

Chapter 2: Data Base Design

* The DB design process can be divided in six steps:

1. Requirement elicitation and analysis:

what data? what operations? ^{who} are the users?

what is the application built on top of DB?

2. Conceptual DB design:

information gathered in the requirement.

→ this step is used to develop a high level description

→ this step is carried out using the ER Model

→ to match how users and developers think of data.

3. Logical data Base design:

Implementation

convert ER design to relational DB Schema.

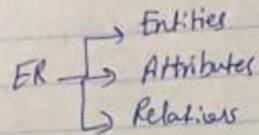
4. Analysis and Refinement

5. Physical DB design: performance, indexing, clustering.

6. Application and Security

Entity-Relationship Model (ER)

The first step is to Build the ER-diagram.



* Entity: real world objects distinguishable from others.

Ex: Student, Employee, courses, ...

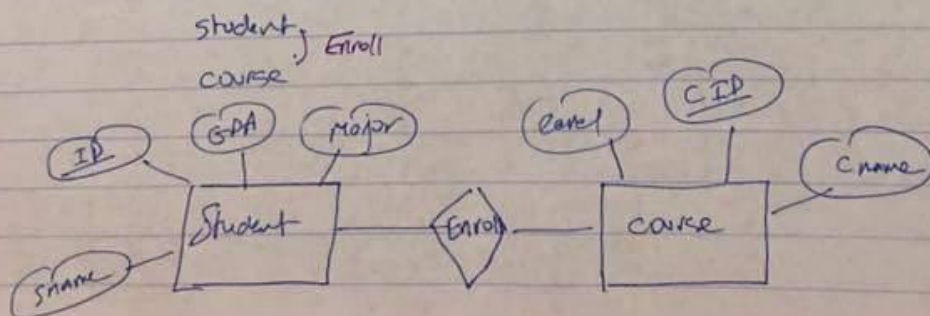
* Attributes: The characteristics of entities

Ex: Student: ID, name, age, GPA, Major.
Key

→ Key: is an attribute or minimal set of attributes whose values uniquely identify an entity.

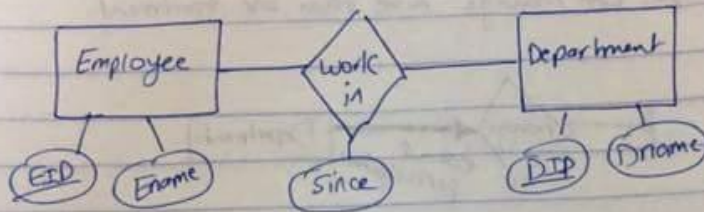
more than one key: candidate keys, must one of them be primary key

* Relationships: is an association between two or more entities.



Relationships also may have an attribute(s)

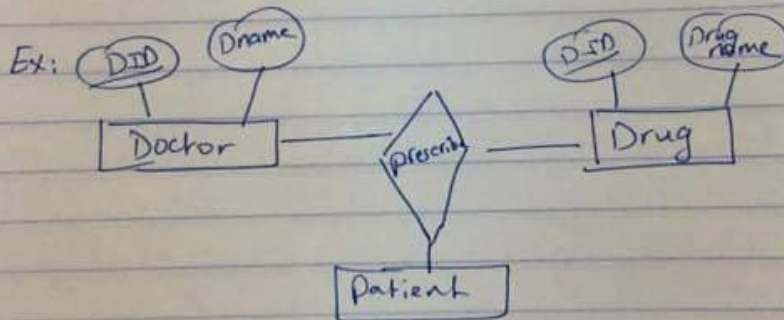
Ex: Employee work in department since Date



* Types of Relationships:

→ number of Entities:

1. Binary.
2. Ternary.

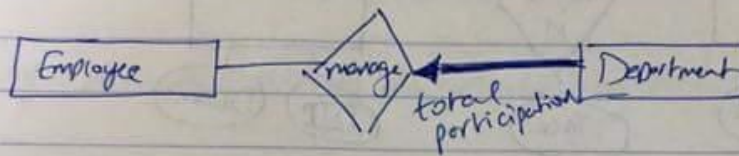


3. U - Unary



* Key constraint:

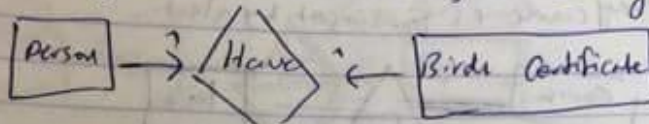
Ex: assume each department is managed by one employee manager
an employee can manage more than one department



* Relationship types:

