

# Data Models

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# Types of Database Model

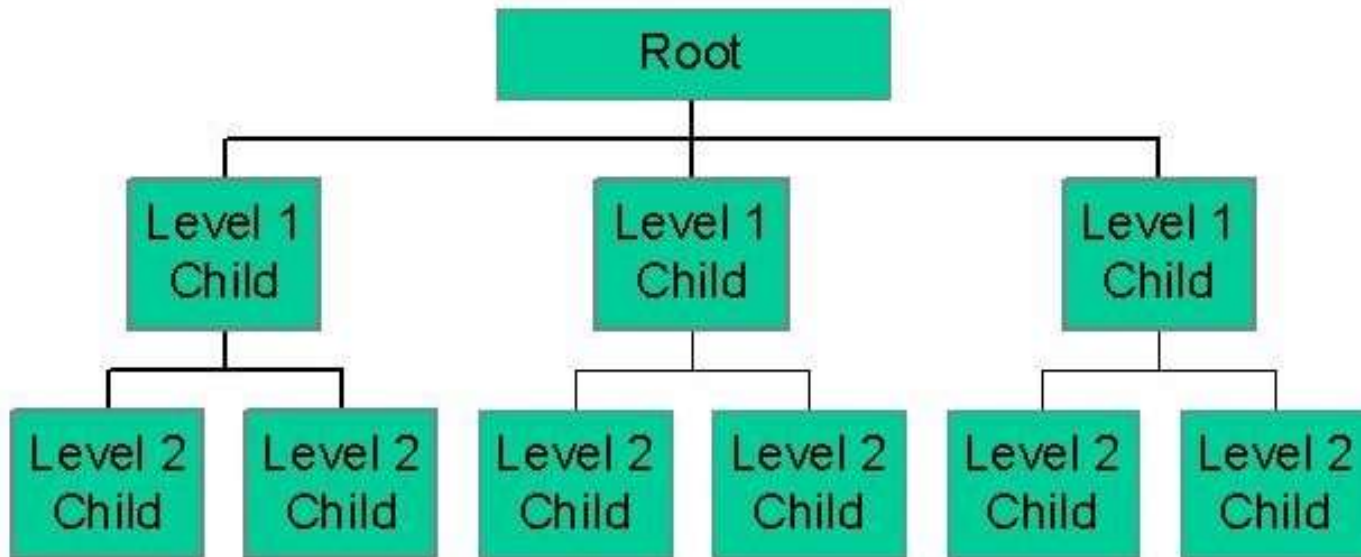
There are four common types of database model that are useful for different types of data or information.

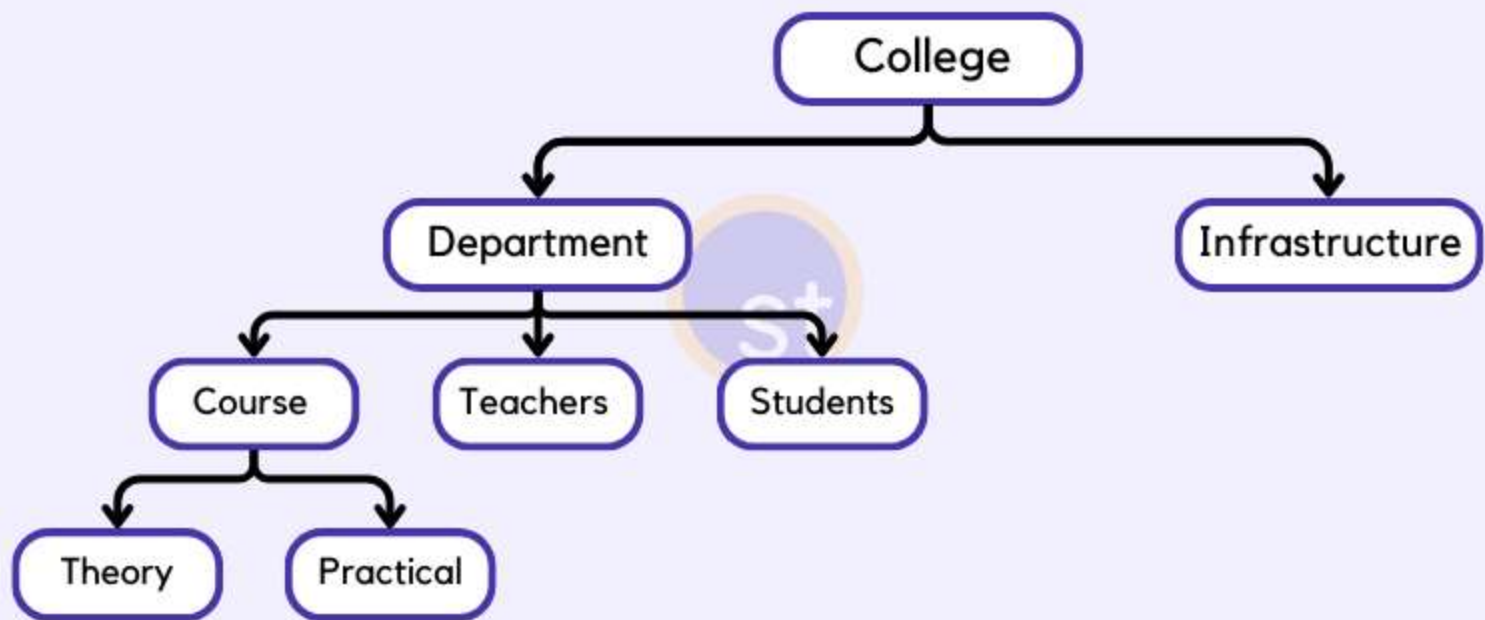
- Hierarchical database model.
- Network model.
- Relational model.
- Object-oriented database model.

