

# Amity School of Business

BBA, Semester 2

Analysis and Design of Business System  
(ADBS)

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## Module -IV

# System And Database Design

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## Database Design

- Database design occurs in two steps
  - Logical Database Model or Design
    - Logical database design is driven not only from the previously developed ER diagram for application but also from form and report layout. In this we study the data element on these system input and output and identify the relationship among the data.
  - Physical Database Model or Design
    - The design for logical databases and system inputs and outputs are then used in physical design activity to specify to computer programmers, database administrator, network manager and others how to implement the new information system.

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- **Four steps are key to logical database modeling and design:**
  1. Develop a logical data model for each known user interface for the application using normalization principles.
  2. Combine normalized data requirements from all user interfaces into one consolidated logical database model.
  3. Translate the conceptual ER data model for the application, developed without explicit consideration of specific user interfaces, into normalized data requirement.
  4. Compare the consolidated logical database design with the translated ER model and produce, through view integration one final logical database model for the application.

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- These inputs allow you to make key physical database design decisions :
  1. Choosing the storage format (data type) for each attribute from logical database model.
  2. Grouping attributes from logical database model into physical records.
  3. Arranging related records in secondary memory.
  4. Selecting the media and structures for storing data to make access more efficient.

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## Data, Database and Database Systems

- Data – Collection of raw facts and figures .
- Information – Processed meaningful and usable data.
- Database – Collection of interrelated data items.
- Database System – Collection of interrelated data items that is organized so that it can easily be accessed, managed, and updated .

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## Database Management System

A database management system (DBMS) is system software used to manage the –

- Data Organization
- Data storage
- Access
- Security and
- Integrity of data in a structured database.

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## What is a Database?

Integrated collection of related files. It is a combination of two words Datum and Base.

- **Datum** – A fact or proposition from which inferences can be drawn.
- **Base** – The foundation or supporting part of anything.
- A store of a large amount of information in a form which can be handled by computer and provides the basis upon which an organization can draw inferences for conducting its work.

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A database can be a set of files stored on computer's memory or it could consist of **database tables** that are managed by a Database Management System (DBMS).

There are different types of DBMS products: relational, network and hierarchical. The most widely commonly used type of DBMS today is the Relational Database Management Systems (RDBMS).

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## RDBMS

A **Relational database management system (RDBMS)** is a database management system (DBMS) that is based on the relational model as introduced by E. F. Codd. Most popular commercial databases currently in use are based on the relational model.

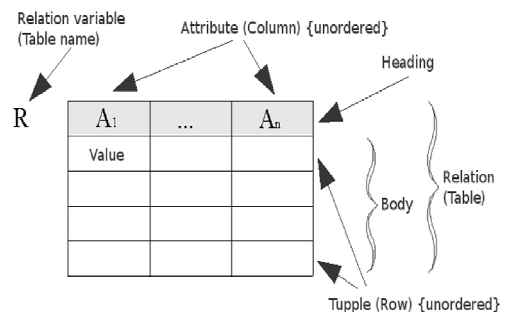
A short definition of an RDBMS may be a DBMS in which data is stored in the form of tables and the relationship among the data is also stored in the form of tables.

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## Relational Model

- The Relational Model is in demand because of its simple way in representing information in a well understood form of tables.
- In broader aspect, models that present the data to the user as relations i.e. in tabular form, as a collection of tables with each table consisting of a set of rows and columns, could be called as Relational models.

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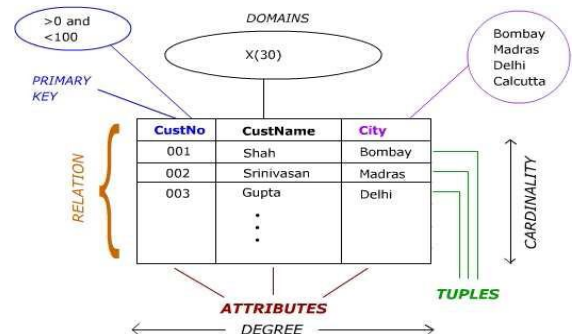


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- Data in the tables is related through common columns and not physical links or pointers. Unlike the Hierarchical & Network Model, there is no need to traverse pointers in the RDBM. This makes querying much more easier in a RDBM.
- Oracle, Sybase, DB2, Ingress, Informix, MS-SQL Server are few of the popular RDBMS.

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### Relational Databases: Terminology



- Relation**  
It is a table.
- Tuple and Attribute**  
A row or a record and a field or a column in a relation.
- Cardinality and Degree of a relation**  
The number of Tuples & attributes in a relation respectively.
- Domain of an attribute**  
The set of all values that can be taken by the attribute.
- Primary Key of a relation**  
An attribute or a combination of attributes that is assigned to uniquely identify each Tuple in a relation.
- Foreign Key of a relation**  
An attribute or a combination of attributes in relation R1 which indicates the association.

