Database Management System

For

Computer Science

&

Information Technology

By

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Syllabus for Database Management System

ER-Model, Relational Model, Relational Algebra, Tuple Calculus, SQL, Integrity Constraints, Normal Forms, File Organization, Indexing (E.g., B and B+ Trees), Transactions and Concurrency Control

Previous Year GATE Papers and Analysis

GATE Papers with answer key

thegateacademy.com/gate-papers

Subject wise Weightage Analysis

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"The greatest glory in living lies not in never falling, but in rising every time we fall."

... Nelson Mandela

CHAPTER 1

ER Diagrams

Learning Objectives

After reading this chapter, you will know:

1. Levels of Abstraction
2. Entities
3. Attribute
4. Specialization
5. Utility of E-R Model

DBMS Contains Information about a Particular Enterprise

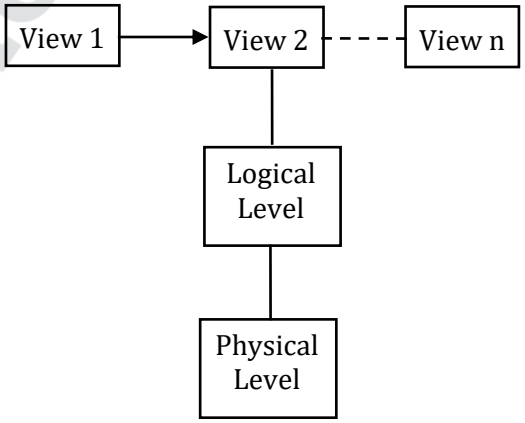
- Collection of interrelated data
- Set of programs to access the data
- An environment that is both convenient and efficient to use

Levels of Abstraction

Physical Level: Describes how a record (e.g., customer) is stored.

Logical Level: Describes data stored in database, and the relationships among the data.

View Level: Application programs hide details of data types. Views can also hide information (Such as an employee's salary) for security purposes.



View level

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Points to Emphasize

- How to use Entity-Relationship (ER) modeling in database design.
- The basic concepts associated with the Entity-Relationship (ER) model.
- A diagrammatic technique for displaying an ER model using the Unified Modeling Language (UML).
- How to identify and resolve problems with ER models called connection traps.
- How to build an ER model from a requirements specification.

What to Model?

Static Information
Data -- Entities
Associations -- Relationships among entities
Dynamic Information
Processes -- Operations/Transactions
Integrity constraints -- Business Rules/Regulations and Data meanings

What is data Model?

A collection of tools for describing:-
Data
Data relationships
Data semantics
Data constraints

Data Model: A data model is a collection of concept that can be used to describe the structure of database.

Schema: The description of a database is called the database schema.

System Model Tools

Data flow diagram (DFD)
Hierarchical input process and output (HIPO)
State transition diagrams (STD)
Entity Relationship (ER) diagrams

Entity-Relationship Model (ER Model): A data model in which information stored in the database is viewed as sets of entities and sets of relationships among entities and it is diagram-based representation of domain knowledge, data properties etc...., but it is more intuitive and less mechanical. Entity – Relationship is a popular high-level conceptual data model.

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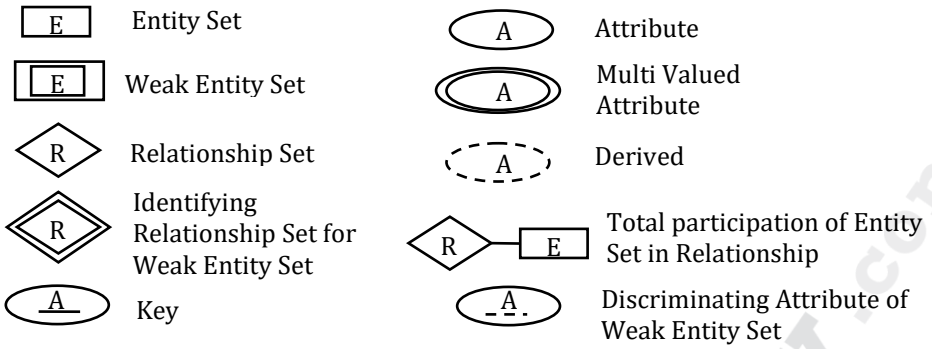
ER Diagram Symbols Figure



Components of E-R Model

(a) Entity
(b) Relationship
(c) Attributes

Entities

The basic object that the ER model represents is an entity, which is a "thing" in the real world with an independent existence and is distinguishable

Example: Student entities with unique roll number
Account entities with unique account number

Example: Identify two entities that might be important for a retail business.
Solution: Two entities for a business might include employee and customer.