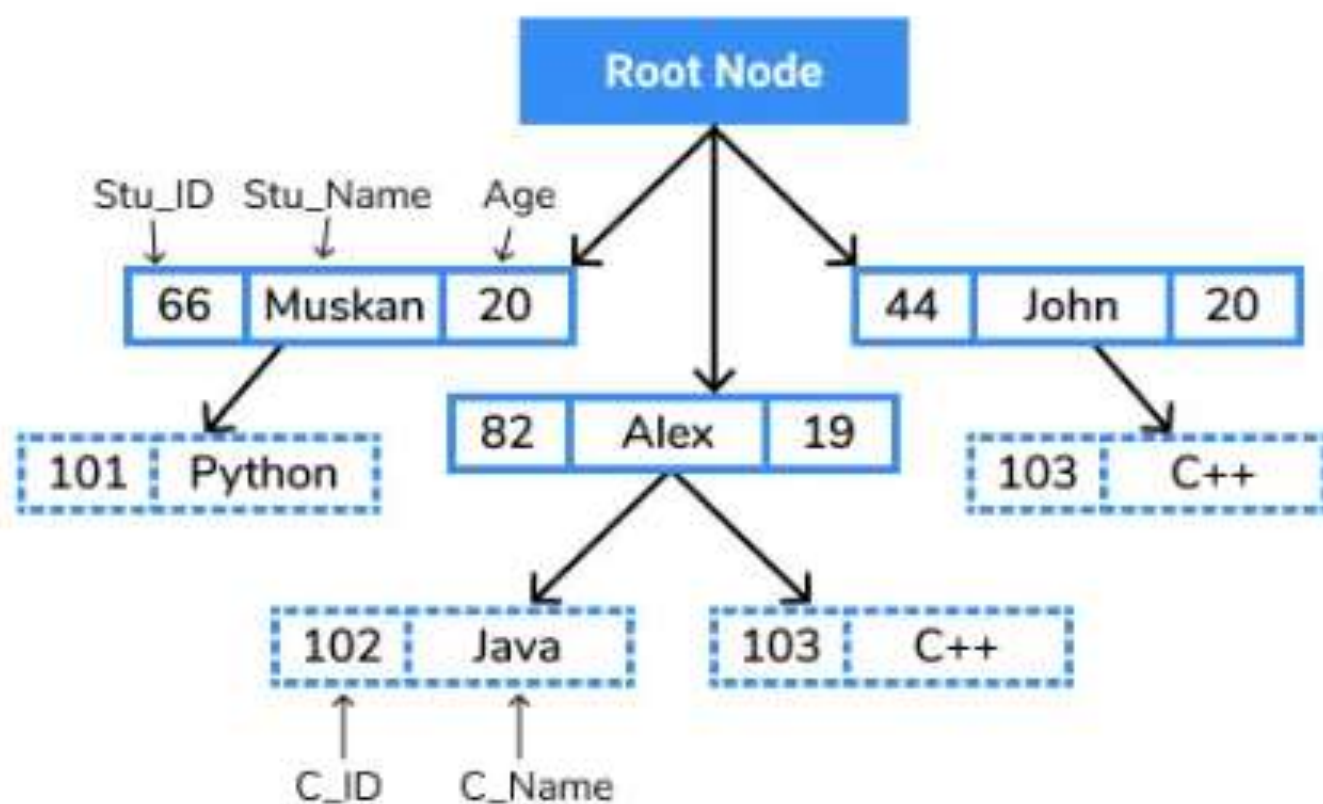
# Hierarchical Data Model

- It is the oldest type of the data model. It was developed by IBM in 1968.
- It organizes data in the tree-like structure.
- It contains nodes which are connected by branches or links.
- The topmost node is called the root node.
- If there are multiple nodes appear at the top level, then these can be called as root segments.
- Each node has exactly one parent.
- One parent may have many child.
- This type of Database model is rarely used nowadays.

