Database Management System -I

INTRODUCTION

0301203

DATABASE MANAGEMENT SYSTEM - I

0301206

PRACTICAL ON DBMS - I

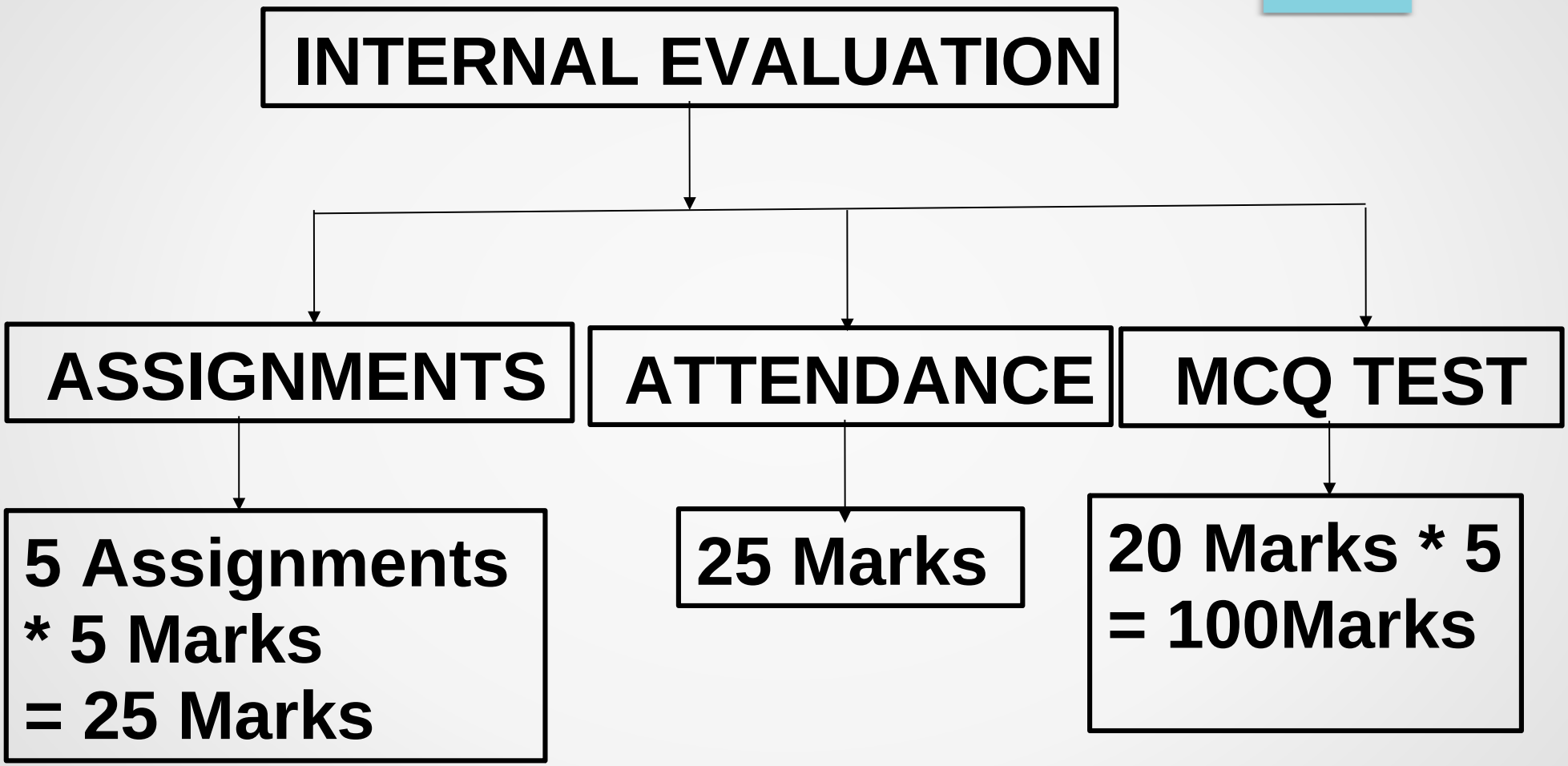
BY:

Prof. (Dr.) Ankit Bhavsar

0301203 Database Management System - I

UNIT	MODULES	WEIGHTAGE
1	Introduction to DBMS	20 %
2	Introduction to RDBMS	20 %
3	Inroduction to Normalization	20 %
4	Open Source Database Management Software	20 %
5	Introduction to MySQL	20 %

INTERNAL EVALUATION



TEXT BOOK

- **Database Principles Fundamentals of Design, Implementation and Managements**
  - Publisher : - Cengage Learning
  - Author : - Coronel, Morris and Rob

UNIT - 1 Introduction to DBMS

- Introduction of the Data and DBMS
- Role and Advantage of DBMS
- DBMS Function and Environment
- DBMS Users
- Types of Database
- Advantage and Disadvantage of DBMS
- Database Models

Introduction to Database Management System

- **Information** is the result of processing raw data to reveal its meaning
- A **database** is a shared, integrated computer structure that stores a collection of
  - **End user data,** that is, raw facts of interest to the end user
  - **Metadata, or data about data**, through which the enduser data are integrated and managed

Role of DBMS

- **DBMS is a collection of programs that manages the database structure and controls access to the data stored in the database.**

Role of DBMS :

- The **DBMS serves as the intermediary** between the user and the database.
- The only way to **access the data in the files is through the DBMS.**
- The DBMS **hides much of the database's internal complexity** from the application programs and users.

