

Section - 6 ER Model

1. Need of ER

- ¹⁵ There are 2 approaches to design database :
- ① ER Modelling : Identifying entity and relations
 - ② Normalization : Refinement of Database designing
- ²⁰ ER Modelling is Top down approach because in ER model, we start from requirements and then those requirements are converted to visual representations by identifying entities & relationships
- ²⁵ Normalization is Bottom up approach as we start from tables. Some tests are applied on tables by following some predefined rules called as normal form
- ³⁰ ER Model is used to convert Software requirements written in textual form into visual representation

② Basic constructs of ER Model

→ Entity

- An entity is a real world object that exists independently and is distinguishable from other objects
- eg: specific person, company

→ Entity Set

- Group of entities of same type that share some properties
- eg: group of persons
- Entities have attributes. eg: people have names and addresses

→ In OOPS

student → object \Leftrightarrow entity
 group of students → class \Leftrightarrow entity set

③ OOPS

Class

 \Leftrightarrow Entity Set \Leftrightarrow

Relational Model

Table

Object

 \Leftrightarrow Entity \Leftrightarrow

Row

Attribute

 \Leftrightarrow Attribute \Leftrightarrow

Column

③ Types of Attributes

Attributes describe the properties of entity of which they are associated

①

Simple

②

Composite

③

Single-value

④

Multi-value

⑤

Derived

⑥

Stored

(i) Simple Attribute

Can't be divided into smaller components

e.g.: age of employee, roll no. of student

(ii) Composite Attribute

Can be divided into simpler components

e.g.: name of employee can be first name & last name, address of student can be house no., locality

(iii) Single Value Attribute

Can have only single value

e.g.: roll no. of student (one student has one roll no. like 100)

~~multiple~~

father's name

(iv) Composite Attribute

Can have more than one value

e.g.: mobile no. (a person can have multiple mobile no.s), hobbies (a student can have more than one hobby)

(v) Fored Attribute

Attribute that need to be stored permanently in a database

e.g.: name, roll no. of student, DOB

(vi) Derived Attribute

Attribute that need not to be stored and can be calculated at runtime based on other attributes

e.g.: ① age can be calculated based on DOB

② experience of employee can be calculated by subtracting current date from date of joining