# Hierarchical database model







## Advantages

- Efficient storage for data that have a clear hierarchy
- Parent/ child relationship promotes conceptual simplicity & data integrity
- It is efficient with 1: M relationships
- It promotes data sharing

## Disadvantages

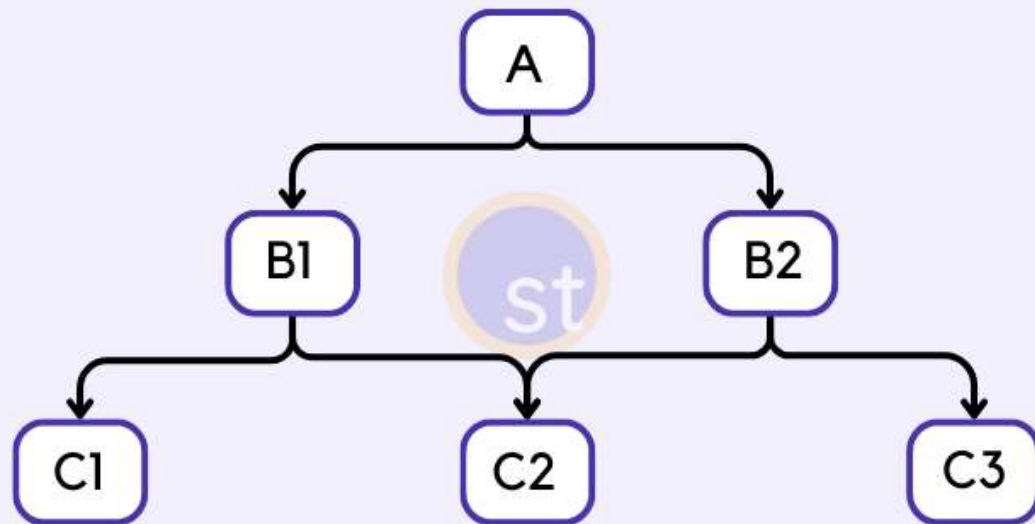
- It is complex to implement
- It is difficult to manage
- There are implementation limitations ( no M: N relationships)
- There is no DDL & DML
- There is lack of standards

