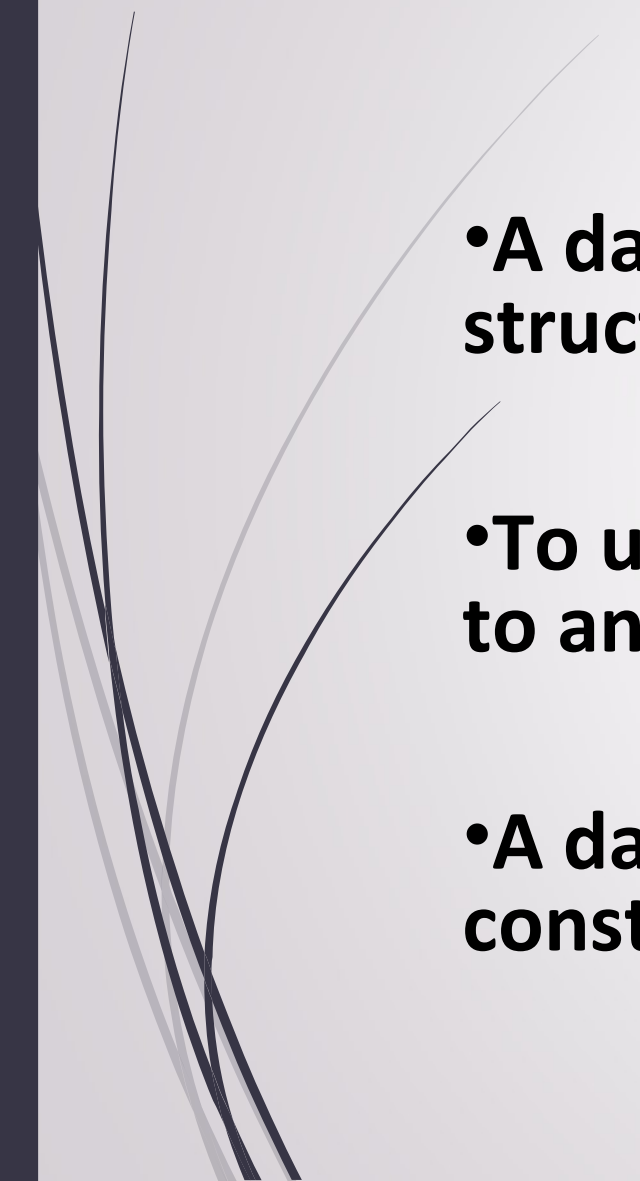# DIFFERENT DATA MODELS

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DATA MODELING

- A data model is a conceptual representation of the data structures that are required by a database.

- To use a common analogy, the data model is equivalent to an architect's building plans.

- A data model is independent of hardware or software constraints.
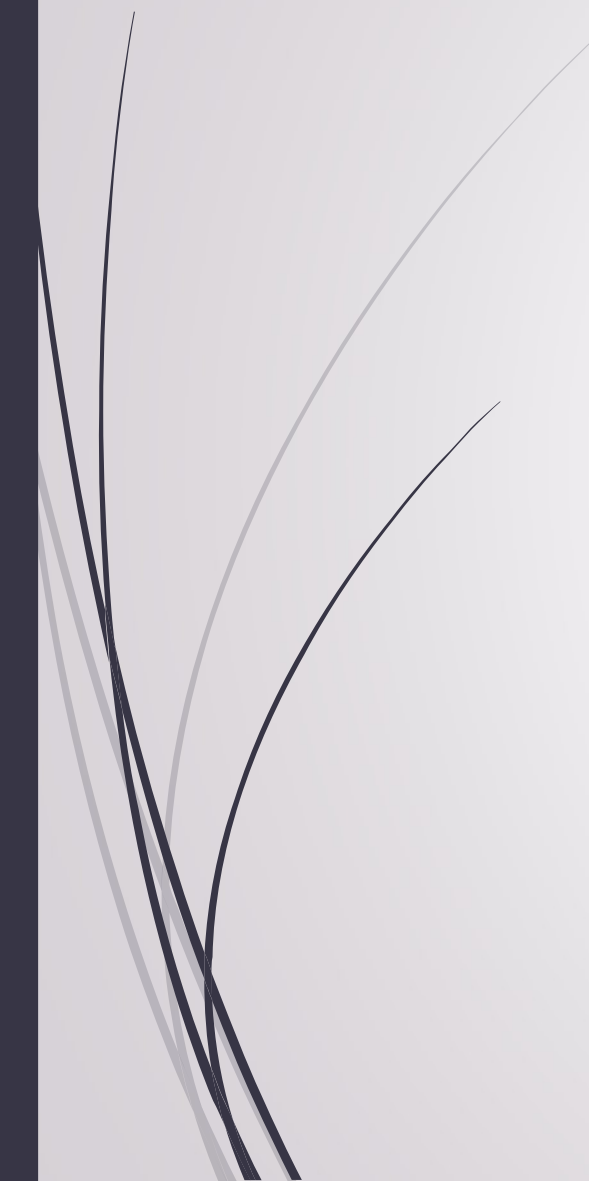
IMPORTANCE OF DATA MODELS