Advantages of DBMS

- **Improved data sharing** :
  - DBMS enables the data in the database to **be shared among multiple applications** or users.
- **Improved data security :**
  - The **more users access the data, the greater the risks** of data security breaches. A **DBMS provides a framework for better enforcement of data privacy and security** policies.
- **Better data integration :**
  - It becomes **much easier to see how actions in one segment of the company affect** other segments.

Advantages of DBMS

- **Minimized data inconsistency :**
  - Data **inconsistency exists when different versions of the same data appear in different places**.The probability of data inconsistency is greatly reduced in a properly designed database.
- **Improved data access :**
  - The **DBMS makes it possible to produce quick answers to the queries.**

Advantages of DBMS

- **Improved decision making :**
  - Better-managed data and improved data access make **it possible to generate better quality information, on which better decisions are based.**
- **Increased end-user productivity :**
  - The **availability of data, combined with the tools that transform data into usable information,** empowers end users to make quick, informed decisions that **can make the difference between success and failure in the global economy.**

The Database System Environment

- The **term database system** refers to an organization of components that **define and regulate the collection, storage, management, and use of data** within a database environment
- The database system is **composed of the five major parts**
  - Hardware
  - Software
  - People
  - Procedures
  - data

The Database System Environment

- **Hardware.**
  - Hardware refers to all of the system's physical devices; **for example, computers storage devices, printers, network devices , and other devices**

The Database System Environment

- **Software:**
  - To make the database system function fully, **three types of software are needed:**
    - operating system software
    - DBMS software
    - Application programs and utilities.
  - **Operating system software manages all hardware** components and makes it possible for all other software to run on the computers. Examples of operating system software include **Microsoft Windows, Linux, Mac OS, UNIX, and MVS.**
  - **DBMS software manages the database within the database system**. Some examples of DBMS software include **Microsoft SQL Server, Oracle Corporation's Oracle, MySQL AB's MySQL and IBM's DB2.**
  - **Application programs and utility software are used to access and manipulate data** in the DBMS and to manage the computer environment in which data access and manipulation take place.

The Database System Environment

- **People:**
  - This component includes **all users of the database system**. On the basis of primary job functions, **five types of users** can be identified in a database system:
    - Systems administrators
    - Database administrators
    - Database designers,
    - Systems analysts and programmers
    - End users.

The Database System Environment

- **People:**
  - **System administrators:** oversee the database **system's general operations.**
  - **Database administrators:** also known as DBAs, manage the DBMS and **ensure that the database is functioning properly.**
  - **Database designers: design the database structure**. If the the architecture is poor then the DBA or System adminstrator cannot produce produce a useful database environment
  - **Systems analysts and programmers: design and implement the application programs.** They design and create the data entry screens, reports, and procedures through which end users access and manipulate the database's data.
  - **End users:** are the people who use the application programs to run the organization's daily operations.

The Database System Environment

- **Procedures.**
  - Procedures **are the instructions and rules that govern the design and use of the database system.**
  - Procedures also are **used to ensure that there is an organized way to monitor and audit both the data that enter the database** and the information that is generated through the use of that data.

- **Data.**
  - The word **data covers the collection of facts stored** in the database.
  - the **determination of what data are to be entered into the database and how that data are to be organized is a vital part of the database designer's job.**

Types of database users

- **System administrators:** oversee the **database system's general operations**.
- **Database administrators:** also known as **DBAs, manage the DBMS and ensure that the database is functioning properly**.
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DBMS Functions

A DBMS performs **several important functions that guarantee the integrity and consistency of the data in the database.**

- **Data dictionary management:**
  - The DBMS stores definitions of the **data elements and their relationships (metadata)** in a data dictionary.
- **Data storage management:**
  - The DBMS creates and manages the **complex structures required for data storage**,thus relieving you from the difficult task of defining and programming the physical data characteristics.
- **Data transformation and presentation:**
  - The DBMS transforms entered data to conform to required data structures.
- **Security management:**
  - The DBMS creates a security system that enforces user security and data privacy.

DBMS Functions

- **Multiuser access control:**
  - To provide data integrity and data consistency, the DBMS **uses sophisticated algorithms to ensure that multiple users can access the database** concurrently without compromising the integrity of the database
- **Backup and recovery management:**
  - The DBMS provides backup and data recovery to ensure data safety and integrity
- **Data integrity management:**
  - The DBMS promotes and enforces integrity rules, thus minimizing data redundancy and maximizing data consistency.

DBMS Functions

- **Database access languages and application programming interfaces:**
  - The DBMS provides data access through a query language. A **query language** is a nonprocedural language—one that lets the user specify what must be done without having to specify how it is to be done. **Structured Query Language (SQL)** is the de facto query language and data access standard supported by the majority of DBMS vendors.
- **Database communication interfaces:**
  - Current-generation DBMSs accept end-user requests via multiple,different network environments.

Types of Database

Databases can be classified according to the

- **Number of users**
- **Database location(s)**
- **Extent of use**

- The **number of users** determines whether the database is classified:
    1. Single-user
    2. Multiuser

Types of Database

- **Location** might also be used to classify the database. It can be classified as

3. Centralized

4. Distributed

- The most popular way of classifying **database is based on how they will be used**

5. Operational database

6. Data warehouse

Types of Databases

1. Single-user database :

- It supports only one user at a time. In other words, if user A is using the database, users B and C must wait until user A is done.
- A single-user database that runs on a personal computer is called a **desktop database.**

Types of Databases

2. Multiuser database

- It **supports multiple users at the same time**.
- When the multiuser database supports a relatively small number of users (usually fewer than 50) or a specific department within an organization, it is called a **workgroup database**.
- When the database is used by the entire organization and supports many users (more than 50, usually hundreds) across many departments, the database is known as an **enterprise database.**

Types of Databases

3. Centralized database:

- A database that supports data located at a single site is called a centralized database.

