is achieving key business objectives. Organizations use KPIs at multiple levels to evaluate their success at reaching targets.

High-level KPIs – Focus on the overall performance of the enterprise.

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KPIs in Different Business Functions

KPIs are used across the organization in numerous business functions.

- Financial KPIs
- Marketing and Sales KPIs
- Operations, Production and Inventory KPIs
- Human Resources KPIs

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Marketing and Sales KPIs

There are numerous KPIs used in Marketing and Sales according to the business goals and strategies.

- Customer Satisfaction Index
- Net Promoter Score
- Customer Life-time Value
- Customer Churn Rate
- Conversion Rate
- Bounce Rate

Financial KPIs

Finance is one of the most important business functions to leverage KPIs.

- Net Profit
- Gross Profit Margin
- Net Profit Margin
- Current Ratio
- P/E
- ROI
- Working Capital

Financial KPIs : Net Profit Margin

Net profit margin is one of the most important indicators of a company's financial health.

$$\text{Net Profit Margin} = [\ \text{Sales Revenue (\$)} - \text{Total costs (\$)}\ ] \ / \ \text{Sales Revenue}$$

- Sales Revenue = Price (of product) * Quantity Sold
- Total Costs = Cost of Sales and other Direct Costs + Overheads and Other Indirect Costs + Tax and Other Financial Costs

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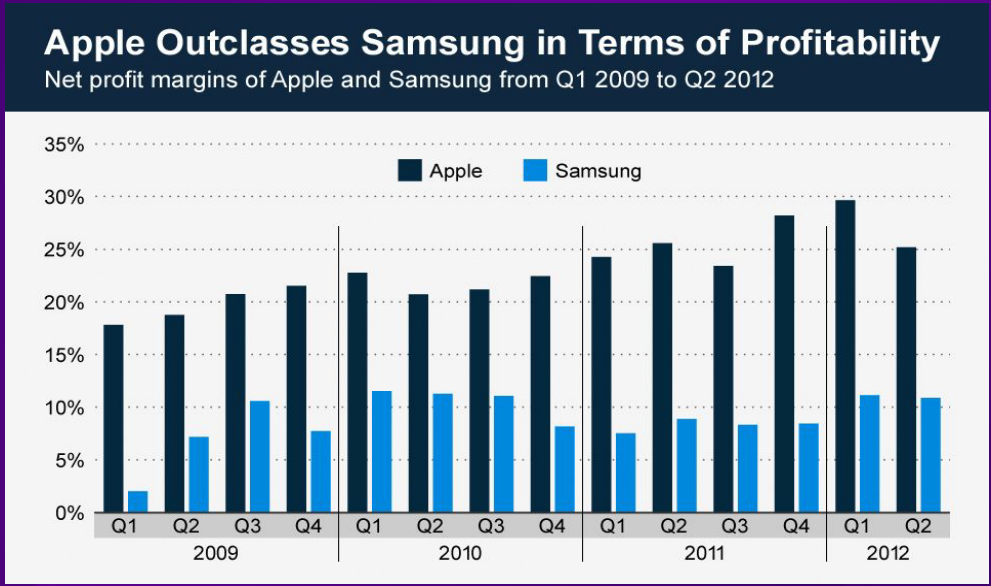
Financial KPIs : Net Profit Margin

Net profit margin helps investors assess if a company's management is generating enough profit from its sales and whether costs are being contained.

For instance, if NPM = 10%, it indicates that 10 cents of every dollar the company generates as revenue is profit.

Industry Average



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Financial KPIs : Gross Profit Margin

Gross Profit Margin assesses a company's efficiency at using its labor and supplies in producing goods or services.

Gross Profit Margin = (Sales Revenue – Direct Costs) / Sales Revenue

The metric mostly considers variable costs—that is, costs that fluctuate with the level of output.

