

Rules of Relational DB

Relational DB consists of a set of relations.

Rule 1 : First Normal Form : 1NF

No multi-valued attributes are allowed in a table.

Employees

eid	Name	Age	Dependents
234	Bob	40	Allen, Ann
693	Mary	32	John
999	Andrew	35	Mike, Susan, David

Solution 1:

eid	Name	Age	Dep1	Dep2	Dep3
234	Bob	40	Allen	Ann	
693	Mary	32	John		
999	Andrew	35	Mike	Susan	David

Rule 2 The unique row rule.

No two rows in the same table can be identical at any given time.

Super key

A super key of a relation is a set of attributes whose values can uniquely identify every potential tuple of the relation.

R1

A	B	C	D
a1	b1	c1	d1
a1	b2	c2	d1
a2	b2	c1	d1
a2	b1	c2	d1

Find all possible super keys

AB, AC, BC, ABC, BCD, ABD,
ACD, ABCD

- Every relation has at least one super key
- Any super set of a super key is a super key

(candidate) key

A set of attributes is key of a relation if (1) it is a super key of the relation and (2) no proper subset of it is a superkey of the relation.

From previous example

Candidate keys AB, AC, BC

If any attribute is removed from a key then the remaining attributes no longer form a key (minimality property)

Example:

students (ssn, name, home_address, birthdate, GPA, email, major, phone)

possible candidate keys

ssn

name, home_address, birthdate

Rule 3: Entity Integrity Rule:

No attribute in the primary key can take on null values.

primary key: is the candidate key selected by the database designer for a particular application.

Solution 2

eid	name	age	dependent
234	Bob	40	Allen
234	Bob	40	Ann
693	Mary	32	John
999	Andrew	35	Mike
999	Andrew	35	Susan
999	Andrew	35	David

Solution 3

Employees

<u>eid</u>	name	age
234	Bob	40
693	Mary	32
999	Andrew	35

Dependents

<u>eid</u>	dep-name
234	Allen
234	Ann
693	John
999	Mike
999	Susan
999	David

Foreign key

A set of attributes FK of a relation R1 is a foreign key in R1 if it satisfies the following two conditions:

- ① there is a relation R2 with the primary key PK such that FK and PK have the same number of attributes with compatible domains.
- ② For any tuple (row) t1 in R1, either there exists a tuple t2 in R2 such that $t1[FK] = t2[PK]$ or t1[FK] is null.

Example

employees (eid, name, salary, did)

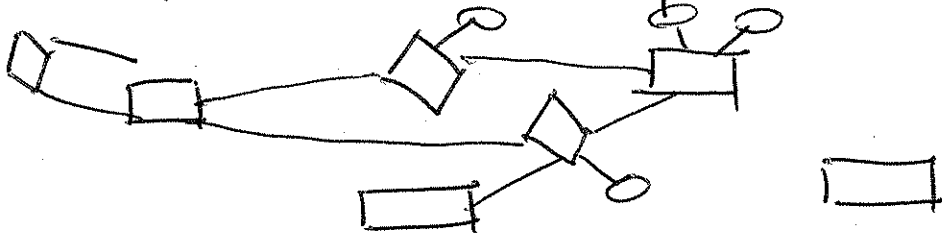
departments (did, location, meid)

Rule 4 Referential Integrity Rule.

No relation is allowed to contain unmatched foreign key values.

E-R Model

Entity - Relationship



E-R model was proposed by Peter Chen in 1976.

Entity (Entity Set)

- An entity is an object/concept with properties
- it exists
 - it is distinguishable

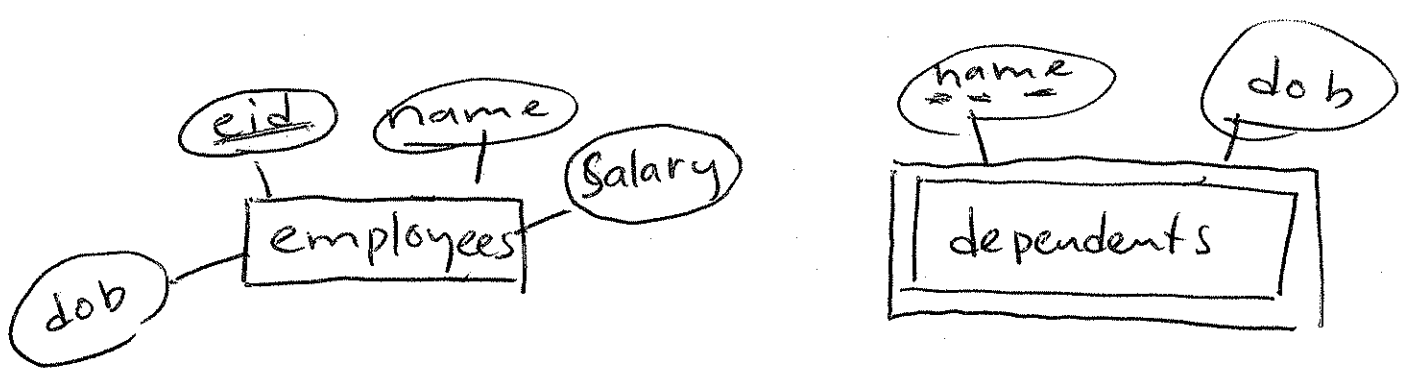
Examples: Person, company, vehicle, department, student, course, etc.