3. Distributed database :

- A database that supports data distributed across several different sites is called a distributed database.

Types of Databases

5. Operational database :

- A database that is designed primarily to **support a company's day-to-day operations is classified as an operational database** (sometimes referred to as a transactional or production database).

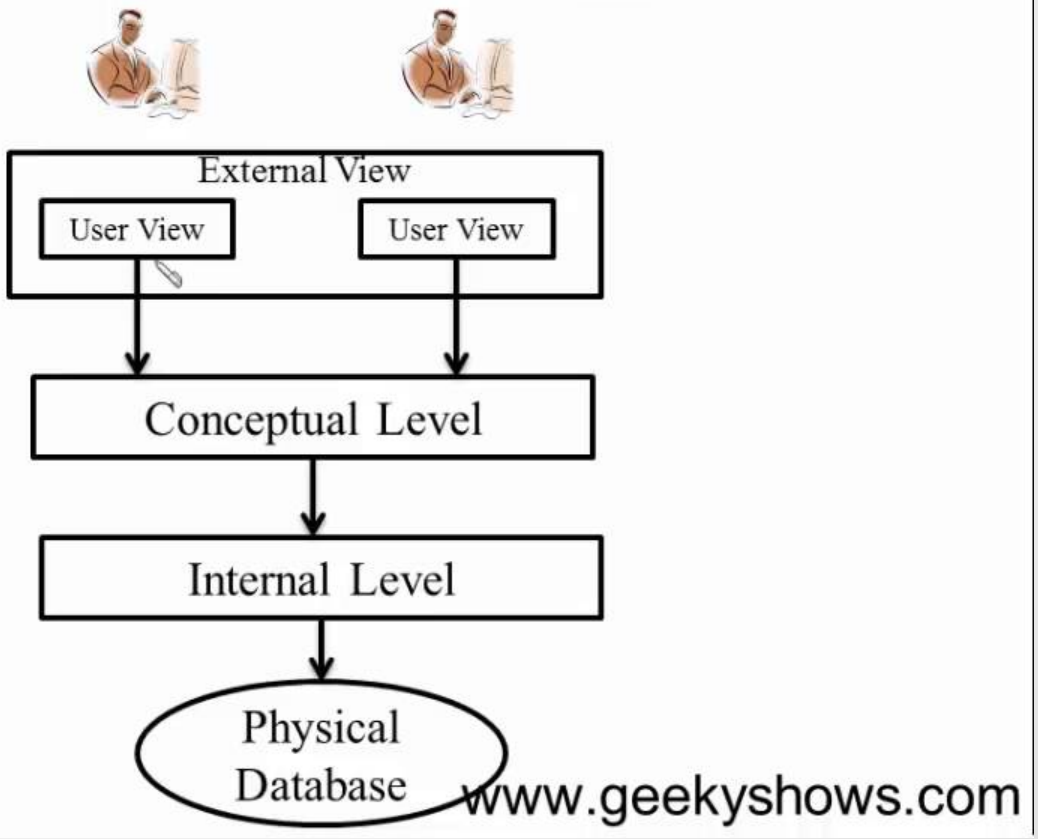
6. Data warehouse :

- This type of database focuses primarily on s**toring data used to generate information required to make tactical or strategic decisions**

Database Architecture

Architecture of DBMS

- Logical DBMS Architecture or Three Level Architecture of DBMS
  - The External or View Level
  - The conceptual or Global Level
  - The Internal or Physical Level
- Physical DBMS Architecture



Database Architecture

- Three level architecture is also called **three schema architecture**
- This framework is used for describing the structure of specific database systems (small systems may not support all aspects of the architecture)

Database Architecture - External View

- Highest or **Top level of data abstraction** (No knowledge of DBMS S/W and H/W or physical storage).
- **This level is concerned with the user.**
- Each e**xternal schema describes the part of the database that a particular user is interested** in and hides the rest of the database from user.
- There **can be *n* number of external views** for database where n is the number of users.
- All database users work on external level of DBMS

Database Architecture -Conceptual View

- This level is in between the user level and physical storage view.
- It **hides the details of physical storage structures and concentrates on describing entities, data types, relationships, user operations, and constraints.**

Database Architecture - Internal View

- It is the **lowest level of data abstraction**. (it has the knowledge about s/w and h/w).
- At this level, **it keeps the information about the actual representation of the entire database i.e. the actual storage of the data** on the disk in the form of records or blocks.
- **It is close to the physical storage method.**
- The internal view is **the view that tells us what data is stored in the database and how.**