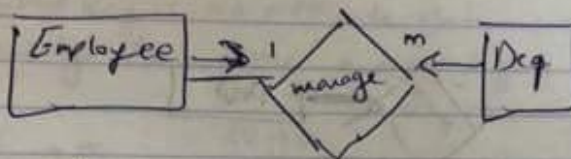
① one to one

one entity is associated with only one entity



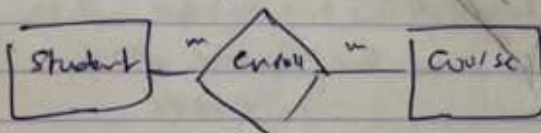
② one to many

one employee can manage several dep.
each dep. can be managed by one manager

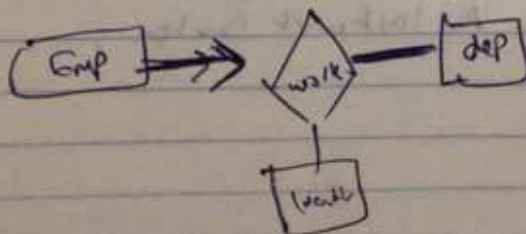


③ many to many

each student can enroll many courses,
course has many students



Ex each Employee work in one dep and location, a dep. can have many locations and Emp.



* Participation constraints :-

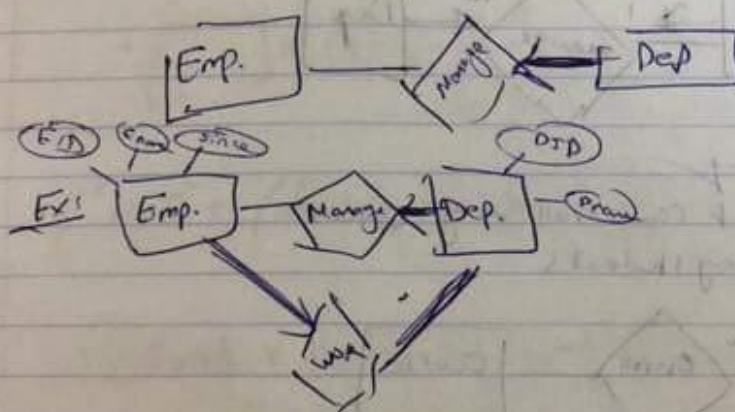
① Total : every instance from entity E must participate in relation R.

∴ every course is Target by elect.



- in ER diagram, total part. is denoted by a thick line.

② Partial : any instance is not total is partial.



- each department must have one manager.

- " " " " " at least one employee.

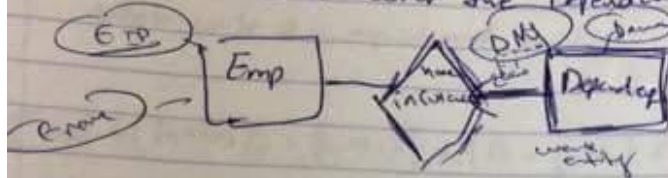
- each emp. must work in one Dep.

- an Emp. can manage more than one Dep.

- The system store the last work location

⇒ weak entity and Partial key:-

Ex The ministry of education make insurance for its employees.
The insurance can cover the Dependents of every emp.

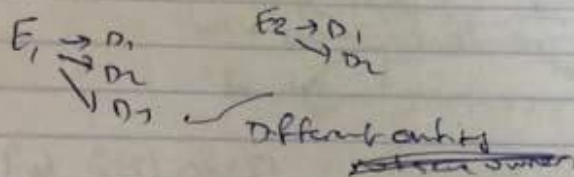


- Emp is the owner entity for dependent.

→ DepNo is a Partial Key

- The

Partial key is an attribute that uniquely identify a weak entity for a given owner entity.



⇒ two restrictions with weak entity:

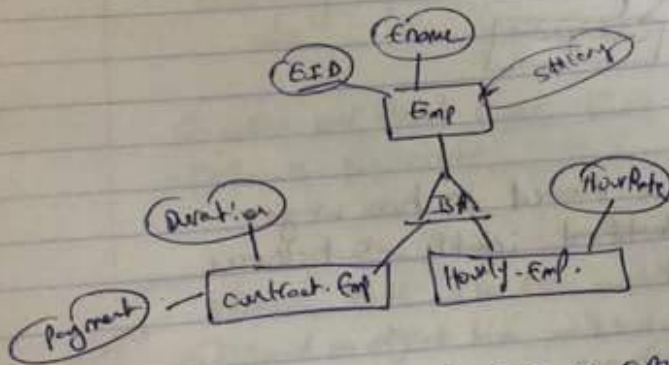
1. The owner and weak participate in one to many relation.
2. The weak entity must have total part.