- **Data models**

  - ✓ **Representations, usually graphical, of complex real-world data structures**

  - ✓ **Facilitate interaction among the designer, the applications programmer and the end user**

- **End-users have different views and needs for data**

- **Data model organizes data for various users**

TYPE 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**.

  1. Traditionally each department in a company would maintain its own collection of files.

  2. The data processing department would write programs for each application each office needed performed.
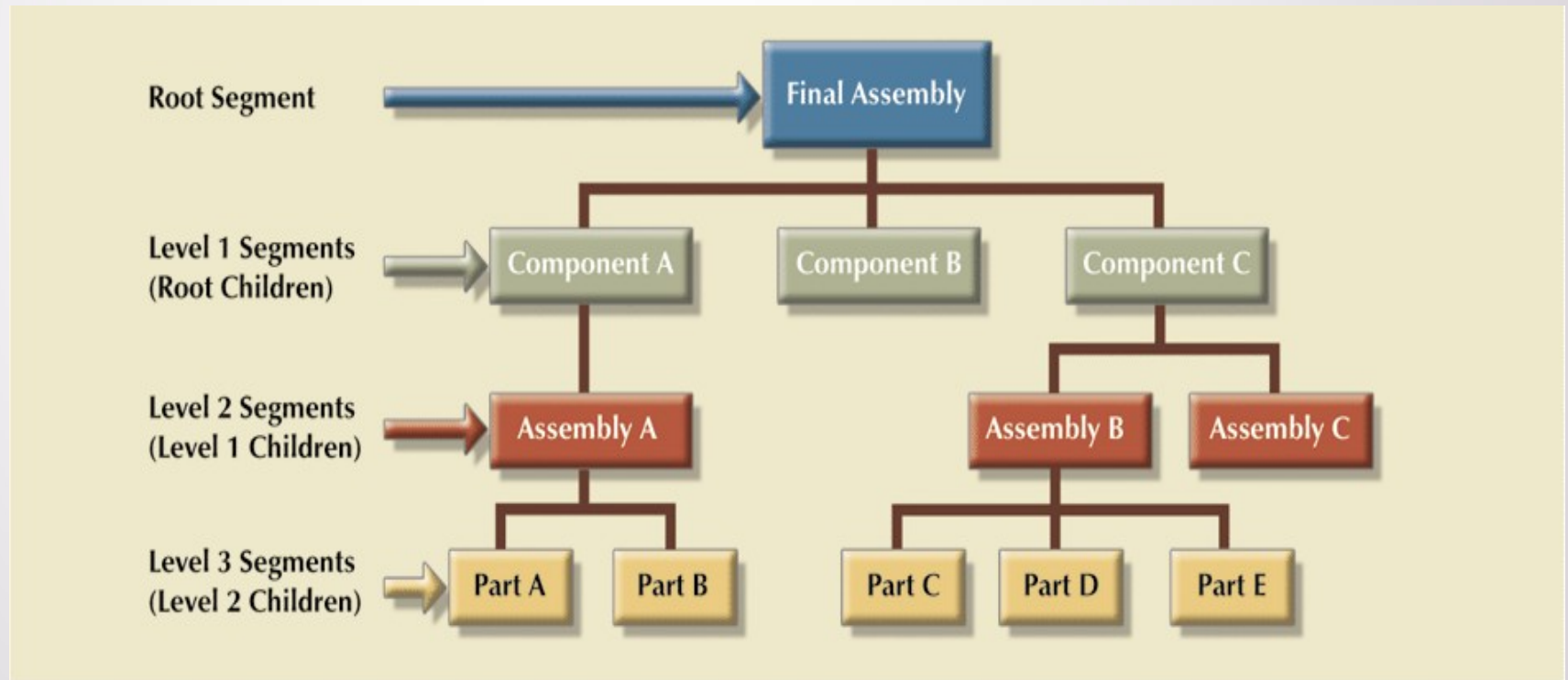
LIMITATIONS OF THE FILE-BASED APPROACH