Entity Set
A set of entities of the same type.

Example: All the student entities in a college
Entity sets need not be disjoint.

Example: A person entity could be in both the customer and employee sets

Types of Entities
Entities with physical existence
Example**:** Student, customer, book etc
Entities with Conceptual existence
Example: Sale, University course etc

Relationship

An association among two or more entities.
Example: The relationship between a Faculty and Student i.e. faculty take course for student

Relationship Set
A set of relationships of the same type

Attribute

The particular properties of entity that describe it.

Example: A student entity might have attributes such as: Roll number, Name, Age, Address etc.

As all entities in an entity set have the same attributes, entity sets also have attributes - the attributes of the contained entities. The value of the attribute can be different for each entity in the set.

In ER Model Attributes can be Classified into the Following Types

- Simple and Composite Attribute
- Single Valued and Multi Valued attribute
- Stored and Derived Attributes

Simple and Composite Attribute

Simple attribute that consist of a single atomic value. A composite attribute is an attribute that can be further subdivided. For example the attribute ADDRESS can be subdivided into street, city, state, and zip code. A simple attribute cannot be subdivided. For example the attributes age, sex etc are simple attributes.

Simple Attribute: Attribute that consist of a single atomic value.

Example: Salary, Age etc

Composite Attribute: Attribute value not atomic.

Example: Address: 'House no: City: State'

Name: 'First Name: Middle Name: Last Name'

Single Valued and Multi Valued Attribute

A single valued attribute can have only a single value. For example a person can have only one 'date of birth', 'age' etc. That is a single valued attributes can have only single value. But it can be simple or composite attribute. That is 'date of birth' is a composite attribute, 'age' is a simple attribute. But both are single valued attributes. Multivalued attributes can have multiple values. For instance a person may have multiple phone numbers, multiple degrees etc. Multivalued attributes are shown by a double line connecting to the entity in the ER diagram.

Single Valued Attribute: Attribute that hold a single value

Example1: Age

Example2: City

Example3: Customer id

Multi Valued Attribute: Attribute that hold multiple values.

Example1: A customer can have multiple phone numbers, email id's etc

Example2: A person may have several college degrees

Stored and Derived Attributes

The value for the derived attribute is derived from the stored attribute.

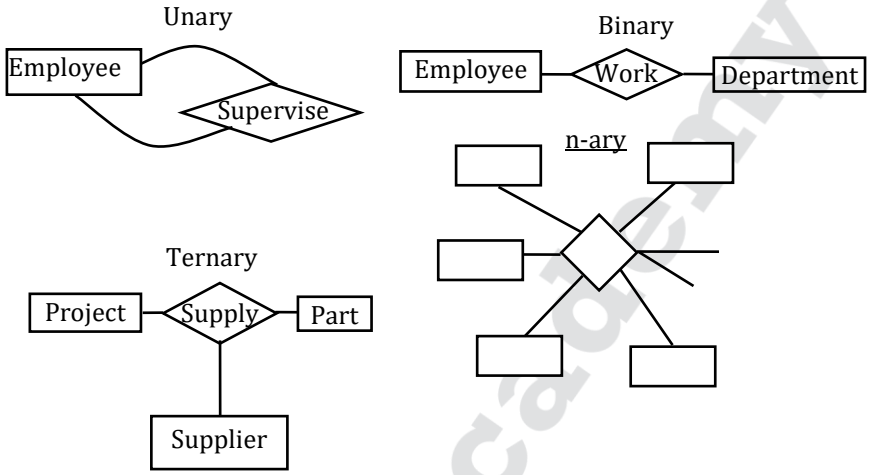
For example 'Date of birth' of a person is a stored attribute. The value for the attribute 'AGE' can be derived by subtracting the 'Date of Birth'(DOB) from the current date. Stored attribute supplies a value to the related attribute.

Stored Attribute: An attribute that supplies a value to the related attribute.

Example: Date of Birth
Derived Attribute: An attribute that's value is derived from a stored attribute.
Example: Age and its value is derived from the stored attribute Date of Birth.

