Data Base Technologies

Day 1

Agenda

- What is a database?
- Disadvantages of File Management Systems
- Data Management system
- Data Abstraction
- Data Independence
- Data Models
  - Hierarchal Model
  - Network Model
  - Relational Model
- Relational Data Base Management System Concepts

Definitions

Data :- It is defined as an information that can be recorded and that has implicit meaning.

Database : Collection of related data, stored in a standardized format ,designed to be shared by multiple users.

DBMS(Data Base Management System):-
- It consists of collection of inter related data and a set of programs to access the data
- It provides a convenient & efficient environment for inserting, retrieving,modifying and storing database information.

Database Applications

Banking: all transactions

Airlines: reservations, schedules

Universities: registration, grades

Sales: customers, products, purchases

Manufacturing: production, inventory, orders, supply chain

Human resources:employee records, salaries, tax deductions

FMS & Disadvantages

- Data redundancy and inconsistency
- Difficulty in accessing the data
- Data isolation
- Integrity problems
- Atomicity problems
- Concurrent access anomalies
- Security problems

Database Management System

- Control of data redundancy
- Sharing of data
- Maintenance of Integrity
- Control over Security
- Data abstraction
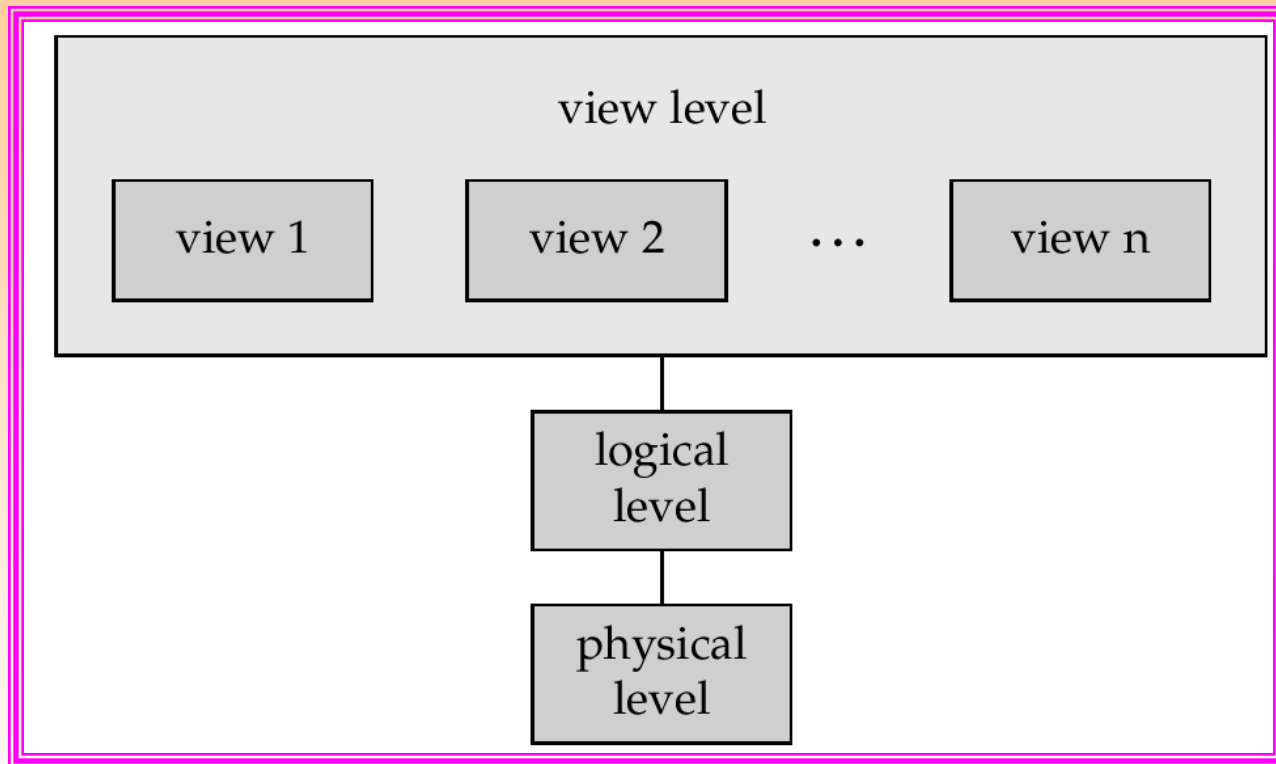- Data independence

Data Abstraction

- DBMS provides users with an abstract view of data.
- It hides the complex data structures for the representation of data in database.