- 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.
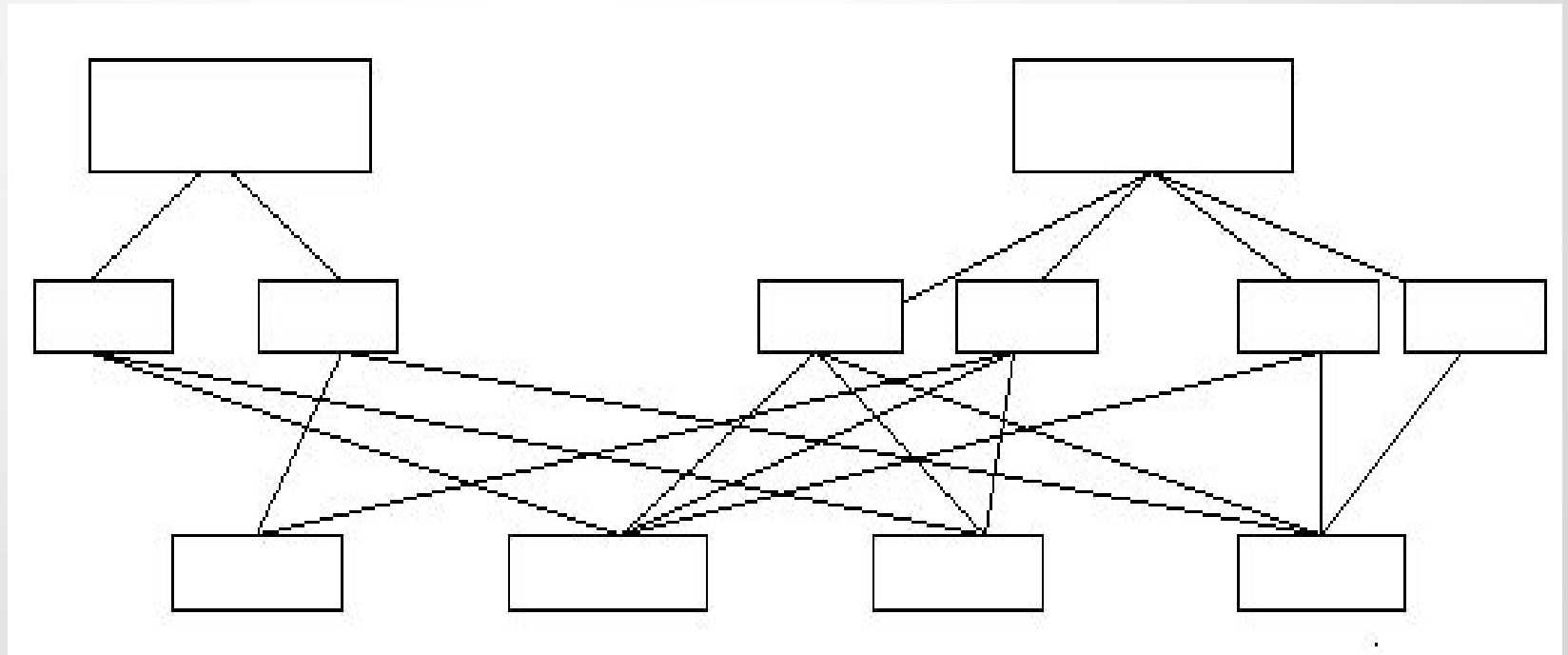- organize data elements as tabular rows

Advantages

- 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

Advantages

- 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 → application entity**
- **each row → instances of that entity**
- **SQL serves as a uniform interface for users providing a collection of standard expression for storing and retrieving data**
- **Most popular database model**

attributes   column

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

tuple

table (relation)

Formal Relational terms	Informal Equivalence
Relation	*Table*
Tuple	*Row/record*
Cardinality of relation	*Number of rows*
Attribute	*Columns/field*
Degree of relation	*Number of columns*
Primary Key	*Unique identifier*
Domain	*A pool of values from which the values of specific attributes of specific relations are taken*