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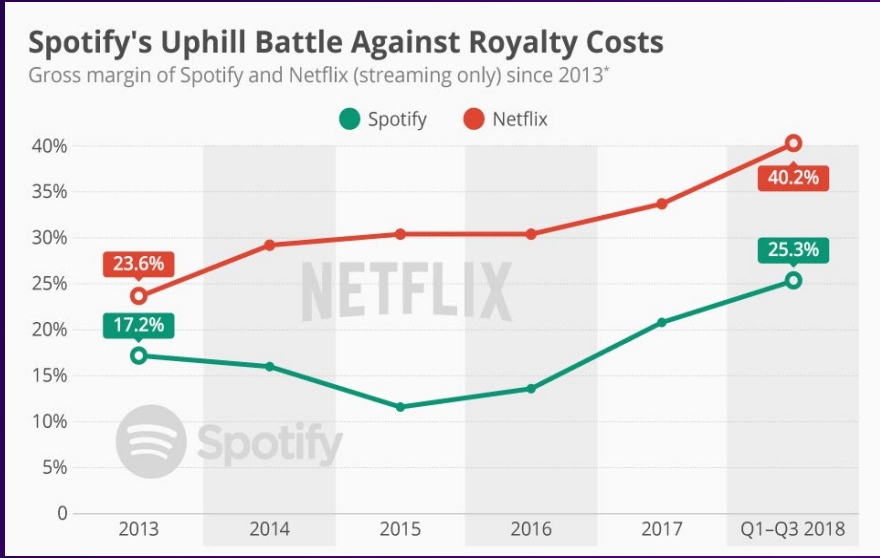
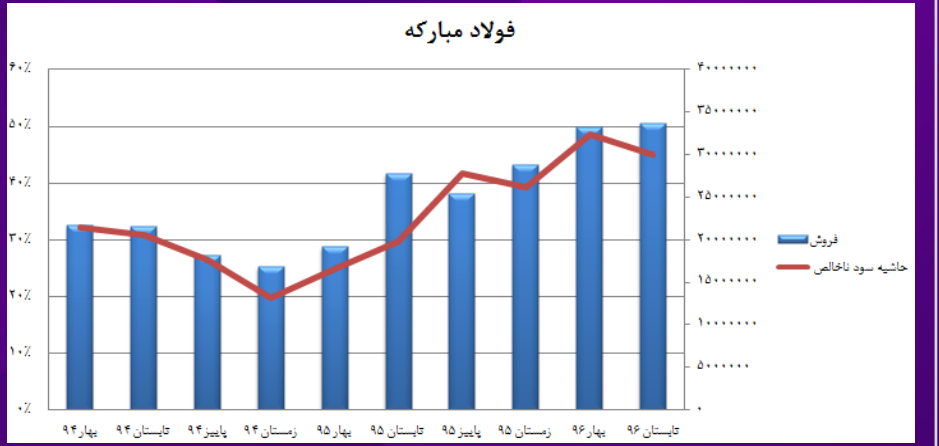
Financial KPIs : Gross Profit Margin





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Financial KPIs : Example

Gross Profit Margin
= (13,387,214 – 13,342,586) / 133,387,214
= 0.0033

Net Profit Margin
= (13,387,214 – 13,342,586 – 31,838,+
18,985 – 41,033) / (13,406,199)
= -0.0007

شرح	دوره منتهی به ۱۳۹۸/۱۲/۲۹ جهت ارائه به حسابرس
درآمدهای عملیاتی	13,387,214
بهای تمام‌شده درآمدهای عملیاتی	13,342,586
سود (زیان) ناخالص	
هزینه‌های فروش، اداری و عمومی	31,838
سایر درآمدها	18,985
سایر هزینه‌ها	41,033
سود (زیان) عملیاتی	
هزینه‌های مالی	۰
سود (زیان) عملیات در حال تداوم قبل از مالیات	
هزینه مالیات بر درآمد:	
سال جاری	۰
سال‌های قبل	۰
سود (زیان) خالص عملیات در حال تداوم	
عملیات متوقف شده:	
سود (زیان) خالص عملیات متوقف شده	۰
سود (زیان) خالص	

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Financial KPIs : Industry Average

Financial KPIs depend on the industry sector of the business.

- There are benchmarks for each of industry sectors
- Companies should compare their margins with their industry average

Industry	Net Profit Margin	Gross Profit Margin
Restaurants	15%	67%
Retail	5%	22%
Tax Services	20%	90%
Transportation	19%	47%

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Business Intelligence Career

Job positions and titles:

- BI Specialist
- BI Analyst
- BI Developer
- BI Manager

Business intelligence analysts have a minimum of a bachelor's degree in business, management, accounting, economics, statistics or information science.
A Business Intelligence Analyst can get an average wage ranging from 48000$ – 72000$ depending on the level of experience. Business Intelligence Analysts will normally get an annual wage of 67000$.

- BI in Iran

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Business Intelligence Tools

Business intelligence tools are types of application software designed to retrieve, analyze, transform and report data for business intelligence.

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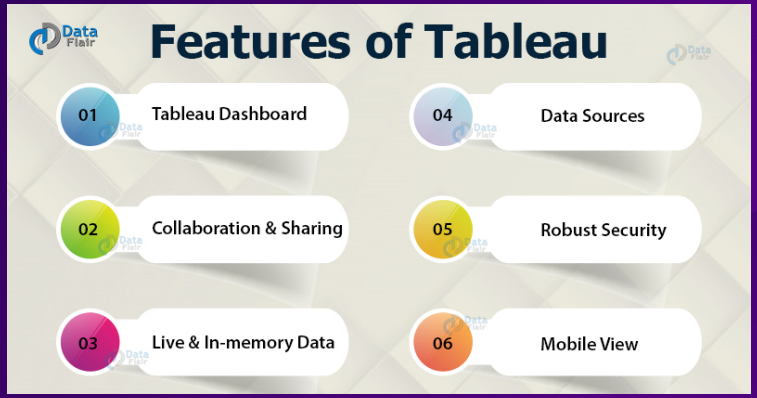
Introducing Tableau

Tableau is a visual analytics platform transforming the way we use data to solve problems—empowering people and organizations to make the most of their data.



