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YEAR  
**II**

SEM  
**IV**

**CS 8492**

**DATABASE MANAGEMENT SYSTEMS**  
(Common to CSE & IT)

**UNIT NO. 1**

**1.1.1 DATA MODELS**



### 1.1.1 DATA MODELS

Content (Times New Roman 12)

A set of concepts to describe the structure of a database, the operations for manipulating these structures, and certain constraints that the database should obey.

Data Model Structure and Constraints:

- Constructs are used to define the database structure
- Constructs typically include elements (and their data types) as well as groups of elements
- (e.g. entity, record, table), and relationships among such groups
- Constraints specify some restrictions on valid data; these constraints must be enforced at all times
- Data Modeling and Data Models Data model emphasizes on
  - (1) what data is needed and
  - (2) how it should be organized instead of what operations need to be performed on the data.
- Simple representations of complex real-world data structures.
- Useful for supporting a specific problem domain Model - Abstraction of a real-world object or event
- Data Models are used to support the development of information systems by providing the definition and format of data to be involved in future systems.
- Data model also gives idea about possible alternatives to achieve targeted solution.

### Advantages of Data model

- The main goal of a designing data model is to make certain that data objects offered by the functional team are represented accurately.
- The data model should be detailed enough to be used for building the physical

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database.

- The information in the data model can be used for defining the relationship between tables, primary and foreign keys, and stored procedures.
- Data Model helps business to communicate the within and across organizations.
- Data model helps to documents data mappings in ETL process Help to recognize correct sources of data to populate the model

**Data Model Basic Building Blocks**

- Entity: Unique and distinct object used to collect and store data Attribute: Characteristic of an entity
- Relationship: Describes an association among entities
- One-to-many (1:M)
- Many-to-many (M:N or M:M)
- One-to-one (1:1)
- Constraint: Set of rules to ensure data integrity

**Data Model Operations**

- These operations are used for specifying database retrievals and updates by referring to the constructs of the data model.
- Operations on the data model may include
- basic model operations (e.g. generic insert, delete, update) and
- user-defined operations (e.g. compute\_student\_gpa, update\_inventory)

**Categories of Data Models**

- Conceptual (high-level, semantic) data models:
- Provide concepts that are close to the way many users perceive data.
- (Also called entity-based or object-based data models.)
- Physical (low-level, internal) data models:
- Provide concepts that describe details of how data is stored in the computer. These are usually specified in an ad-hoc manner through DBMS design and administration manuals
- Implementation (representational) data models:
- Provide concepts that fall between the above two, used by many commercial DBMS

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implementations (e.g. relational data models used in many commercial systems).

**TYPES OF DATA MODELS**

- File based approach
- • Hierarchical Model
- • Network Model
- • Relational Model
- • ER Model
- • Object Oriented Model
- • Object Relational Model
- • Deductive / Inference Model

**FILE BASED APPROACH**

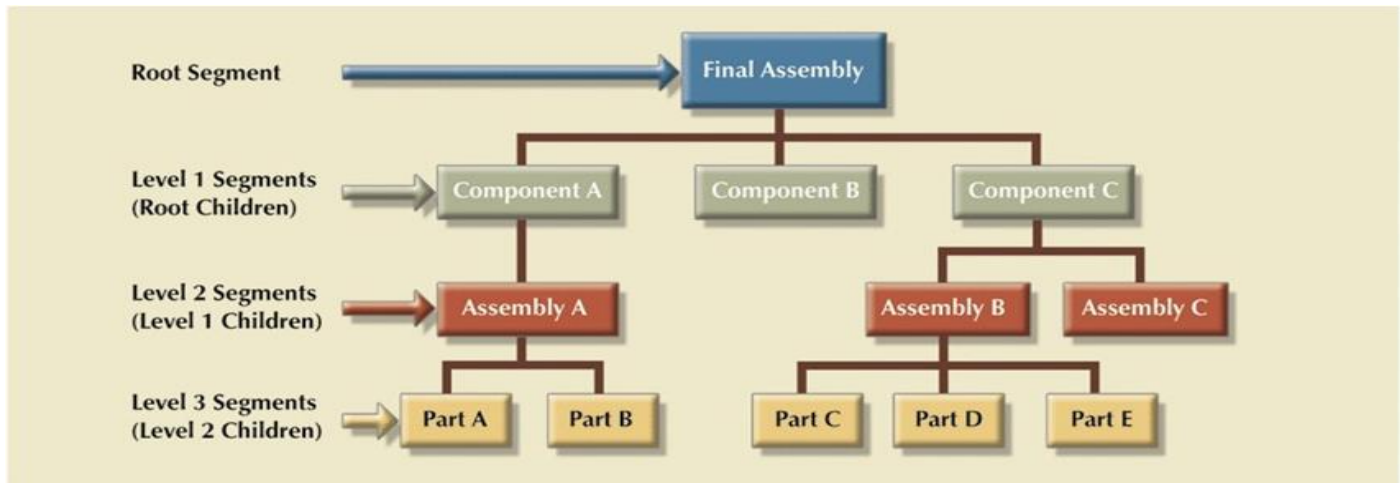
- A collection of un-related files and a collection of application programs that perform services for the end-users, such as the production of reports.
- Each program defines and manages its own data.
- Traditionally each department in a company would maintain its own collection of files.
- The data processing department would write programs for each application each office needed performed.