Working of three level architecture

Presentation tier

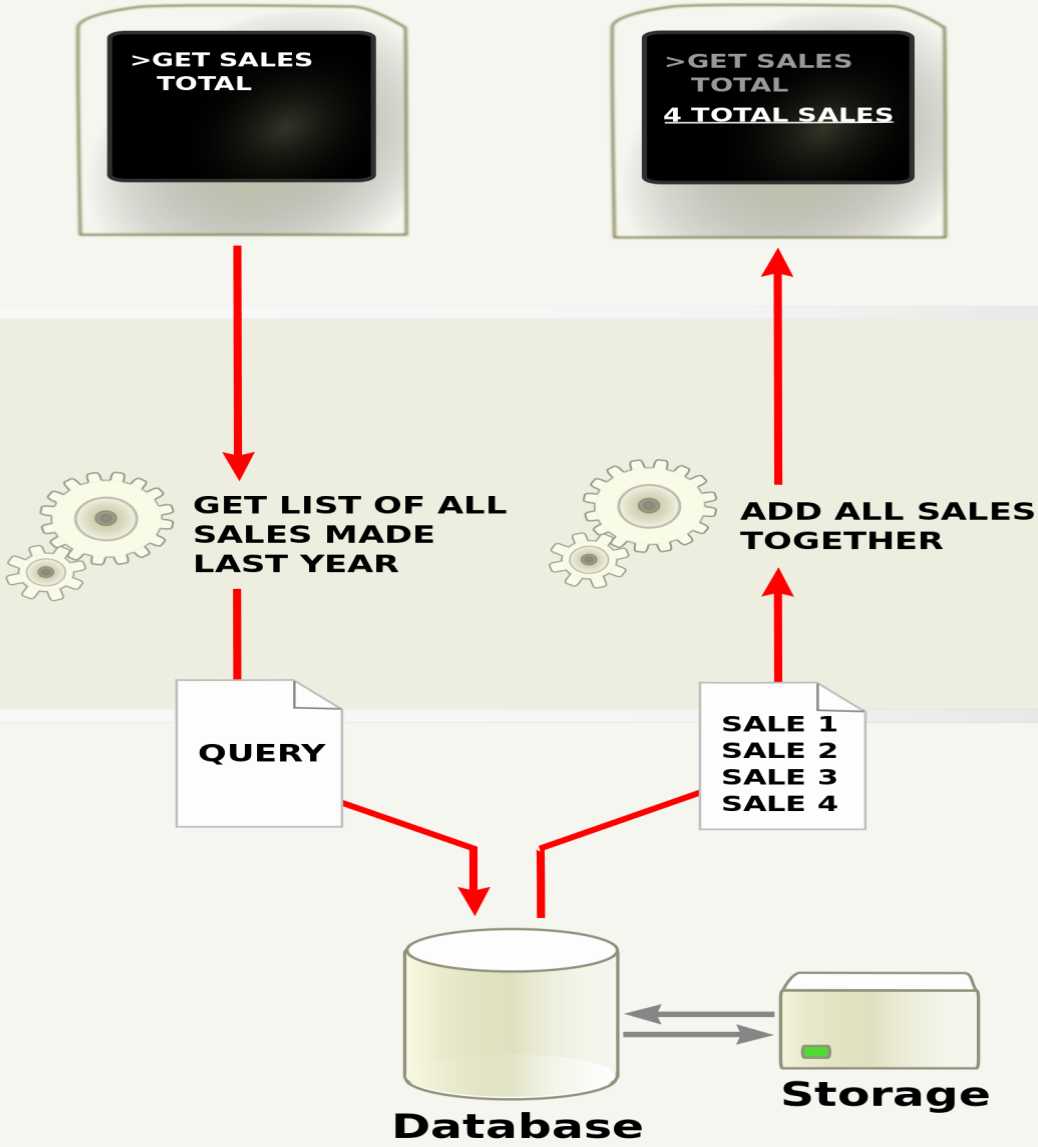
The top-most level of the application is the user interface. The main function of the interface is to translate tasks and results to something the user can understand.

Logic tier

This layer coordinates the application, processes commands, makes logical decisions and evaluations, and performs calculations. It also moves and processes data between the two surrounding layers.

Data tier

Here information is stored and retrieved from a database or file system. The information is then passed back to the logic tier for processing, and then eventually back to the user.



Disadvantages of DBMS

- **Increased costs :**
  - The **cost of maintaining the hardware, software, and personnel required to operate and manage** a database system can be costly
- **Management complexity :**
  - Databases systems hold crucial company data that are **accessed from multiple sources, security issues** must be assessed constantly.
- **Maintaining currency :**
  - To maximize the efficiency of the database system, **you must keep your system updated.**
- **Vendor dependence :**
  - Given the **heavy investment in technology and personnel training, companies might be reluctant to change database vendors.**
- **Frequent upgrade/replacement cycles :**
  - **DBMS vendors frequently upgrade their products** by adding new functionality.

DATABASE MODEL

- **Database design** focuses on **how the database structure will be used to store and manages end-user data.**
- **Data Modeling - the first step in desigining a database,** refers to the **process of creating a specific data model** for a determined problem domain.
- **A Data Model is a relatively simple representation,** usually graphical or more **complex real world data structure.**
- The **term “Data Model” and “Database Model” are same.**

DATABASE MODEL

- **Hierarchical Model :** data model based on trees.
- **Network Model:** data model based on graphs with records as nodes and relationships between records as edges.
- **Relational Model :** data model based on tables
- **E-R Model :** data model based on entiities and their relationship