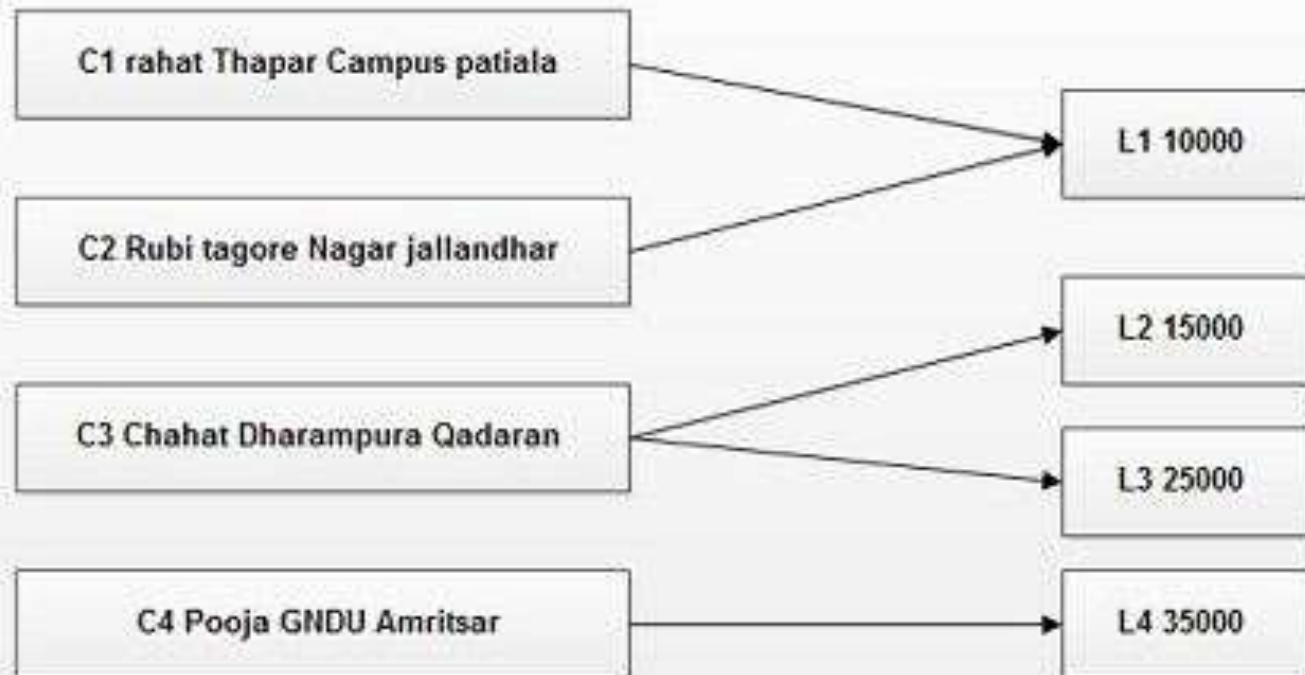
# Network Data Model

- It is the advance version of the hierarchical data model.
- To organize data it uses directed graphs instead of the tree-structure.
- In this child can have more than one parent.
- It uses the concept of Records and Sets.
- A network structure allows 1:1 (one: one), 1: M (one: many), M: M (many: many) relationships.



- A relationship is a set.
- Each set is made up of at least two types of records: an owner record (equivalent to parent in the hierarchical model) and a member record (similar to the child record in the hierarchical model).





Network Model Of Customer Loan Databse

- Advantages

- Represents complex data relationships better than hierarchical models
- It handles more relationship types, such as M: N & multi-parent
- Data access is more flexible than hierarchical model
- Improved database performance
- It include DDL & DML