11 Symbols used to represent these constructs

1 Rectangle



→ Entity

2 Rhombus



→ Relationship

3 Oval

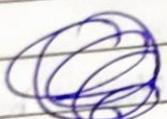


→ Attribute

4 Oval (with another inside)



→ Multi-value attribute

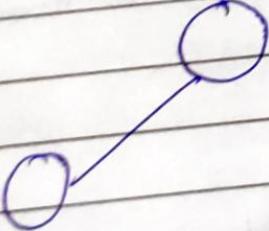


→ Key Attribute

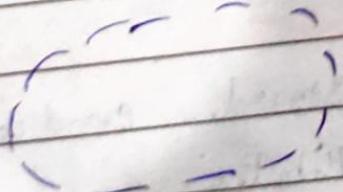
Primary key

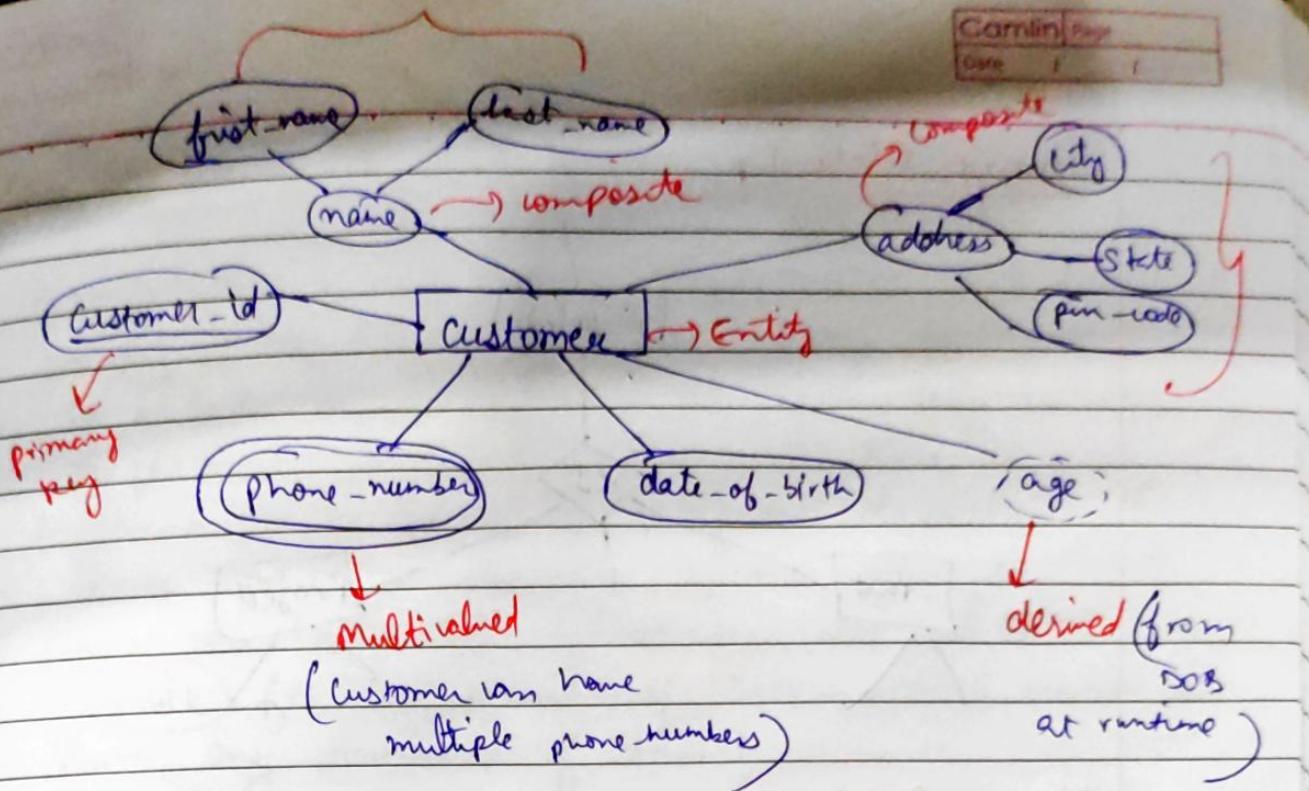


→ Composite attribute

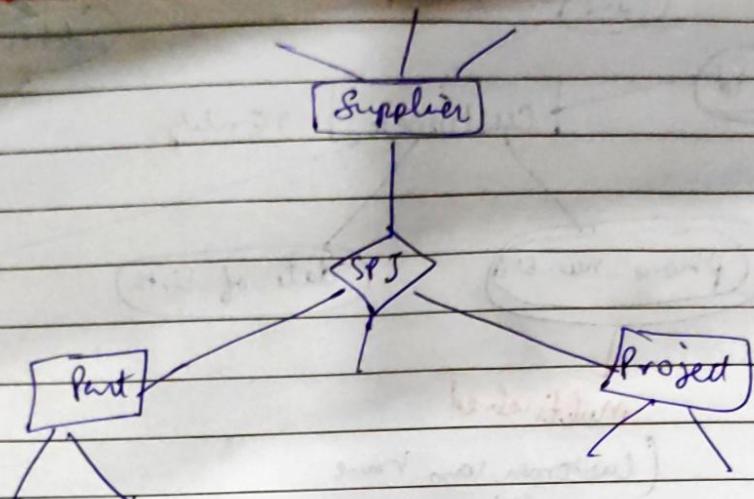


25 → Derived attribute

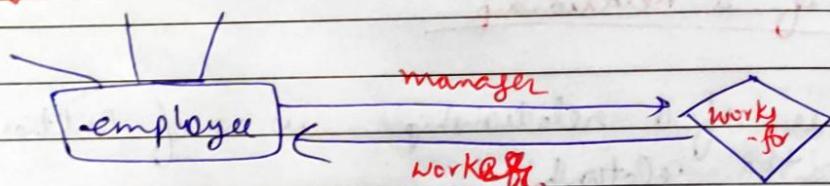




Ternary relationship



Unary Relationship



→ employee entity set connected with itself and only one entity set connected with relationship

⑤

Designing of ER Model ~~(Part 1)~~

#

Steps to Design ER Model

Step 1

Identify the Entities

Step 2

Find relationship among these entities

Step 3

Identify the key attributes - i.e. primary key

Step 4

Identify other relevant attributes

Step 5

Draw the complete ER diagram

Case Study of University Management System

A university contains many departments. Each department can offer any number of courses. Many teachers can work in a department. A teacher can work only in one department. For each department, there is a Head. A teacher can be head of ^{hard working} only one department. Each teacher can take can any number of courses. A course can be taken by one instructor. A student can enroll for any number of courses. Each course can have any number of students.