Levels of abstraction

- **Physical level** : Lowest level of abstraction describes how data is stored.

- **Logical level** : Next higher level of abstraction describes what data is stored and the relationships among the data

- **View level** : Highest level of abstraction describes only part of database.

view level

view 1   view 2   ...   view n

logical
level

physical
level

Data Independence

Physical data independence

- Ability to modify the physical schema without causing application programs to be rewritten

Logical data Independence

- Ability to modify logical schema without causing application programs to be rewritten

Data Model

- An integrated collection of concepts for describing data, relationships between data and constraints on the data.

- A data model comprises three components:
  - a **structural part** (a set of rules describing how the database is to be constructed)
  - a **manipulative part** (defines the types of operations allowed on the data)
  - a **set of integrity rules** (ensures data accuracy)

Types of data models

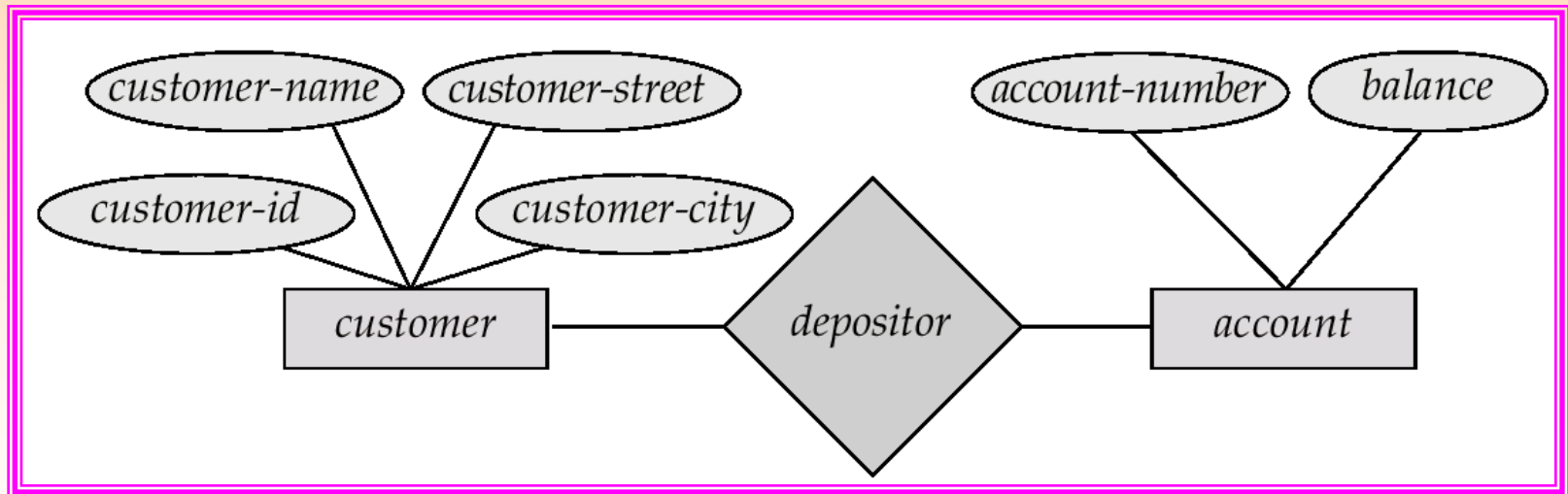- Object-based logical models: Based on collection of objects.

  ER-model,object-oriented model

- Record-based logical model:Database is structured in fixed format record.