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Part II) Tableau Software Tutorial

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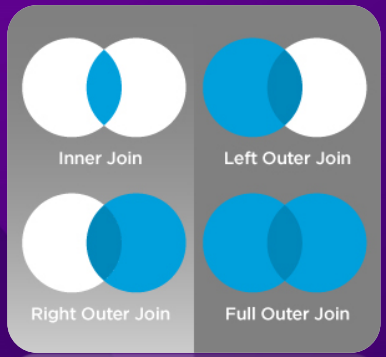
Joins

A join is an operation performed to establish a connection between two or more database tables (worksheets) based on matching columns, thereby creating a relationship between the tables (worksheets).



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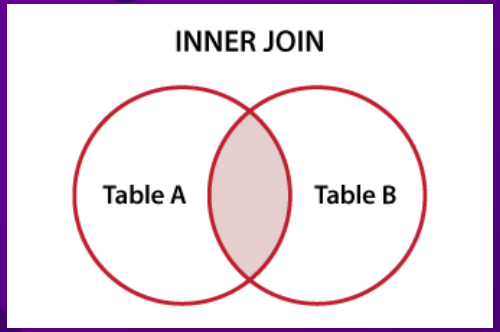
Joins : Inner Join

Returns records that have matching values in both tables.

NAME	COURSE
ALI	PHYSIC
HASAN	MATHEMATICS
MOHAMMAD	STATISTICS
REZA	PHYSIC
MEHRDAD	BIOLOGY

NAME	SCORE
MOSTAFA	17
MOHSEN	16
MOHAMMAD	16.5
REZA	17
MEHRDAD	18



NAME	COURSE	SCORE
MOHAMMAD	STATISTICS	16.5
REZA	PHYSIC	17
MEHRDAD	BIOLOGY	18

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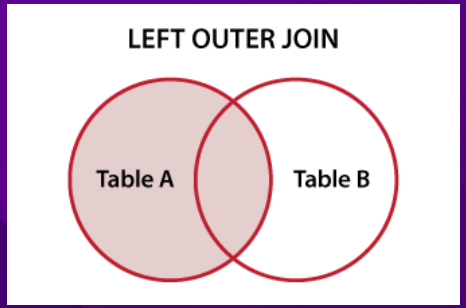
Joins : Left Outer Join

Returns all records from the left table, and the matched records from the right table.

NAME	COURSE
ALI	PHYSIC
HASAN	MATHEMATICS
MOHAMMAD	STATISTICS
REZA	PHYSIC
MEHRDAD	BIOLOGY

NAME	SCORE
MOSTAFA	17
MOHSEN	16
MOHAMMAD	16.5
REZA	17
MEHRDAD	18



NAME	COURSE	SCORE
ALI	PHYSIC	*null*
HASAN	MATHEMATICS	*null*
MOHAMMAD	STATISTICS	16.5
REZA	PHYSIC	17
MEHRDAD	BIOLOGY	18

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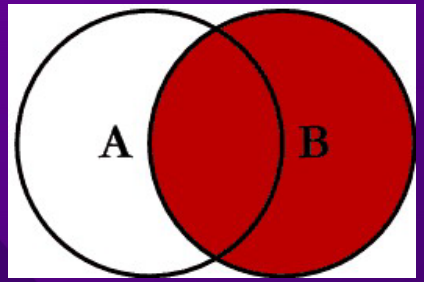
Joins : Right Outer Join

Returns all records from the right table, and the matched records from the left table.

NAME	COURSE
ALI	PHYSIC
HASAN	MATHEMATICS
MOHAMMAD	STATISTICS
REZA	PHYSIC
MEHRDAD	BIOLOGY

NAME	SCORE
MOSTAFA	17
MOHSEN	16
MOHAMMAD	16.5
REZA	17
MEHRDAD	18



NAME	SCORE	COURSE
MOSTAFA	17	*null*
MOHSEN	16	*null*
MOHAMMAD	16.5	STATISTICS
REZA	17	PHYSIC
MEHRDAD	18	BIOLOGY

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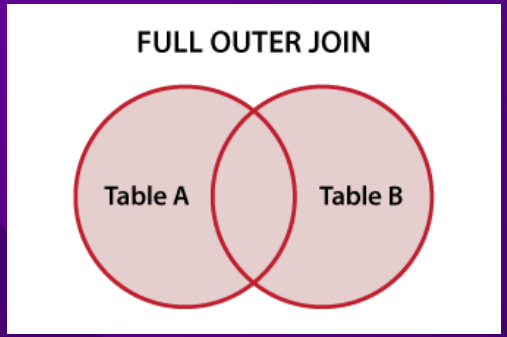
Joins : Full Outer Join