**LIMITATIONS OF THE FILE-BASED APPROACH**

- Separation and isolation of data
- Duplication of data
- Incompatible File Formats
- Data dependence
- Fixed queries/proliferation of application programs
- Inability to generate timely reports

**HIERARCHICAL MODEL**

- Oldest data base model. (1950's)
- Tree structure is most frequently occurring relationship.
- organize data elements as tabular rows

**DATABASE MANAGEMENT SYSTEMS**  
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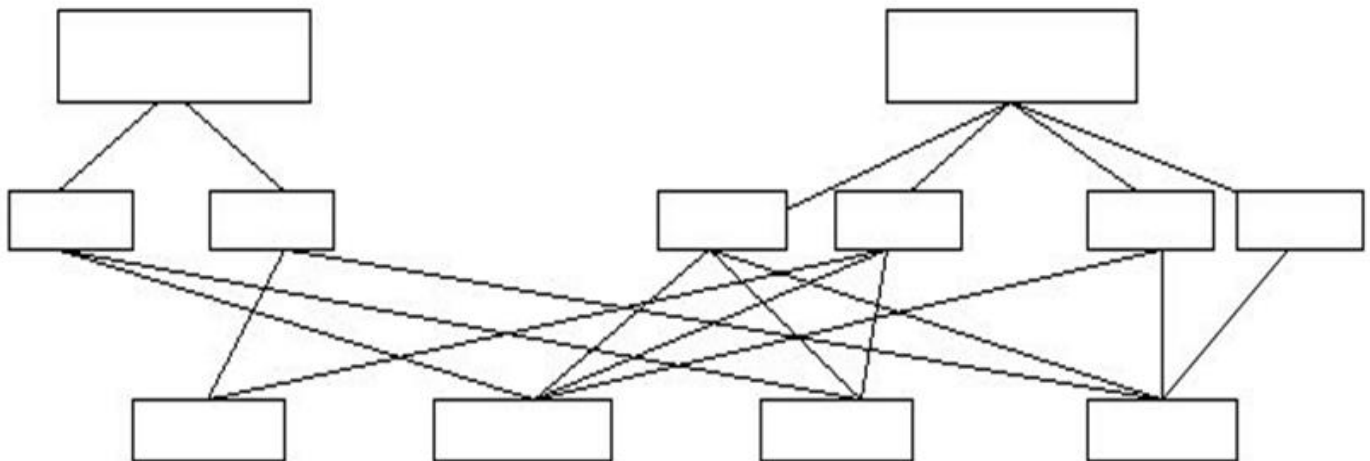
- Simplicity
- Data security
- Data Integrity
- Efficiency : When contains large no of relations

**DISADVANTAGES**

- Implementation complexity
- Database management problem : maintaining difficult
- Lack of structural independence
- programming complexity

**Network Model**

- Graph structure
- Allow more connection between nodes
- Ex: A employee work for two department is not possible in hierarchical model, but here it is possible

**DATABASE MANAGEMENT SYSTEMS**  
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- Conceptual simplicity
- handle more relationships
- Ease of data access
- Data integrity
- Data independence
- Database standards

**Disadvantages**

- System Complexity
- Absence of structural independence

**RELATIONAL MODEL**

- Data in the form of table
- each table is à application entity
- each row is à instances of that entity
- each column is a attribute
- SQL serves as a uniform interface for users providing a collection of standard expression for storing and retrieving data
- Most popular database model



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SID	SName	SAge	SClass	SSection
1101	Alex	14	9	A
1102	Maria	15	9	A
1103	Maya	14	10	B
1104	Bob	14	9	A
1105	Newton	15	10	B

**ERModel-The Entity-Relationship Model**

- The E-R (entity-relationship) data model views the real world as a set of basic objects (entities) and relationships among these objects.
- It is intended primarily for the DB design process by allowing the specification of an enterprise scheme.
- This represents the overall logical structure of the DB. An entity is represented by a set of attributes. (E.g. name, S.S.N., Phone-Num for “customer” entity.)
- ❖ The domain of the attribute is the set of permitted values (e.g. the telephone number must be seven positive integers).
- ❖ Formally, an attribute is a function which maps an entity set into a domain.
- ❖ Every entity is described by a set of (attribute, data value) pairs. There is one pair for each attribute of the entity set.
- ❖ E.g. a particular student entity is described by the set {(name, Yeoh), (S.S.N., 890-123-456), (street, Blaine), (city, Riverside)}.

**OO Model- Object Oriented Model**

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- Object oriented data model is based upon real world situations.
- These situations are represented as objects, with different attributes. All these object have multiple relationships between them.
- In contrast to relational database management systems (RDBMSs), where data is stored in tables with rows and columns, an object-oriented database stores complex data and relationships between data directly, without mapping any links to relational rows and columns.