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### Properties of Relations

- No Duplicate Tuples**  
A relation cannot contain two or more Tuples which have the identical values for all the attributes of each other. i.e. In any relation, every row is unique.
- Tuples are unordered**  
The order of rows in a relation is immaterial.
- Attributes are unordered**  
The order of columns in a relation is immaterial.
- Attribute Values are Atomic**  
Each Tuple contains exactly one value for each attribute.

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### Relationships Tables

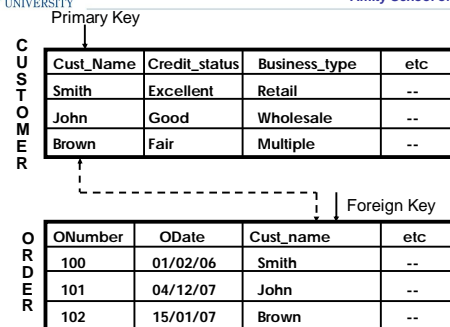
Relation model tables conform to the intuitive notation of tables with columns of values and a header name for each column.

Ex : Customer

Cust_Name	Credit_status	Business_type	etc
Smith	Excellent	Retail	--
John	Good	Wholesale	--
Brown	Fair	Multiple	--

The table has two distinct parts, a header part and a body part. The body part consists of a number of rows.

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Relation of Two table using constraints

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## Functional Dependency

- A functional dependency is an association between the columns of a relation. This means that a given value of one column can determine a unique value from another column.
- Functional dependency is used in the normalization technique in order to simplify the structure of relations.

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## Functional Dependency

An attribute in a relational model table is said to be functionally dependent on another attribute in the table if it can take on only one value for a given value of attribute it is functionally dependent.

"A Data element is functionally dependent on the key of a record if the value of the key determines a unique value for the data element."

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## Functional Dependencies and Keys

- Functional Dependency: The value of one attribute (the determinant) determines the value of another attribute.
- Candidate Key: A possible key.
  - Each non-key field is functionally dependent on every candidate key.
  - No attribute in the key can be deleted without destroying the property of unique identification.

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## Functional Dependencies

EMPLOYEE

Emp_ID	Last_Name	First_Name	M_I
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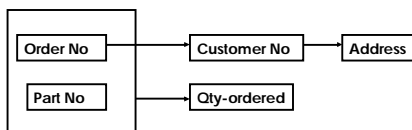
Alternate way to show dependencies

Emp\_ID → Last\_Name, First\_Name, M\_I

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## How to establish a Functional Dependency

Example : In this example we will see how five data element related to customer's order are functionally dependent.



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## How to establish a Functional Dependency

- Each Order No is associated with only one Customer No, but a Customer no may be associated with many Order No.
- Each Customer No may be associated with only one Address, but the same Address may be associated with more than one Customer No.
- Each Customer No is associated with many Part Nos, and each Part No can be associated with many Order Nos.
- Each Order No + Part No taken together is associated with only one Quantity ordered, but a Qty-ordered may be associated with more than one Order No + Part No.

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❑ **Primary Key** : A primary key, also called a primary keyword, is a key in a relational database that is unique for each record. It is a unique identifier, such as a driver license number, telephone number (including area code), or vehicle identification number (VIN). A relational database must always have one and only one primary key. Primary keys typically appear as columns in relational database tables

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❑ **Foreign Key** : A foreign key, also called a foreign keyword, in a database table is a key from another table that refers to (or targets) a specific key, usually the primary key, in the table being used. A primary key can be targeted by multiple foreign keys from other tables. But a primary key does not necessarily have to be the target of any foreign keys.

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- Data redundancy is exactly what you think it is; the repetition of data.
- Redundancy : A situation in which two or more pieces of information in a file are the same.

Student_id	Name	Subject	Time	Professor_id
101	Amit	MI S	10:15	P_11
102	Alok	SAD	10:15	P_12
103	Ajay	CAM	9:15	P_14
101	Amit	MI S	10:15	P_11
105	Vijay	DBMS	11:25	P_14

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- Anomalies are inconsistencies in data that occur due to unnecessary redundancy.
- **Update anomaly**
  - Some copies of a data item are updated, but others are not.
- **Insertion anomaly**
  - Can't insert "real" data without also inserting unrelated or "made up" data.
- **Deletion anomaly**
  - Can't delete some data without also deleting other, unrelated data.

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## Data Normalization

The process of decomposing tables to eliminate data redundancy is called Normalization.

- The occurrence of values for data elements more than once within a file or database are called Data Redundancy.
- Primarily a tool to validate and improve a logical design so that it satisfies certain constraints that avoid unnecessary duplication of data.
- The process of decomposing relations with anomalies to produce smaller, well-structured relations.

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## Anomaly Examples

OID	ODate	CID	CName
1	8/10/2004	2	ABC Inc
2	8/10/2004	2	ABC Inc
3	8/11/2004	3	XZY Co
4	8/11/2004	4	QWE Inc
5	8/12/2004	4	QWE Inc

Add a customer: Must also add an order

Update the name of Customer #2: Must update multiple rows

Delete Order #3: Must also delete info about Customer #3

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