Returns all records when there is a match in either left or right table

NAME	COURSE
ALI	PHYSIC
HASAN	MATHEMATICS
MOHAMMAD	STATISTICS
REZA	PHYSIC
MEHRDAD	BIOLOGY

NAME	SCORE
MOSTAFA	17
MOHSEN	16
MOHAMMAD	16.5
REZA	17
MEHRDAD	18



NAME	COURSE	SCORE
ALI	PHYSIC	*null*
HASAN	MATHEMATICS	*null*
MOHAMMAD	STATISTICS	16.5
REZA	PHYSIC	17
MEHRDAD	BIOLOGY	18
MOSTAFA	*null*	17
MOHSEN	*null*	16

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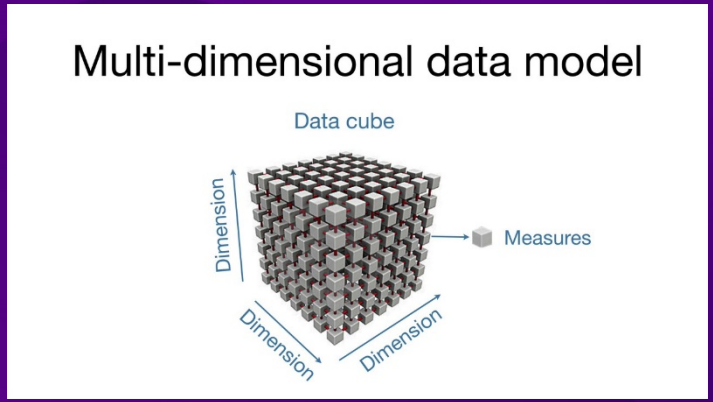
Dimensions and Measures

Measures are numerical values that mathematical functions work on. For example, a sales revenue column is a measure because you can find out a total or average the data.

Dimensions are usually those fields that cannot be aggregated. Dimensions are qualitative and do not total a sum. For example, sales region, employee, location, or date are dimensions.



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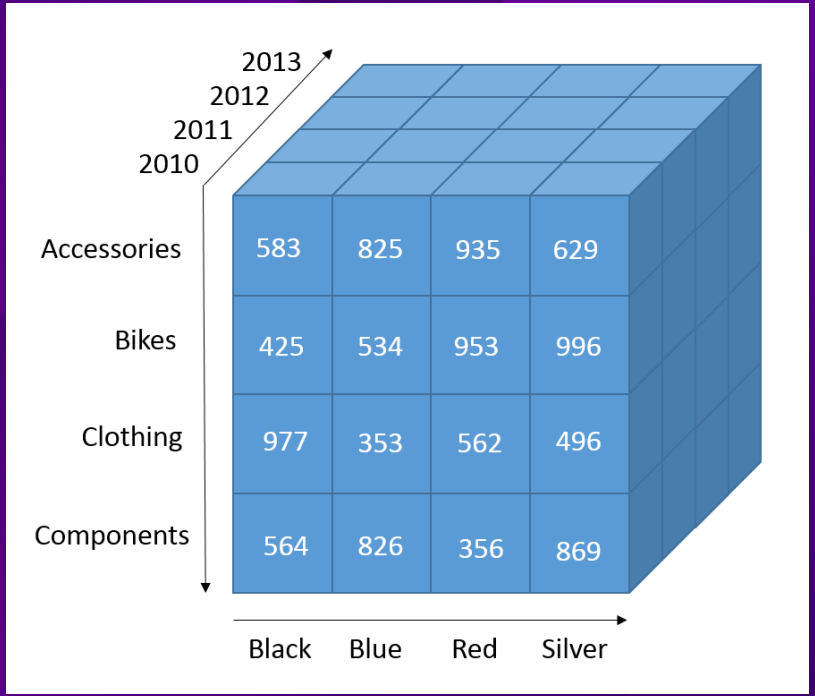
Dimensions and Measures

Dimensions:
Product Type, Product Color, and Year

Measure:
Sales Amount

Data Cube



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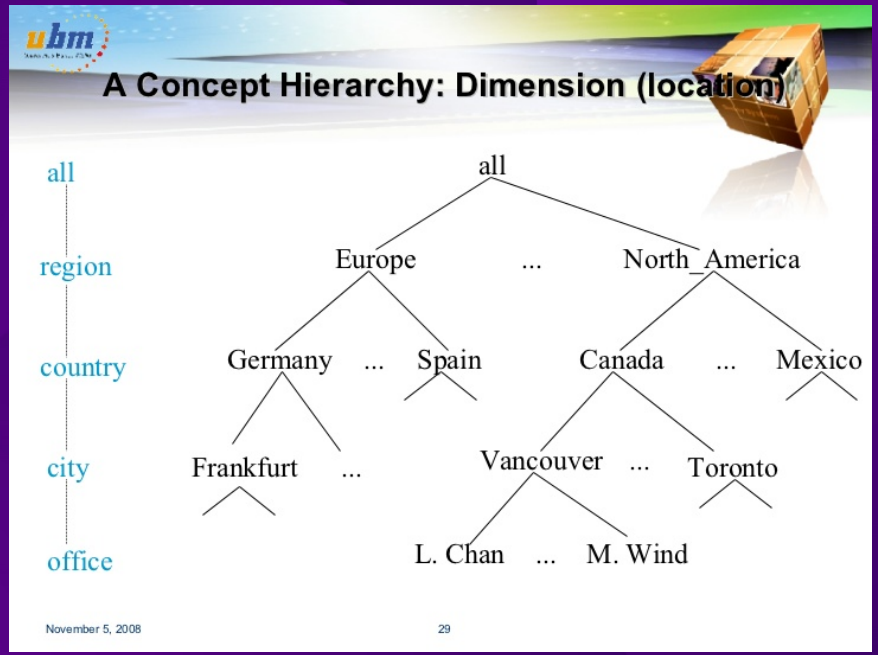
Concept Hierarchy