Strong entity: can exist independently (by itself)

Weak entity existence depends on the existence of other entity (strong).

Example: Employee (strong)
Dependents (weak)

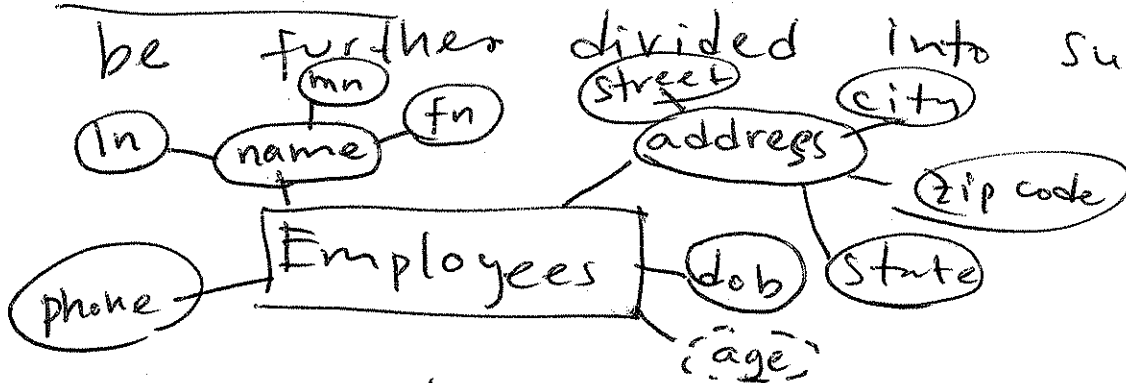
Attributes: properties of an entity set.



Type of attributes

Simple (atomic) take a single and indivisible value for each entity.

Composite: take values that can be further divided into sub parts.