- Disadvantages

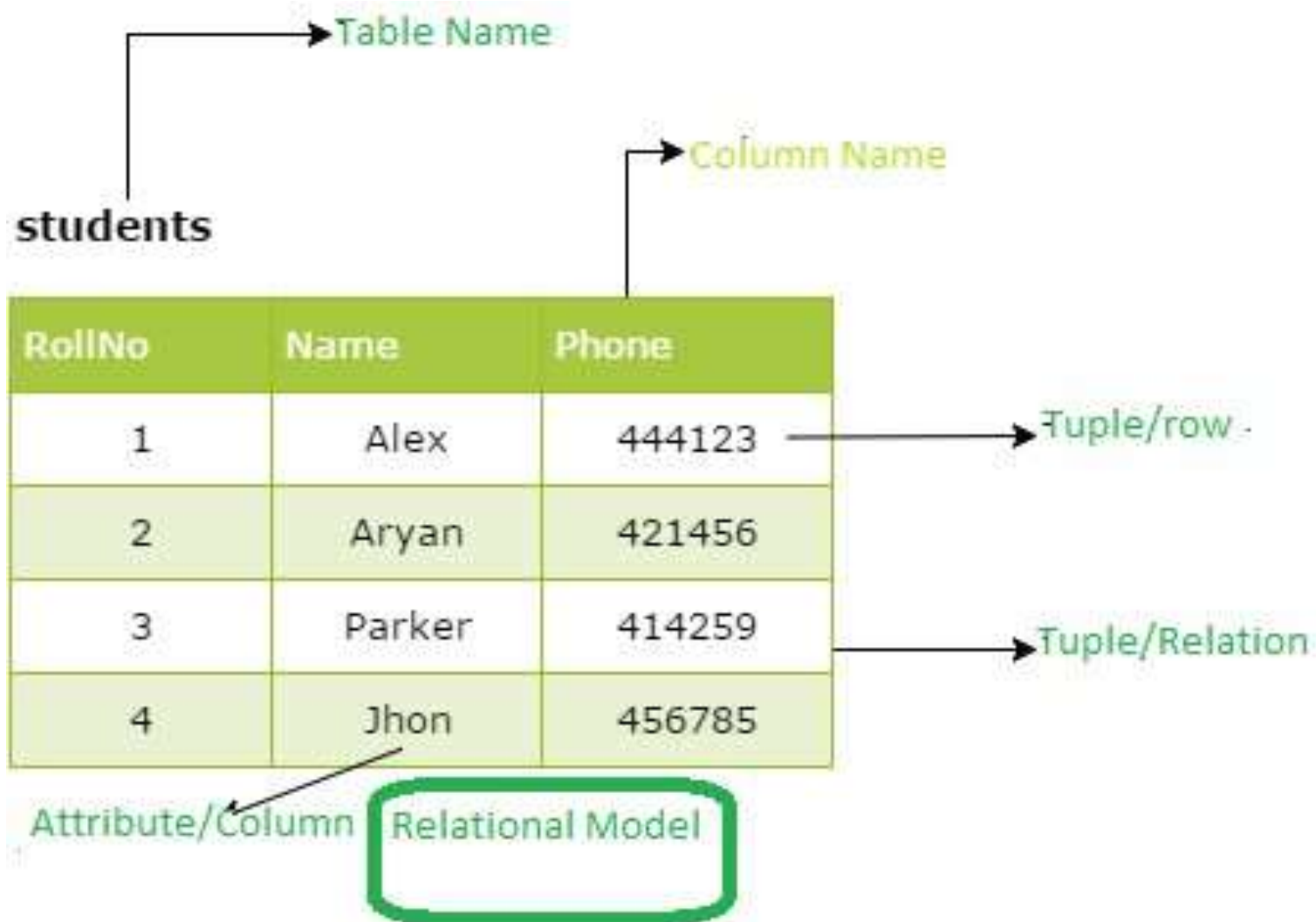
- System complexity limits efficiency
- Navigational system yields complex implementation & management
- Structural changes requires changes in all application programs
- Database contains a complex array of pointers that thread through a set of records
- Put heavy pressure on programmers
- Networks can become chaotic unless planned carefully

# Difference between Hierarchical Data Model and Network Data Model

Hierarchical Data Model	Network Data Model
It implements 1:1 and 1:n relations.	It implements 1:1, 1:n and also many to many relations.
To organize records, it uses tree structure.	To organize records, it uses graphs.
To search for a record , firstly one need to visit parent record before retrieving a child record.	Searching for a record is easy because of the availability of multiple access paths to reach data item.
Insertion anomaly exists in this model i.e. child node cannot be inserted without the parent node.	There is no insertion anomaly.
Deletion anomaly exists in this model i.e. it is difficult to delete the parent node.	There is no deletion anomaly.


# Relational Database

- A relational database is developed by E. F. Codd in 1970.
- In this model, data as well as relationships are organized in two-dimensional tables called relations.
- A relation is a table with rows and columns.
- The named columns of the relation are called as attributes
- The domain is the set of values the attributes can take.



student_id	name	age
1	Akon	17
2	Bkon	18
3	Ckon	17
4	Dkon	19

subject_id	name	teacher
1	Java	Mr. J
2	Python	Miss Py
3	JavaScript	Mrs. JS
4	C#	Mr. C



The diagram illustrates a join operation between the 'student' and 'subject' tables. Two curved arrows originate from the bottom of each table and point towards the 'student\_id' and 'subject\_id' columns of the 'marks' table, respectively. A large, semi-transparent watermark with the letters 'st' is visible in the background of the diagram.

student_id	subject_id	marks
1	1	98
1	2	77
2	1	76
3	2	88

## Advantages:

- Changes in a table's structure do not affect data access or application programs
- Tabular view substantially improves conceptual simplicity
- Have referential integrity controls ensure data consistency
- RDBMS isolates the end- users from physical level details