A concept hierarchy defines a sequence of mappings from a set of low-level concepts to higher-level, more general concepts

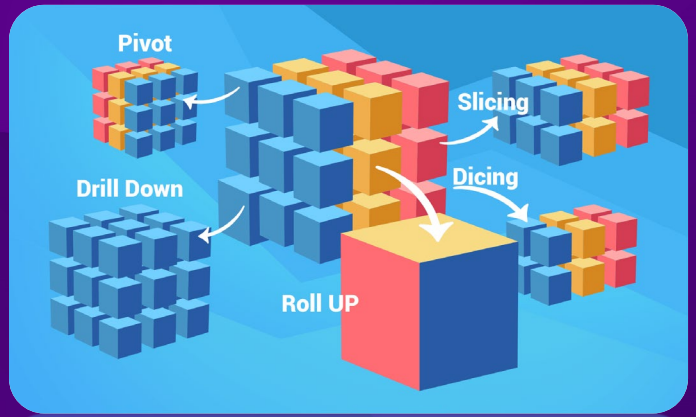


OLAP: Online Analytical Processing

Online Analytical Processing (OLAP) is based on the multidimensional data model. It allows managers, and analysts to get an insight of the information through fast, consistent, and interactive access to information.

OLAP Operations:

- Roll-up
- Drill-down
- Slice and Dice
- Pivot



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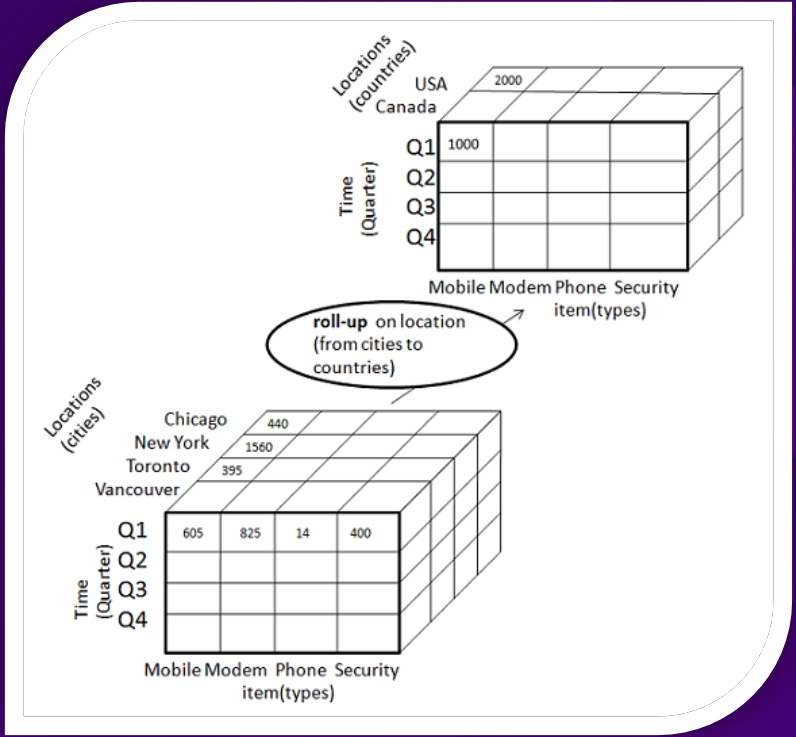
OLAP Operations: Roll-up

Roll-up performs aggregation on a data cube by climbing up a concept hierarchy for a dimension.