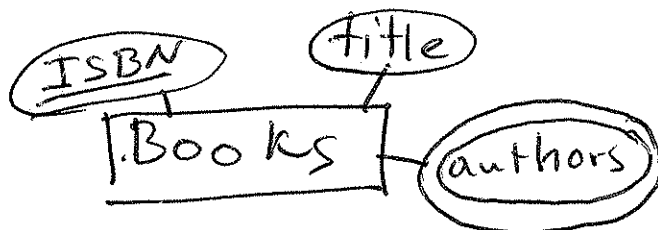


Single-valued attributes

take a single value

multi-valued attributes

take a set of values for each entity

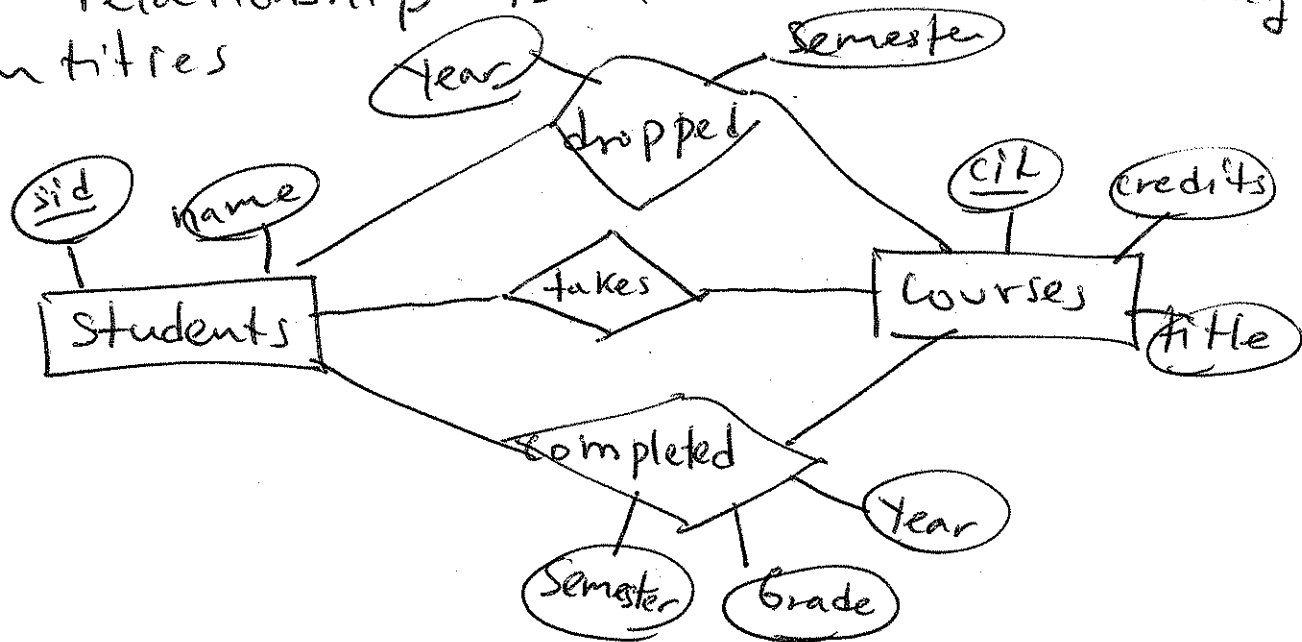


derived attributes

whose values are computed from other attributes

Relationships

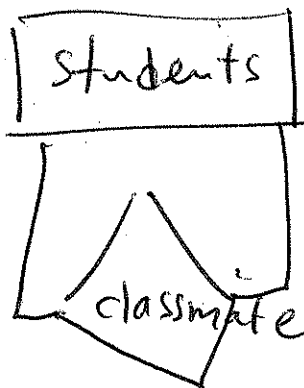
A relationship is an association among entities



Degree of relationship

Number of entity sets participating in the relationship.

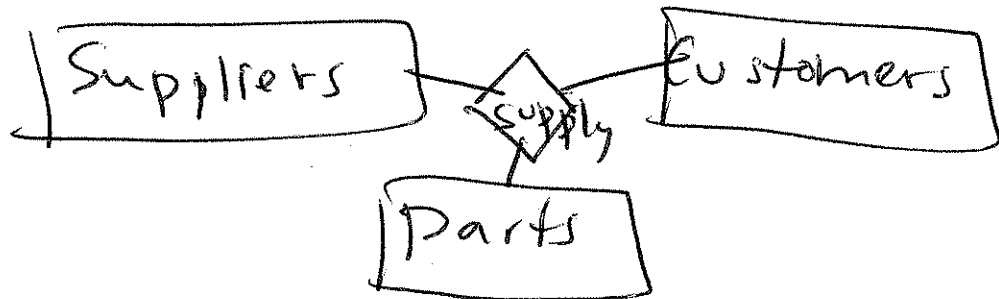
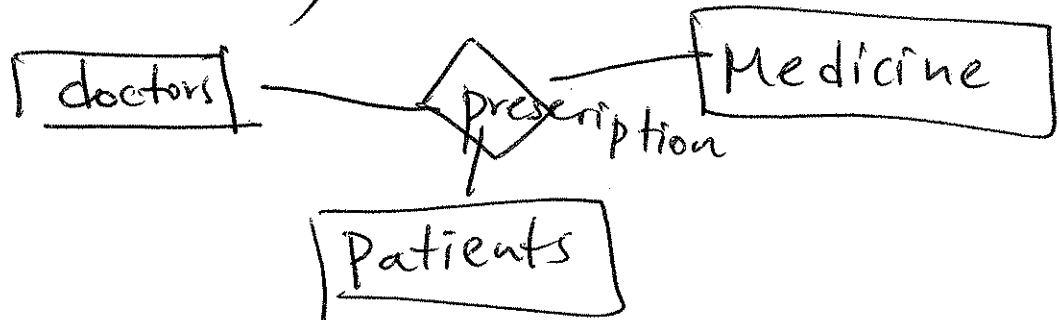
(degree = 1) Unary relationship



(degree = 2) binary relationship



(degree ≥ 3) Ternary relationship



Connectivity

Specifies the mapping between the entity sets participating in the relationship.

one - to - one

one - to - many

many - to - many

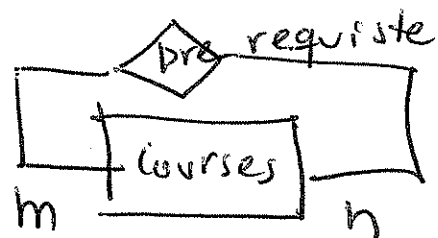
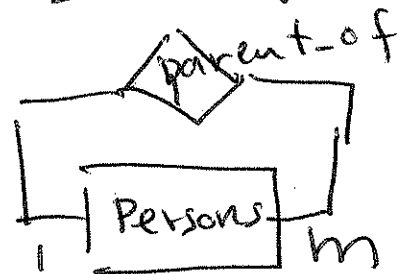
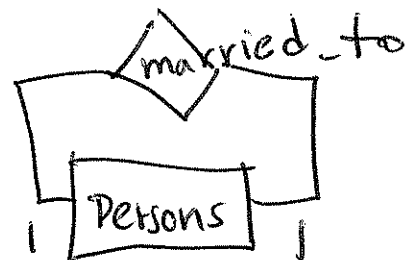
Examples

Unary

1-to-1

1-to-many

many-to-many



Binary

1-to-1

1-to-many

many-to-many