  Hierarchical,Network,relational models

Entity-Relationship Model

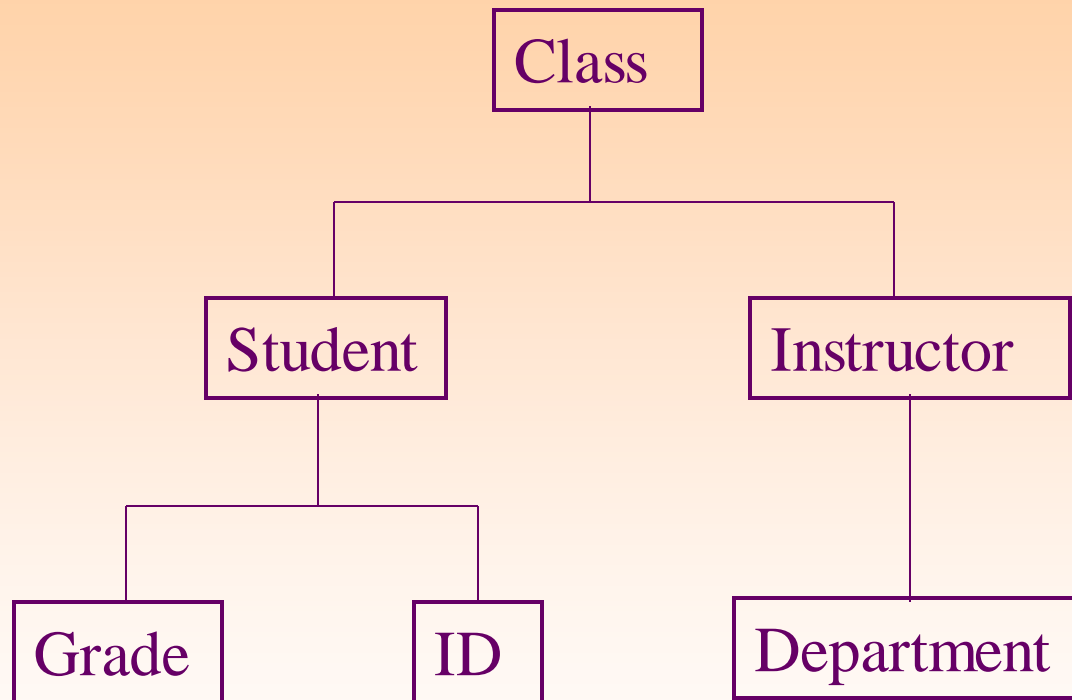## Example of schema in the entity-relationship model

Hierarchical model

- A Hierarchical database consists of a collection of records that are connected to each other through links.

- The hierarchical data model organizes data in a tree structure

- Parent-child relationship (one-to-one or one-to-many) among data

Hierarchical data model

```
                    ┌─────────┐
                    │  Class  │
                    └────┬────┘
              ┌──────────┴──────────┐
         ┌────┴────┐          ┌─────┴──────┐
         │ Student │          │ Instructor │
         └────┬────┘          └─────┬──────┘
       ┌──────┴──────┐              │
    ┌──┴───┐      ┌──┴──┐      ┌────┴───────┐
    │ Grade│      │ ID  │      │ Department │
    └──────┘      └─────┘      └────────────┘
```