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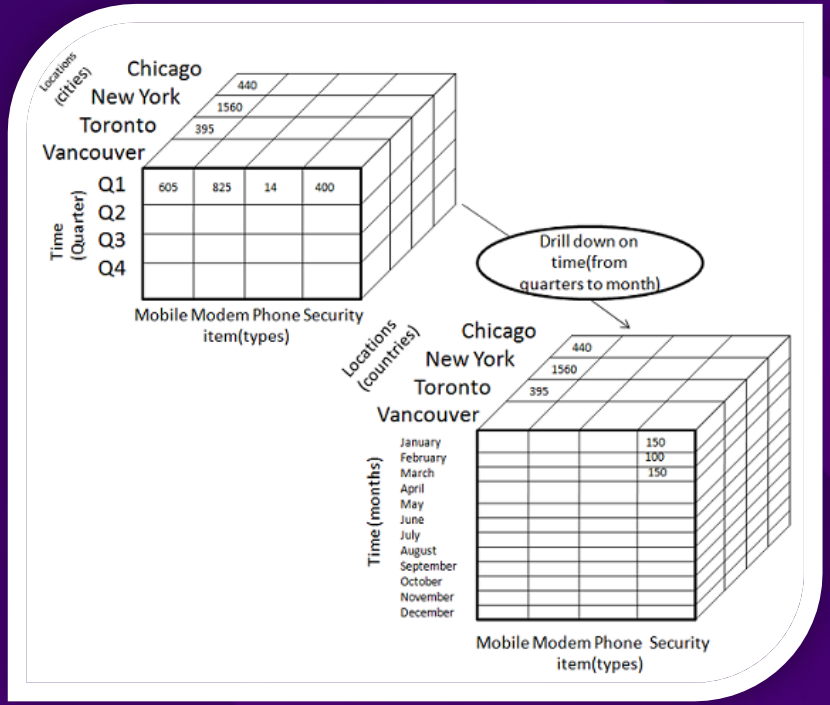
OLAP Operations: Drill-down

Drill-down is the reverse operation of roll-up. It is performed by stepping down a concept hierarchy for a dimension.



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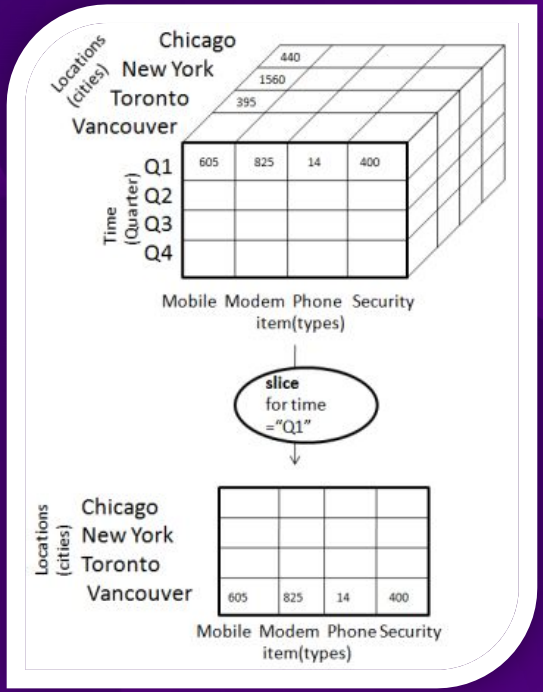
OLAP Operations: Slice

The slice operation selects one particular dimension from a given cube and provides a new sub-cube.



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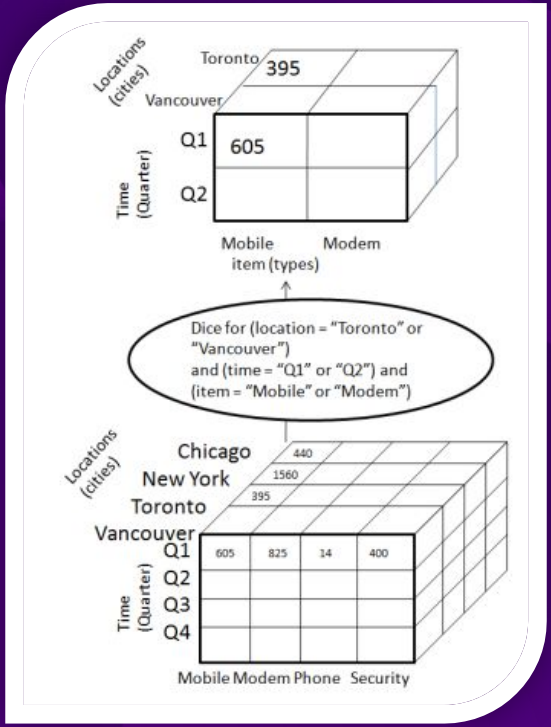
OLAP Operations: Dice

Dice selects two or more dimensions from a given cube and provides a new sub-cube.