Advantages

- **Structural independence**
- **Conceptual simplicity**
- **Design , implementation , maintenance and usage ease**
- **Query capability**
  - **Very powerful**
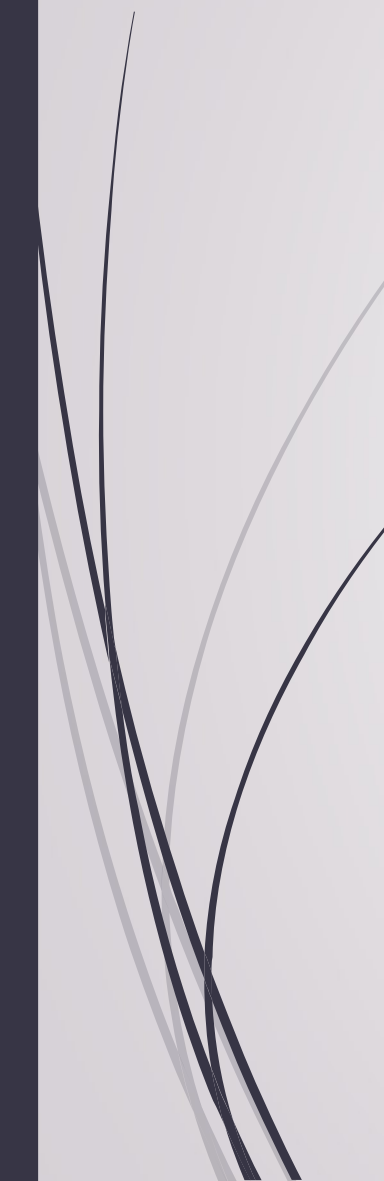 - **Flexible**
  - **Easy to use query capability**

Disadvantages

- Hardware Overheads (Today it is not a big deal...)
- Ease of design leads to bad design
- Information island phenomena
  - It will prevent information integrity
  - cause redundancy
  - cause inconsistency

The main highlights of relations model

- Data is stored in tables called relations.
- Relations can be normalized.
- In normalized relations, values saved are atomic values.
- Each row in a relation contains a unique value.
- Each column in a relation contains values from a same domain.