Database

Class Hierarchy Hierarchies :-
class hierarchy noticed when superclass inherited by subclass.

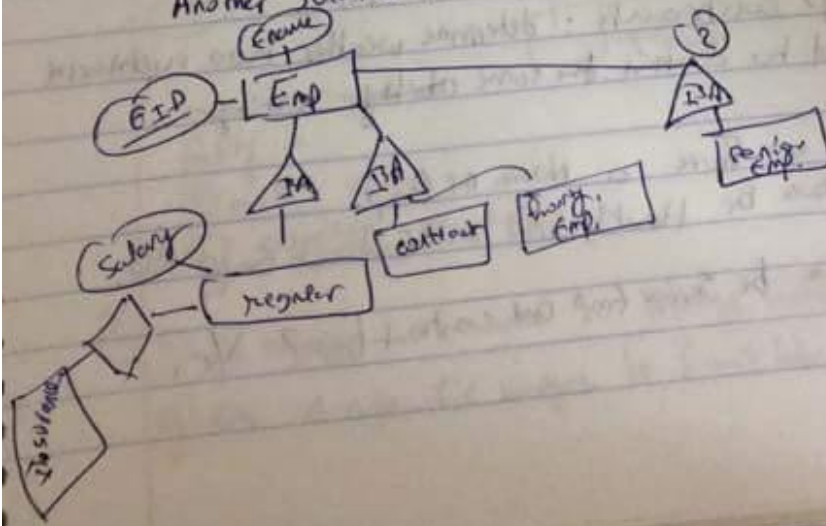
- This model is represented in ER model
by ISA component.

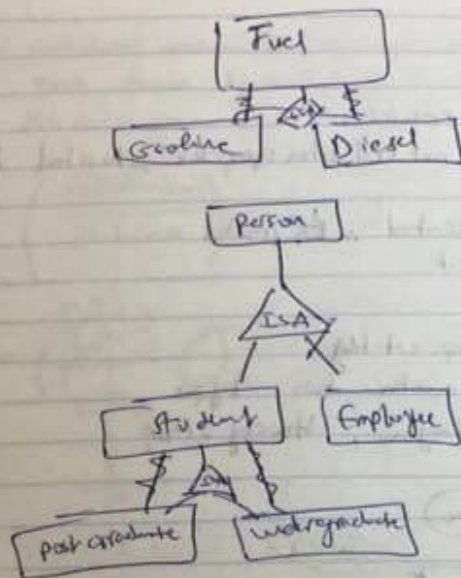
Ex: consider the Emp. entity
also, we have another two types
contract employee, Hourly-Emp.



- Key of subclass is same as superclass.
- The attributes of superclass inherited by subclass.

Another Solution:





* Class Hierarchy is viewed in two ways:

1. Specialization: identify subclasses
From super class ↓

2. Generalization: two or more subclasses generalized
by super class ↑.

* Two types of constraints respect to ISA:

① Overlap constraints: determine whether two subclasses
are allowed to contain the same entity

Ex: suppose we have a Nurse as Emp.

1. Can Nurse be Hourly Emp and Contract Emp? NO.

2. Can Nurse be Senior Emp and contract Emp? Yes.

- contract employee overlaps Senior - Emp

- Default No overlaps constraints

② Covering constraints:

Determine whether subclass entities include all superclass entities

Does every Fuel is either Gasoline or Diesel?

Yes

Does every Emp. is either contract - Emp., hourly or senior?

No

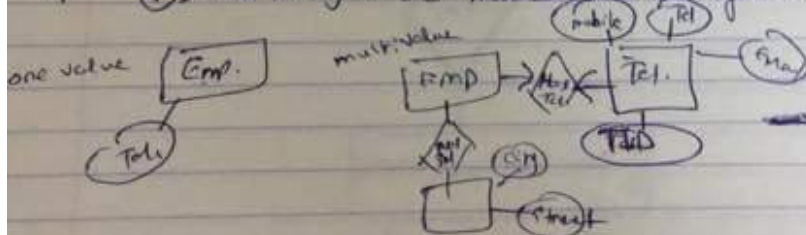
Gasoline and Diesel Cover Fuel.

→ Default No cover.

→ Design issues with ER model

epitaph

① Should an object be modeled as an entity or an attribute?



Entity :-

① multi value

② complex structure

② ③ An employee is allowed to manage several Dep. and the manager is given a specific budget to facilitate the Dept he/she manages