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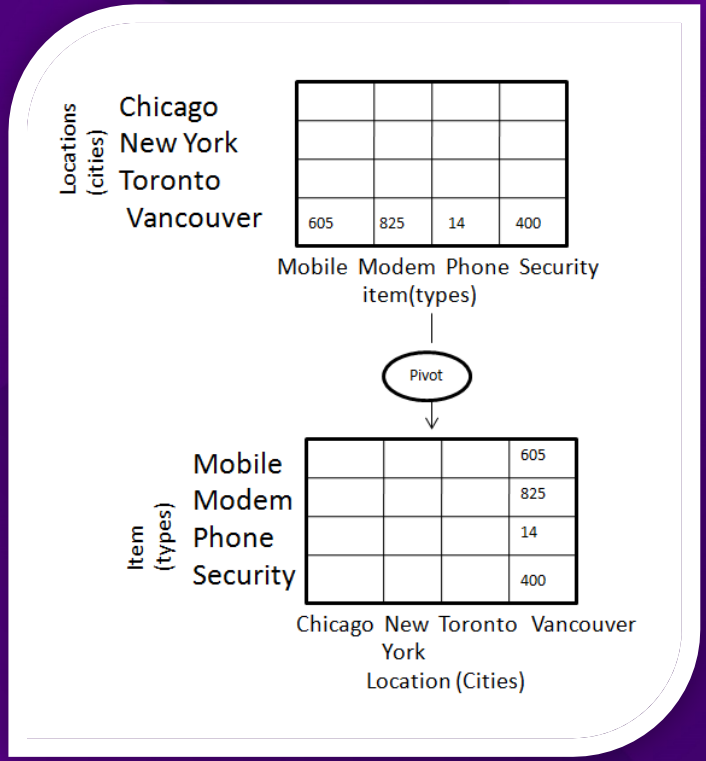
OLAP Operations: Pivot

The pivot operation is also known as rotation. It rotates the data axes in view in order to provide an alternative presentation of data.



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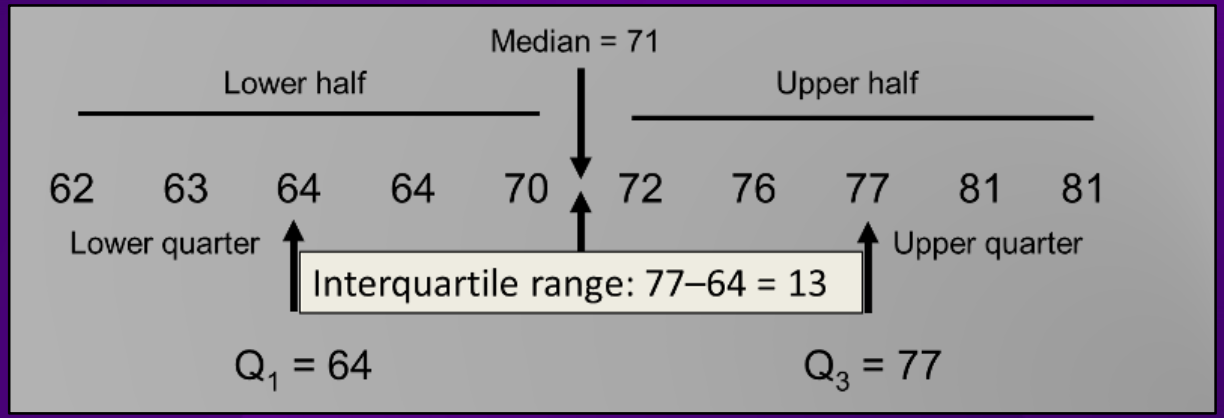
Statistics: Quartiles and Percentiles

A quartile is a type of quantile which divides the number of data points into four more or less equal parts, or quarters.

The first quartile is defined as the middle number between the smallest number and the median of the data set.

Tip: Find the Medians!



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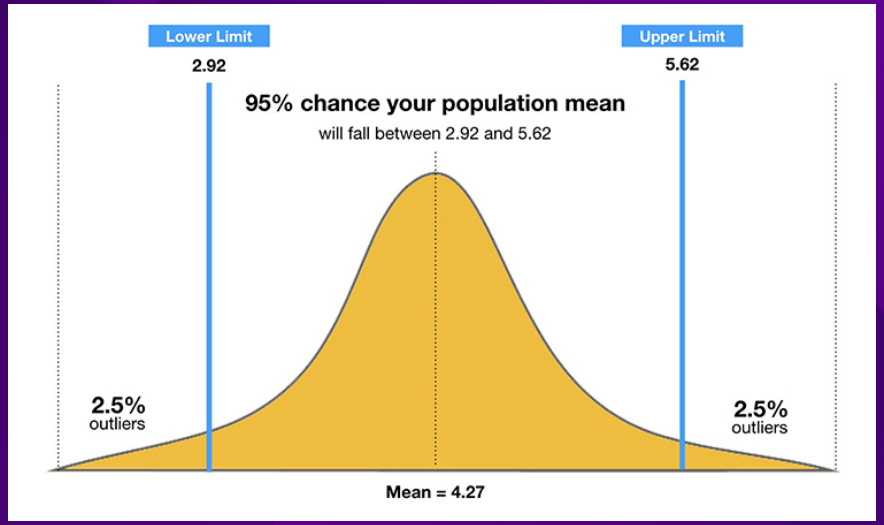
Statistics: Confidence Interval

In statistics, a confidence interval is a type of estimate computed from the statistics of the observed data.
This proposes a range of plausible values for an unknown parameter. The interval has an associated confidence level that the true parameter is in the proposed range.