Hierarchical data model

- Advantages

  easy to search

  can add new branches easily
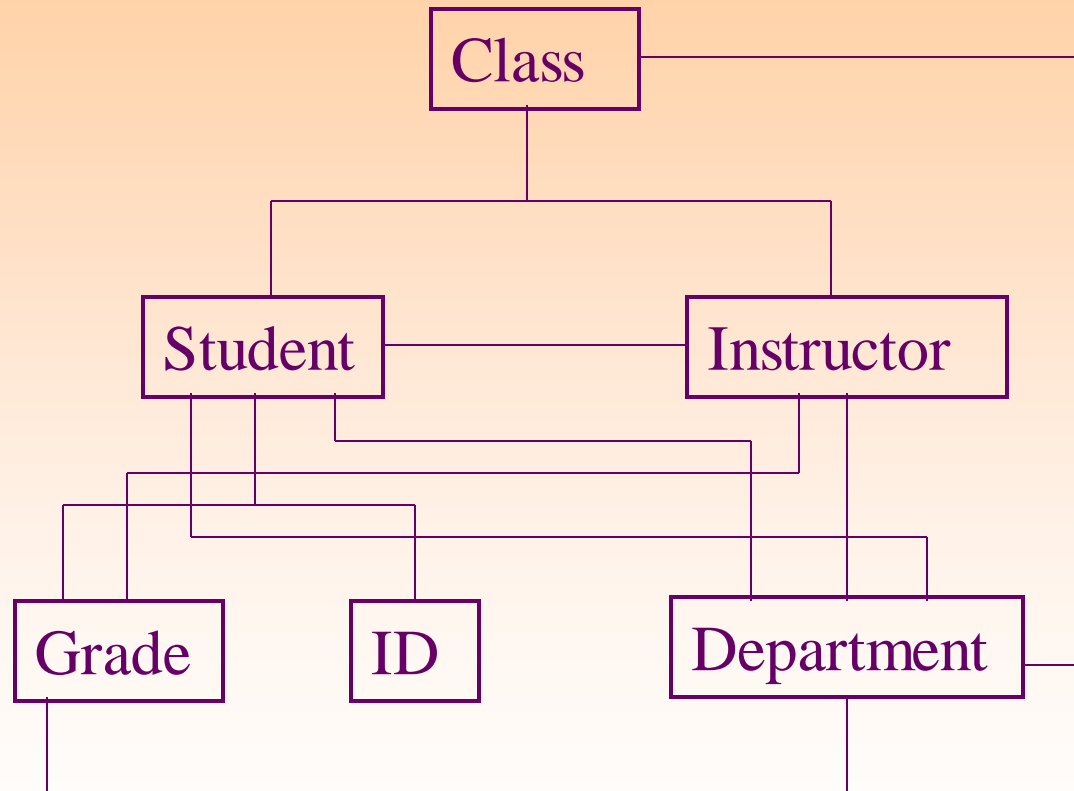
- Disadvantages

  All child records are lost with the deletion of parent record.

Network Model

- A Network database consists of a collection of records connected to one another through links,which can be viewed as pointers.

- The records in the database are organized as collections of arbitrary graphs.

- One-to-one, one-to-many, many-to-one, or many-to-many relationships possible

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Network data model

Network data model

Advantages

    flexible, fast, efficient

Disadvantages

    complex

    restructuring can be difficult because of changing all the pointers

Relational Model

- A relational model consists of relations which represents data and the relationships among data..

- A relation is a two dimensional table with special properties.

- A relational table is a collection of columns and rows

- columns are called attributes and rows are called tuples.

Properties of Relational Tables

- Table name is distinct from all other table names in the database.
- Each cell of table contains exactly one atomic (single) value.
- Each column has a distinct name.
- Values of a column are all from the same domain.
- Each record is distinct; there are no duplicate records.
- Order of columns has no significance.
- Order of records has no significance.

Relational Model

Customer-id	customer-name	customer-street	customer-city	account-number
192-83-7465	Johnson	Alma	Palo Alto	A-101
019-28-3746	Smith	North	Rye	A-215
192-83-7465	Johnson	Alma	Palo Alto	A-201
321-12-3123	Jones	Main	Harrison	A-217
019-28-3746	Smith	North	Rye	A-201

Rows/ Tuples/ Records

Relational Keys

Each record in a table must be unique

- A super key is a column, or a set of columns, that uniquely identifies a record in a table.
- A minimal super key , with no proper subset that is also a super key, is called a candidate key.
- A key consisting of more than one column is called a composite key.
- A primary key is the candidate key that is selected by the database designer, to uniquely identify records within the table.
  – the candidate keys not selected are called alternate keys.
- A foreign key is a column or set of columns within a table that is the candidate key of another table.

Relational Integrity

A set of integrity rules ensure that the data is accurate.

- Domain Integrity:Defines the domain constraint for each column that restrict the set of values allowed for each column

- Entity Integrity:In a table, no column of primary key can be null or duplicate.

- Foreign key and Referential Integrity:If a foreign key exists in a table its value must

  -either match with candidate key value of some record in the home table

  -or be wholly null

Thank you