Domain of Attribute: A set of possible values for an attribute (the type of the attribute).
Example: The domain of student name might be strings of some fixed length.
The domain of roll number might be 10 digit positive integers or alphanumeric.

Relationship Degrees



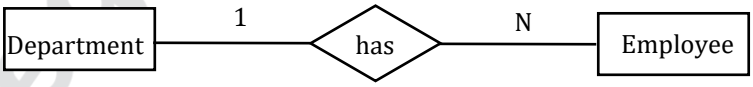
The number of entity types associated with that relationship given below figure.

Connectivity

One – to — One

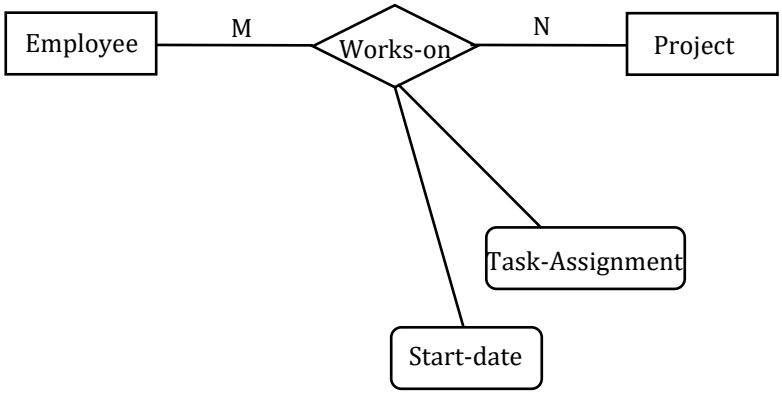
The one-to-one relationship has the cardinality or degree of one and only one in both directions.

One – to - Many



The many-to-one relationship has cardinality in one direction of one or more and in the other direction of one and only one.

Many – to - Many



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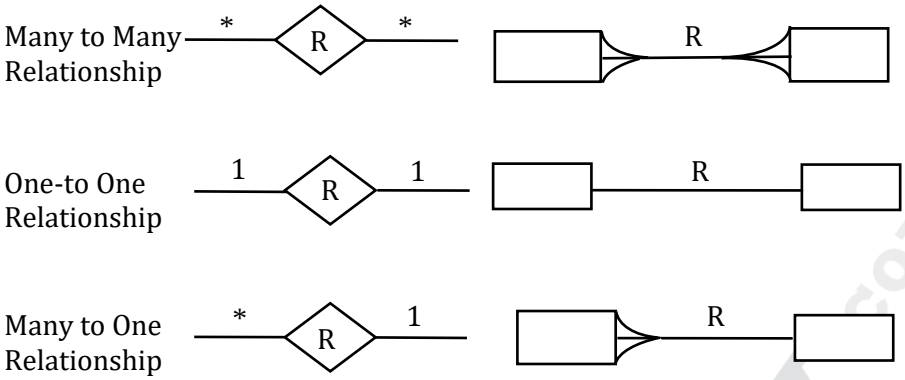
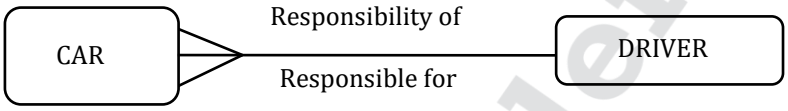


Types of Relationships

Example: Indicate how you would read the following relationship. Identify the type of relationship.
Solution:



L to R: Each Car responsibility must be given to one and only one driver.
R to L: Each DRIVER must be responsible for one or more CARS.
This is a M: One relationship, mandatory in both directions.

Multiplicity: Multiplicity constraints the way that entities are related - it is a representation of the policies (or business rules) established by the user or enterprise. Multiplicity actually consists of two separate constraints.

Cardinality: Cardinality describes the maximum number of possible relationship occurrences for an entity participating in a given relationship type i.e. how many relationship instances is an entity permitted to be linked to.

Participation: Participation determines whether all or only some entity occurrences participate in a relationship i.e., how is an entity linked to the relationship.

Total Participation (indicated by double line): Every entity in the entity set participates in at least one relationship in the relationship set.

Partial Participation: Some entities may not participate in any relationship in the relationship set

Note: Cardinality limits can also express participation constraints.