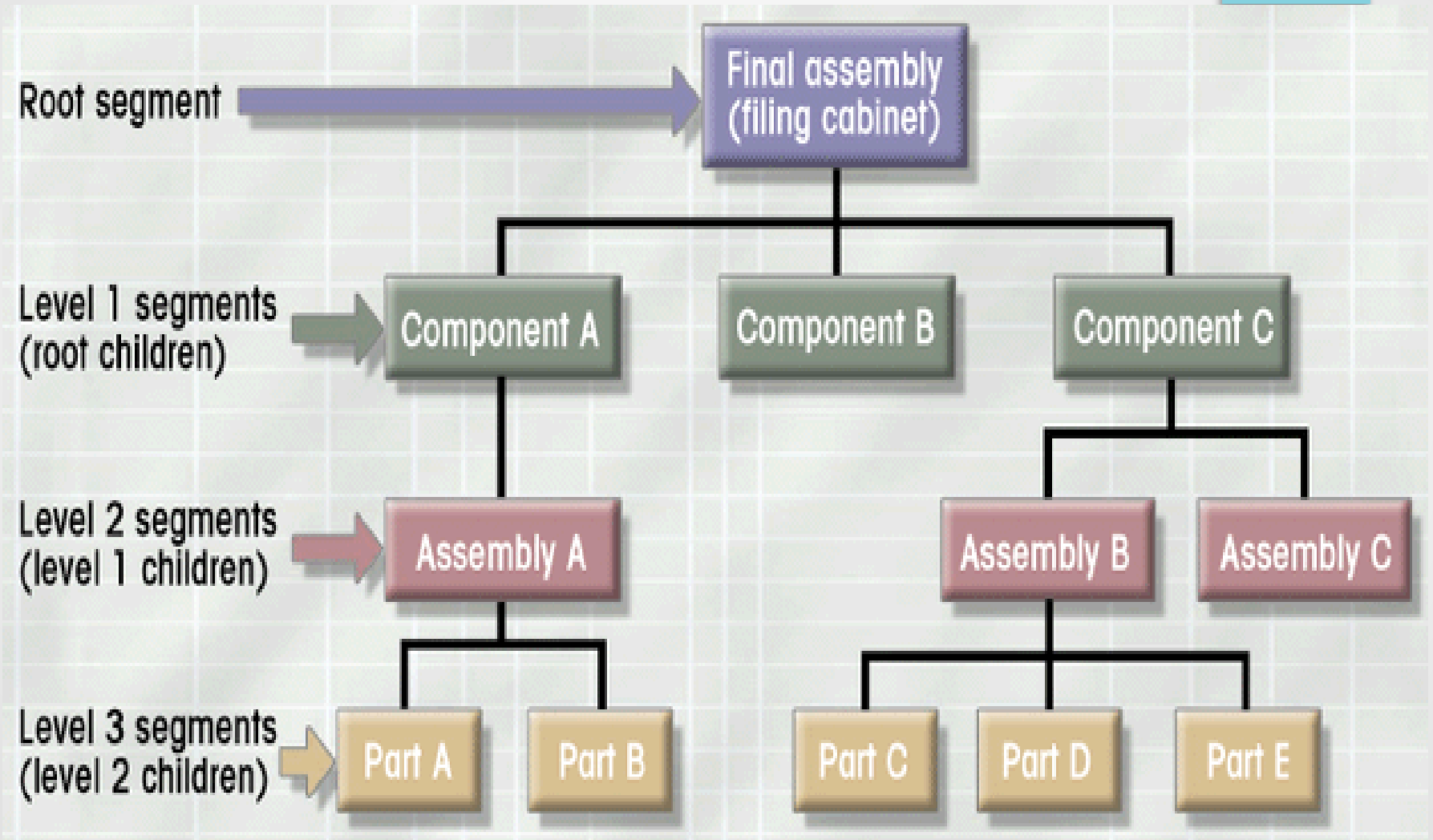
DATABASE MODEL - EVOLUTION

GENERATION	TIME	DATA MODEL	EXAMPLES
First	1960 - 1970	File System	VMS
Second	1970	Hierarchical and Netwowrk	IMS, ADABAS, IDSII
Thired	Mid - 1970	Relational	DB2, Oracle, MS SQL Server
Fourth	Mid - 1980	Object Oriented	DB2
Fifth	Mid - 1990	XML	DBXML
Emerging: No SQL	Late 2000 to Present	Key Value store Column store	Simple DB (Amazon)

Hierarchical Model

- Hierarchical Model was **developed in the 1960** to manage large amount of data for complex manufacturing projects.
- i.e **Apollo rocket** that landed on the moon in 1969.
- The model's basic logical structure is **represented by an upside-down tree.**
- The hierarchical structure **contains levels or segment**.
- **Segment is the equivalent of a file system's record type.**
- Within hierarchical, **each parent can have many children and each child has only one parent.**
- This model depicts a set of **one to many (1:M) relationship**.