## Disadvantages:

- Conceptual simplicity gives relatively untrained people the tools to use a good system poorly
- It may promote "islands of information" problems as individuals and departments can easily develop their own applications

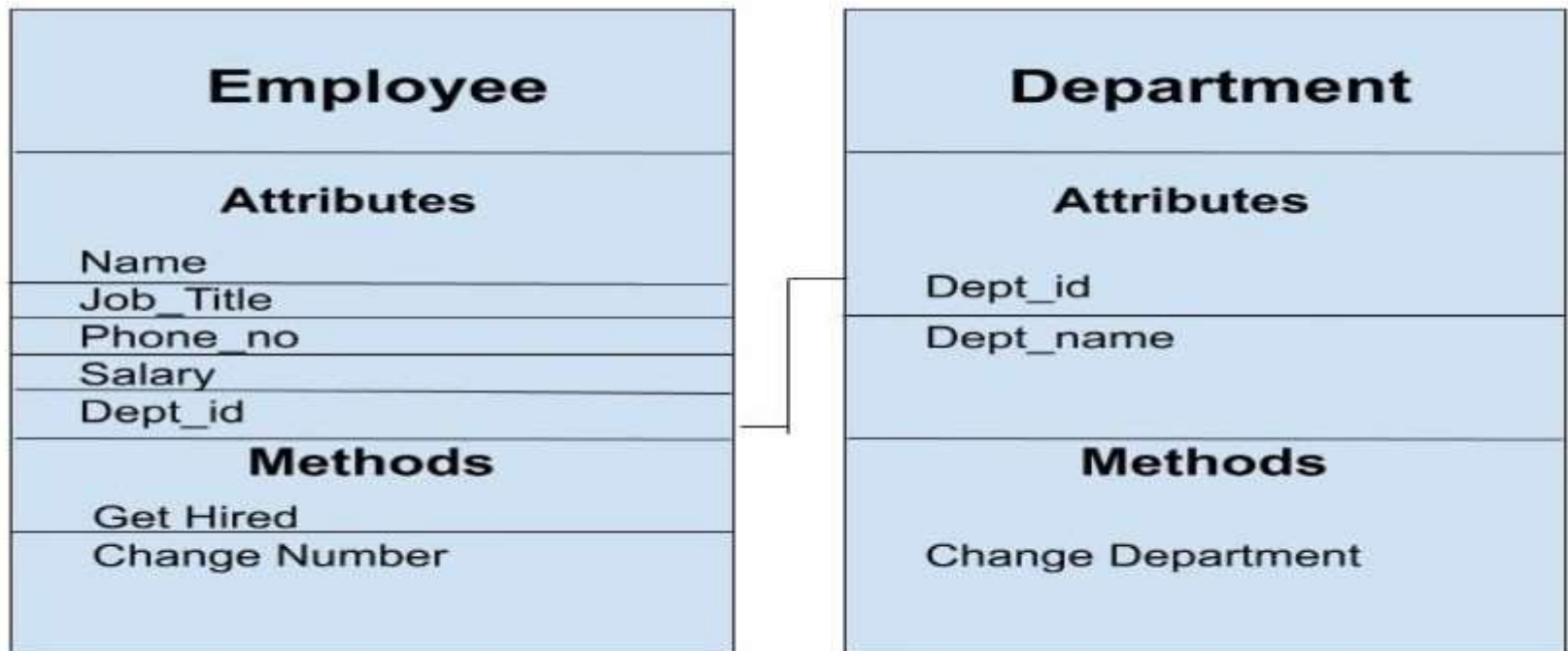


# Object Oriented Model

- An object database is a system in which information is represented in the form of objects as used in object-oriented programming.
- This model is based on the object-oriented-programming language concept.

- It models both data and relationships in a single structure known as **object**
- An object includes information about relationships between facts within object, as well as information about its relationships with other objects
- An object is an abstract of a real world entity
- A class is a collection of similar objects with shared structure and methods

- Advantages:
  - Semantic content is added
  - Support for complex objects
  - Visual representation includes semantic content
  - Inheritance promotes data integrity
- Disadvantages:
  - It is a complex navigational system
  - High system overheads slow transactions
  - Slow development of standards caused vendors to supply their own enhancements, thus eliminating a widely accepted standard



**Object\_Oriented\_Model**