Step 1 : Identify the Entities

→ Collect all nouns in the given question which have some properties and are important for the system.

→ for a noun to be an entity, it must have more than one instances.

→ In the given question : University has one instance, while other nouns have more than one instances.

→ The entities of the ER Model are :

1. Department

2. Course

3. Teacher

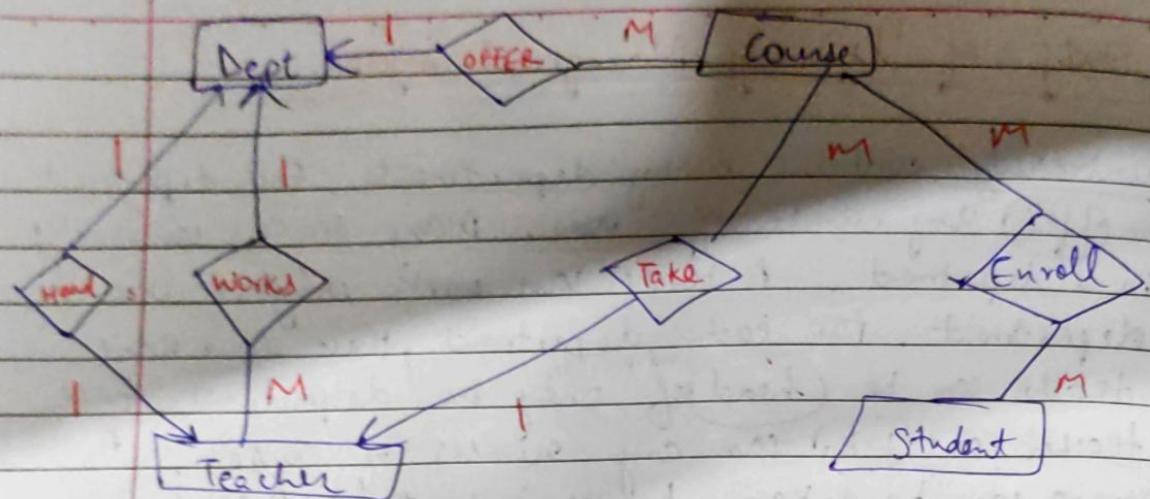
4. Student

Step 2 : Find relationship among these entities

→ Relationships are indicated by verbs or roles in the question that appear b/w nouns or entity sets.