Hierarchical Model



Hierarchical Model

Advantages

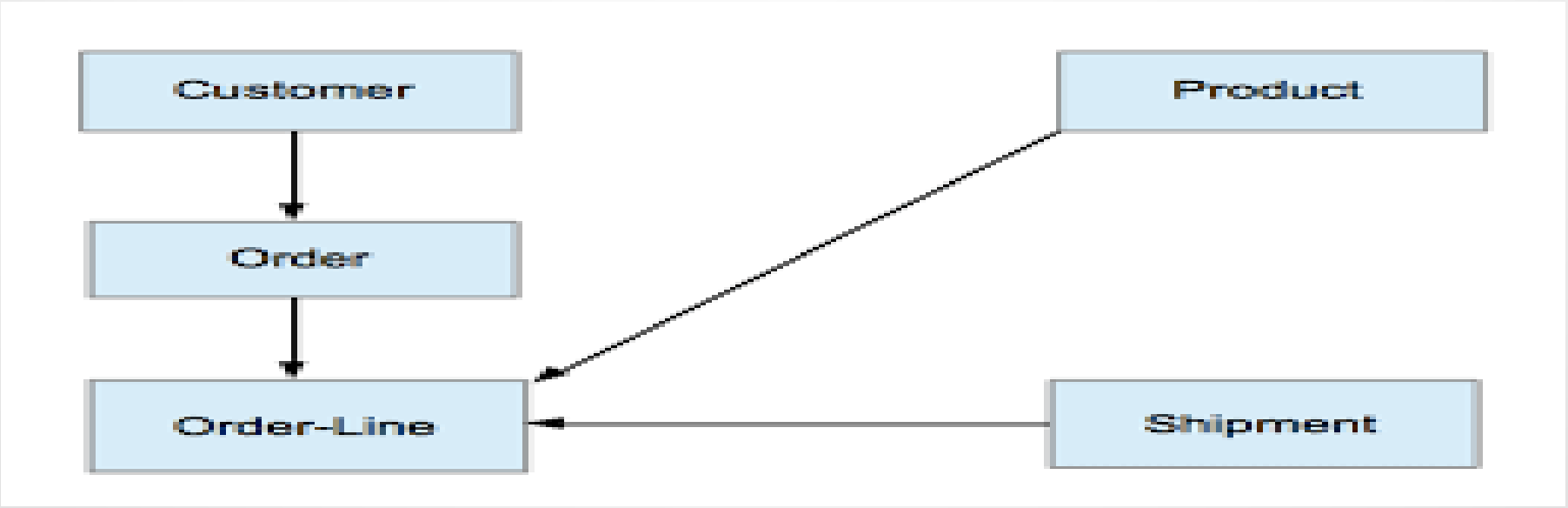
- Promotes data sharing
- Parent/child relationship promotes conceptual simplicity and data integrity
- Database security is provided and enforced by DBMS
- Efficient with 1:M relationships

Disadvantages

- Requires knowledge of physical data storage characteristics
- Navigational system requires knowledge of hierarchical path
- Changes in structure require changes in all application programs
- Implementation limitations
- No data definition
- Lack of standards

Network Model

- The Network Model **was created to represent complex data relationships** more effectively than the hierarchical model.
- It **allow more than one parent.**
- The **Network Model is generally not used today.**
- Starndard database concept like **Schema, DML, DDL still used by morden data model**



Network Model

Advantages

- Conceptual simplicity
- Handles more relationship types
- Data access is flexible
- Data owner/member relationship promotes data integrity
- Conformance to standards
- Includes data definition language (DDL) and data manipulation language (DML)

Disadvantages

- system complexity limits efficiency
- Navigational system yields complex implementation, application development, and management
- Structural changes require changes in all application programs

NETWORK MODEL

- **Standard Database Concepts**
  - **Schema :** is the **conceptual organization of the entire database** as viewed by the database administrator.
  - **SubSchema** : **define the portion of the database "seen"** by the application programs that actually produce the desired **information from the data within the database.**
  - **DML** : the **Data Manipulation Lanaguage** defines the **envionment in which data can be managed** and is used to work with the data in the database.
  - **DDL** : the **Data Definition Language** enable the database **administrator to define the schema componets.**

Hierarchical V/S Network

Hierarchical Model

- Manage large amounts of data for complex manufacturing projects
- Represented by an upside-down tree which contains segments
- **Segments**: Equivalent of a file system's record type
- Depicts a set of one-to-many (1:M) relationships

Network Model

- Represent complex data relationships
- Improve database performance and impose a database standard
- Depicts both one-to-many (1:M) and many-to-many (M:M) relationships