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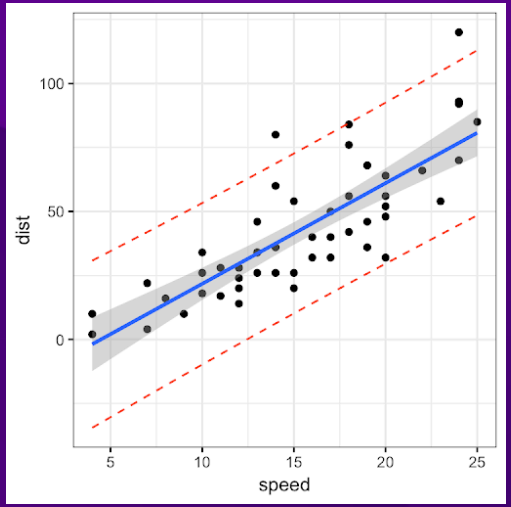
Statistics: Prediction Interval

In statistical inference, specifically predictive inference, a prediction interval is an estimate of an interval in which a future observation will fall, with a certain probability, given what has already been observed.

Prediction intervals are often used in regression analysis



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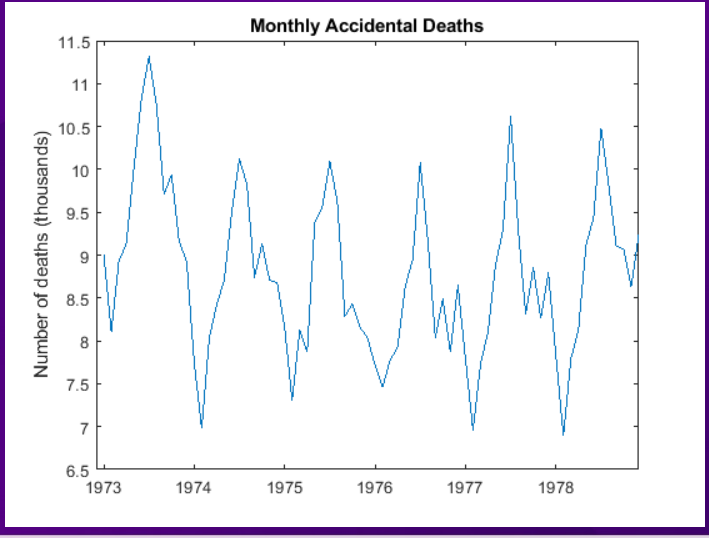
Forecasting: Seasonality

In supply chain, the demand - or the sales - of a given product is said to exhibit seasonality when the underlying time-series undergoes a predictable cyclic variation depending on the time within the year.

Seasonality is one of most frequently used statistical patterns to improve the accuracy of demand forecasts.



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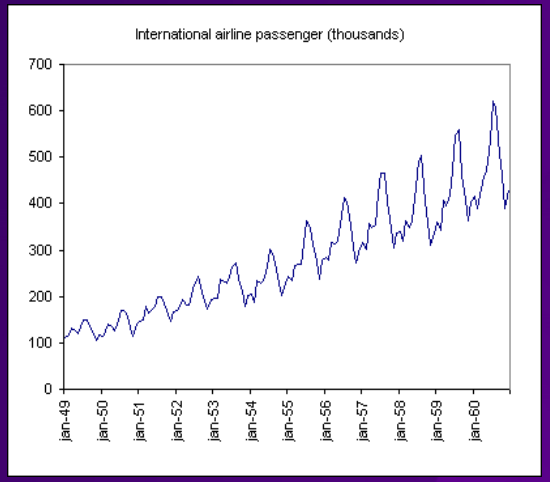
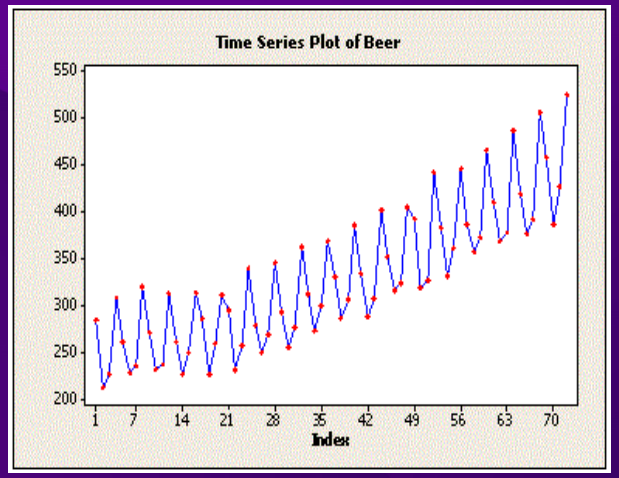
Forecasting: Multiplicative or Additive

There are two types of data. One is additive, which can be considered as the result of adding numbers. This type of data tends to show a linear trend.

Another is multiplicative, which can be considered as the result of the compounding effect with percentage growth. This type of data tends to show an exponential trend.





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Thanks for your Attention!