Comparison between hierarchical model, network model and relational model

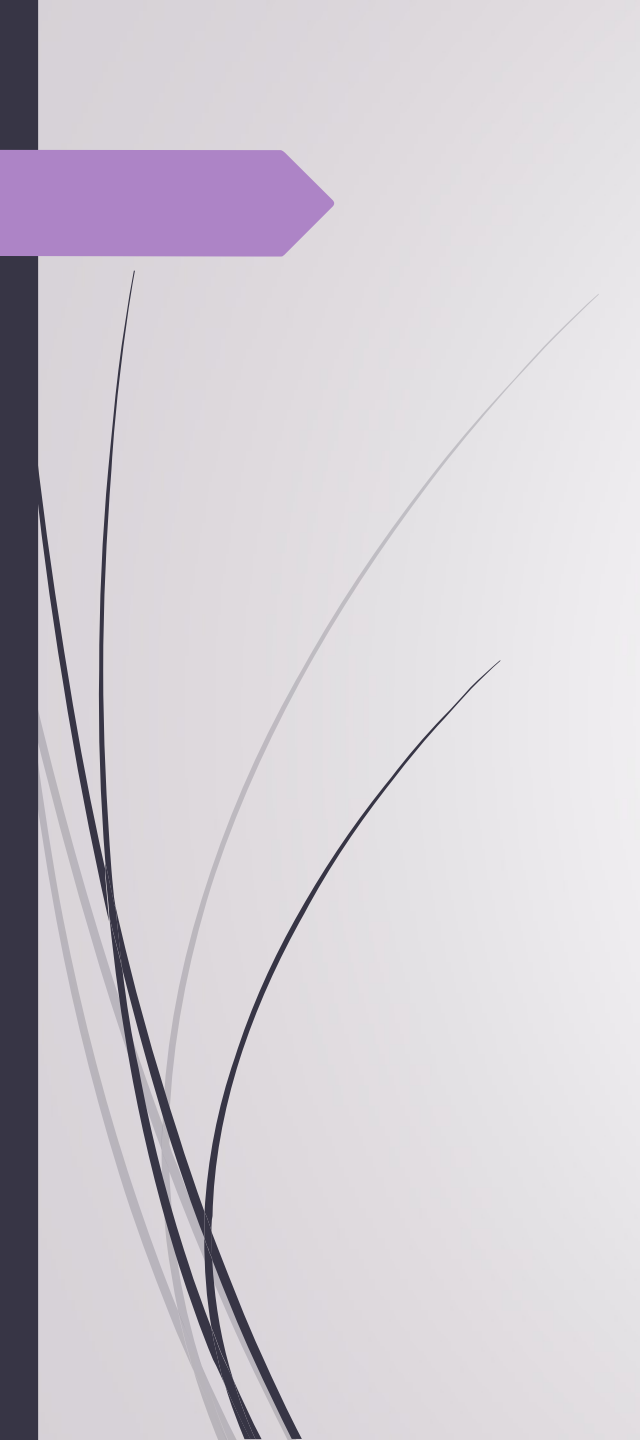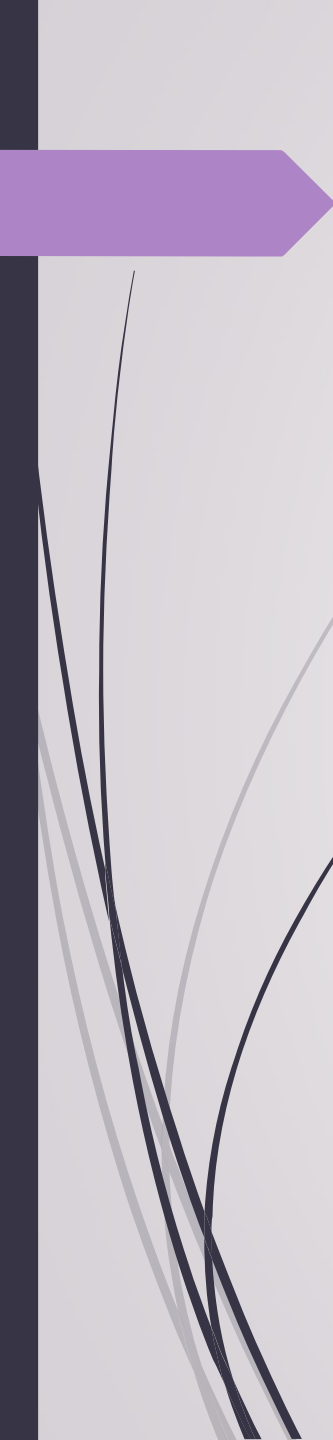| Characteristic	Hierarchical model	Network model	Relational model
Data structure	• One to many or one to one relationships. • Based on parent child relationship.	• Allowed the network model to support many to many relationships. • A record can have many parents as well as many children.	• One to One, One to many, Many to many relationships. • Based on relational data structures.
Data manipulation	• Does not provide an independent stand alone query interface • retrieve algorithms are complex and asymmetric	• CODASYL (Conference on Data Systems Languages) • Retrieve algorithms are complex and symmetric	• Relational databases are what brings many sources into a common query (such as SQL) • Retrieve algorithms are simple and symmetric

Characteristic	Hierarchical model	Network model	Relational model
Data integrity	• Cannot insert the information of a child who does not have any parent	• Does not suffer form any insertion anomaly.	• Does not suffer from any insert anomaly.
	• Multiple occurrences of child records which lead to problems of inconsistency during the update operation	• Free from update anomalies	• Free form update anomalies
	• Deletion of parent results in deletion of child records		
		• Free from delete anomalies	• Free from delete anomalies

why relational model best fits the DAD assignment scenario

- **Tables are basic building blocks of a relational database.**
- **Keys are central to the use of relational tables.**
- **Keys define functional dependencies**
  - ✓ **Candidate key**
  - ✓ **Primary key**
  - ✓ **Secondary key**
  - ✓ **Foreign key**

- Each table row must have a primary key which uniquely identifies all attributes

- Tables can be linked by common attributes. Thus, the primary key of one table can appear as the foreign key in another table to which it is linked

- The relational model supports relational algebra functions: SELECT, DELETE, LIKE, UPDATE, OR AND.

- Good design begins by identifying appropriate entities and attributes and the relationships among the entities.

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