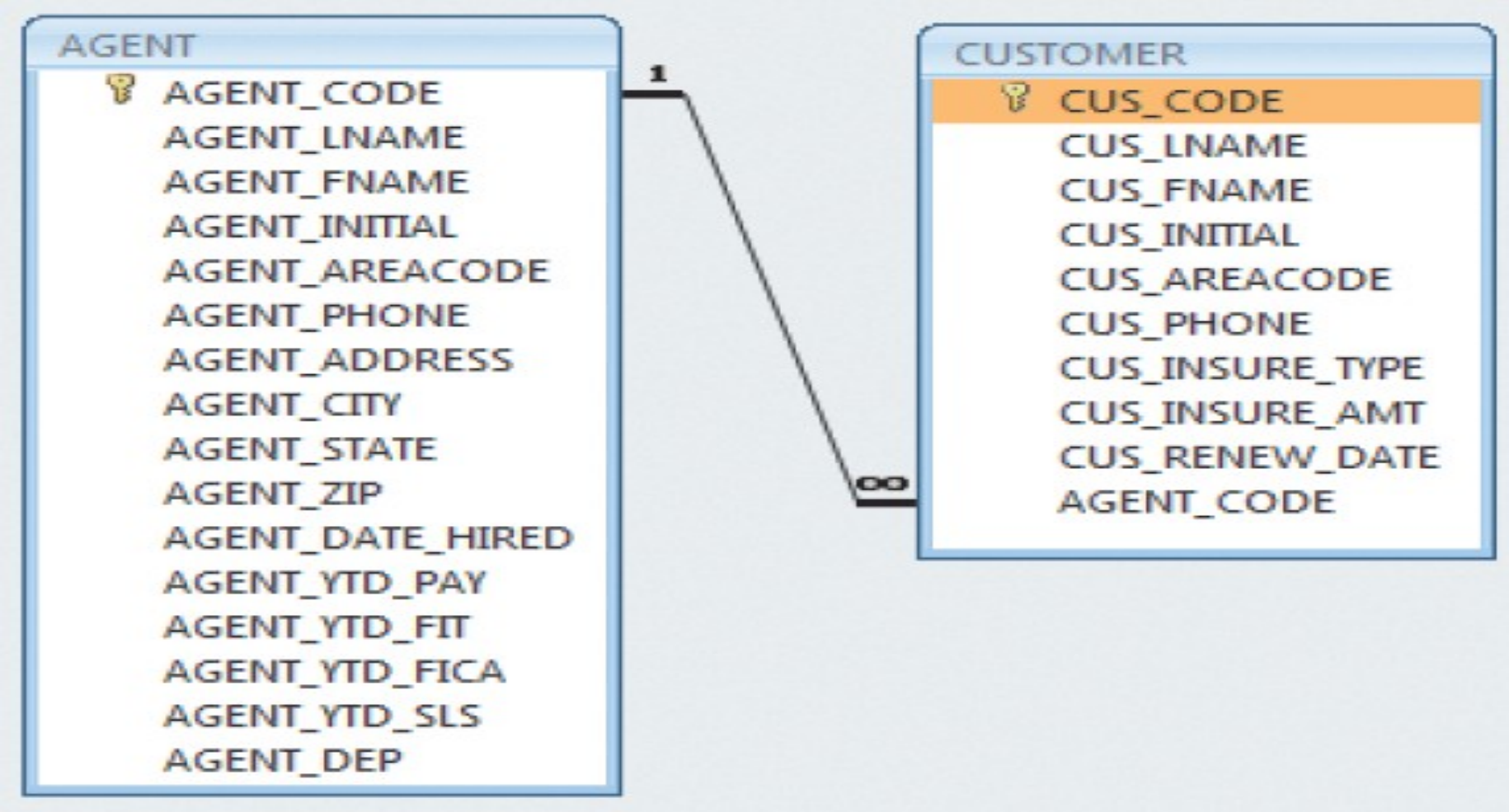
RELATIONAL MODEL

- Relational Model **was introuduced in 1970** bt E.F.Codd of IBM in his landmark paper “A Relational Model of Data for Large Shared Databanks”
- The Relational data model is **implemented through a very sophistiated “Relational Database Management System”**.
- The **RDBMS manages all of the physical details**, while the user sees the **relational database as a collection of table in which data are stored.**

RELATIONAL MODEL

- **Performs basic functions provided by the hierarchical and network DBMS systems.**
- Makes the **relational data model easier to understand and implement.**
- **Hides the complexities of the relational model from the user.**

RELATIONAL MODEL



RELATIONAL MODEL

Database name: Ch02_InsureCo **Table name: AGENT (first six attributes)**

AGENT_CODE	AGENT_LNAME	AGENT_FNAME	AGENT_INITIAL	AGENT_AREACODE	AGENT_PHONE
501	Alby	Alex	B	713	228-1249
502	Hahn	Leah	F	615	882-1244
503	Okon	John	T	615	123-5589

Link through AGENT_CODE

Table name: CUSTOMER

CUS_CODE	CUS_LNAME	CUS_FNAME	CUS_INITIAL	CUS_AREACODE	CUS_PHONE	CUS_RENEW_DATE	AGENT_CODE
10010	Ramas	Alfred	A	615	844-2573	05-Apr-2004	502
10011	Dunne	Leona	K	713	894-1238	16-Jun-2004	501
10012	Smith	Kathy	W	615	894-2285	29-Jan-2005	502
10013	Olowski	Paul	F	615	894-2180	14-Oct-2004	502
10014	Orlando	Myron		615	222-1672	28-Dec-2004	501
10015	O'Brian	Amy	B	713	442-3381	22-Sep-2004	503
10016	Brown	James	G	615	297-1228	25-Mar-2004	502
10017	Williams	George		615	290-2556	17-Jul-2004	503
10018	Farriss	Anne	G	713	382-7185	03-Dec-2004	501
10019	Smith	Olette	K	615	297-3809	14-Mar-2004	503

RELATIONAL Model

Advantages

- Structural independence is promoted using independent tables
- Tabular view improves conceptual simplicity
- Ad hoc query capability is based on SQL
- Isolates the end user from physical-level details
- Improves implementation and management simplicity

Disadvantages

- Requires substantial hardware and system software overhead
- Conceptual simplicity gives untrained people the tools to use a good system poorly
- May promote information problems

ENITITY RELATIONSHIP MODEL

- In turn, the rapidaly increasing requirements for transation and information created the need for more complex database implementation structure.
- Thus creating the need for more effective database design tools -
  - Entity Relationship (ER) Model or ERM
- **Peter Chen first introduced to ER data model in 1976**, the **graphical representation of Entites and their relationships** in a database structure quickly became popular.

ENITITY RELATIONSHIP MODEL

- The ER Model is baed on the following components:
  - **Entity:**
  - an entity is d**efined as anything about which data will be collected and stored.**
  - An entity is represented in the ERD by a RECTANGE also know **as entity box.**
  - The name of enitity , **a noun** is written in the center of the rectangle.
  - The **entity name** is generally written in **capital letters** and in singluar form. i.e PAINTER rather than PAINTERS, EMPLOYEE rather than EMPLOYEES

ENITITY RELATIONSHIP MODEL

- The ER Model is baed on the following components:
  - **Entity**:
  - Each row in the relational table is know as an **ENTITY INSTANCE or ENTITY OCCURRENCE** in the ER model
  - Each **entity consists of a set of attributes that describes particular characteristics of the entity.**
  - i.e EMPLOYEE will have attributes - PAN NUMBER, ADDHAAR NO etc.

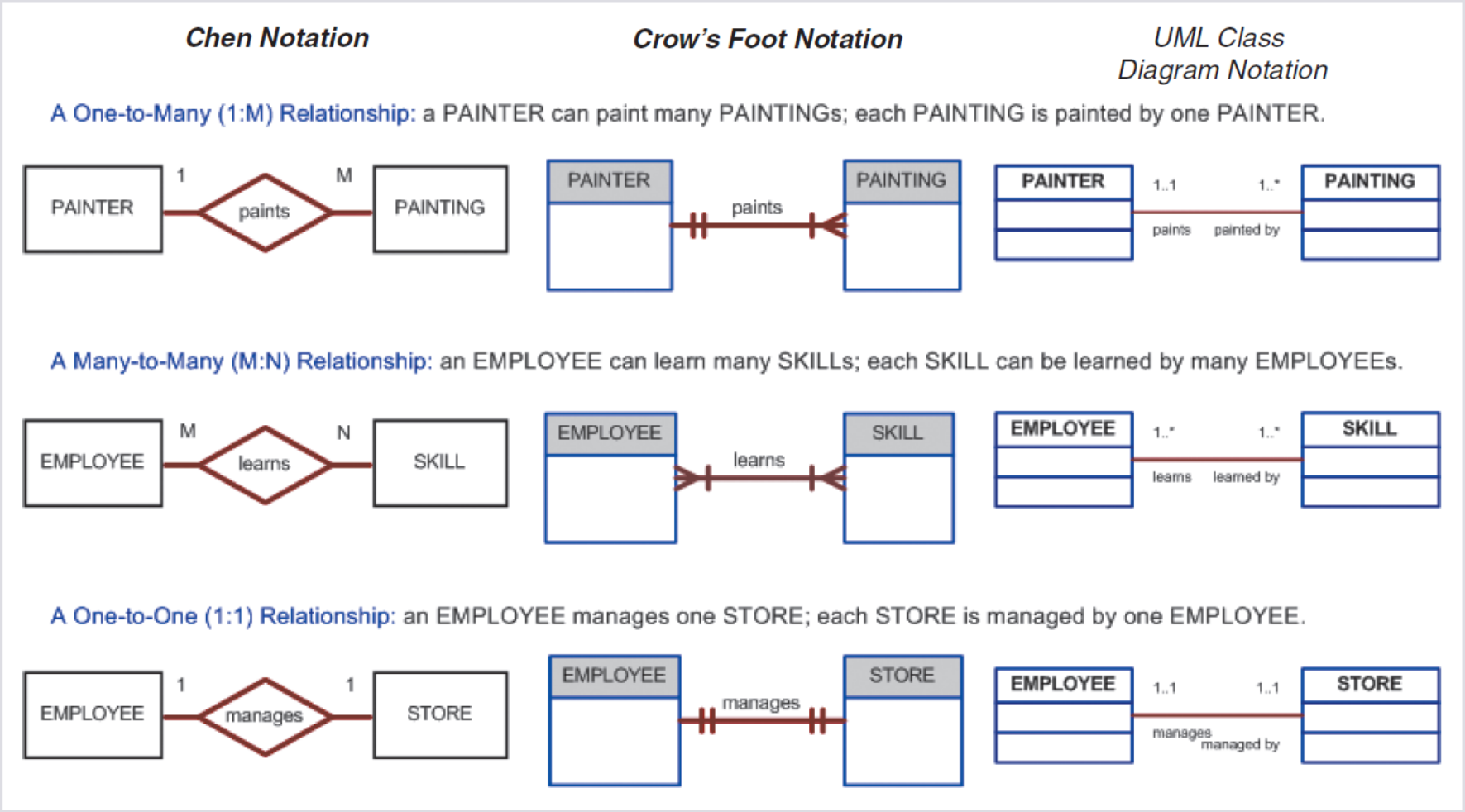
ENITITY RELATIONSHIP MODEL

- The ER Model is baed on the following components:
  - **Relationships:**
  - It describe associations among data. Associations between two entities.
  - Three types of data relations ships :
    - **one – to – many (1:M)**
    - **many – to – many (M:N)**
    - **one – to – one (1:1)**
  - The ER model use the term **“connectivity”** to label the relationship types.
  - The name of the relationship is usually an **active or passive verb.**

ENITITY RELATIONSHIP MODEL

- Type of relationships using three ER notations:
  - **Chen notation**
  - **Crow's Foot notation**
  - **Class diagram notation (part of UML)**

ENITITY RELATIONSHIP MODEL



ENITITY RELATIONSHIP MODEL

Advantages

- Visual modeling yields conceptual simplicity
- Visual representation makes it an effective communication tool
- Is integrated with the dominant relational model

Disadvantages

- Limited constraint representation
- Limited relationship representation
- No data manipulation language
- Loss of information content occurs when attributes are removed from entities to avoid crowded displays

- **Sem – 2**
  - **CEC exam for unit 1 on – --/12 / 2022**
  - **Assignment Submission – -- / 12 / 2022**

UNIT 1 COMPLETED