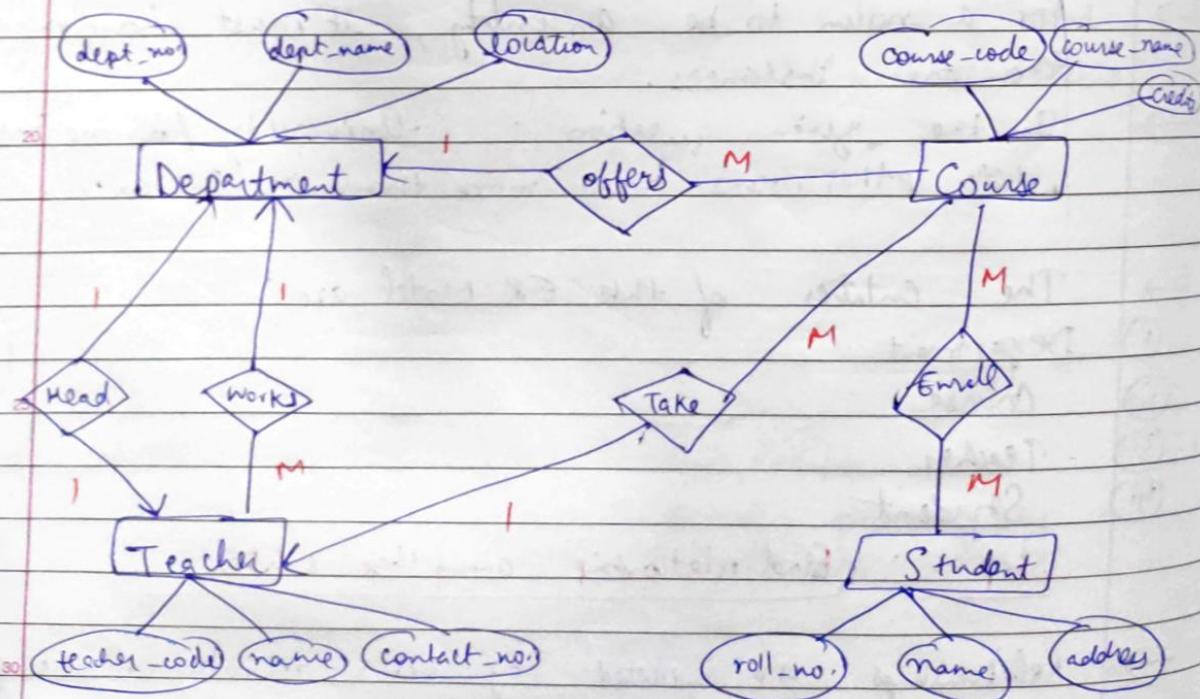
each department offers 'M' courses

Carroll Page
Date / /



- Many teachers
- can work in
- a department
- A teacher
- can work
- ~~only~~ ~~one~~ department

Step 3 & Step 4 : Identify key & other relevant attributes



Strong and Weak Entity Sets

- Weak Entity Set : The entity set which does not have sufficient attributes to form a primary key is called as weak entity set
- Strong entity set : An entity set that has a primary key is called as strong entity set
- A weak entity set does not have a primary key but we need a means to form the primary key so that we can distinguish entities in the entity set
- The weak entity set will have some attribute when combined with primary key of strong entity set provides uniqueness to it

Discriminator or Partial Key of Weak Entity Set

- The attribute of weak entity set which can combine with primary key of strong entity set to form its primary key during creation of table is called as discriminator or Partial key of a weak entity set
- That attribute of weak entity set
- This attribute is indicated with dotted underline

Example

→ Primary key

Cust_id	Cust_name	Cust_addr
C1	Rohan	Delhi
C2	Mohan	Lucknow
C3	Soham	Mumbai

Weak entity set

Loan_name	Loan_date
Education	12/12/19
Name	13/12/20
Education	12/12/19

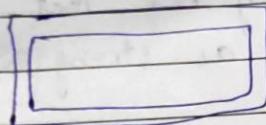
Row 1 & Row 3
exactly same \Rightarrow No primary key

Primary Key

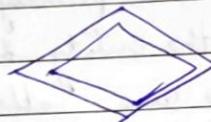
Discriminator or Partial Key

Carolin Page
Date / /

Cust_id	loan_name	loan_date
C1	Name	12/11/19
C1	Education	13/12/20
C3	Name	12/12/19



Weak Entity Set

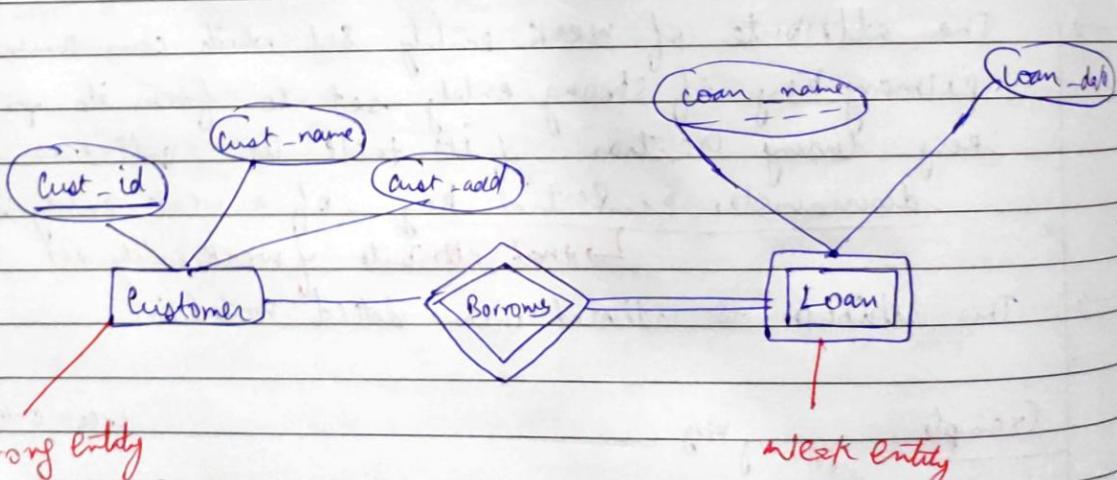


Identifying Relationship

Relationship b/w Strong &
weak entity set



Discriminator or Partial Key



Case Study

Loan - Payment

Partial Key

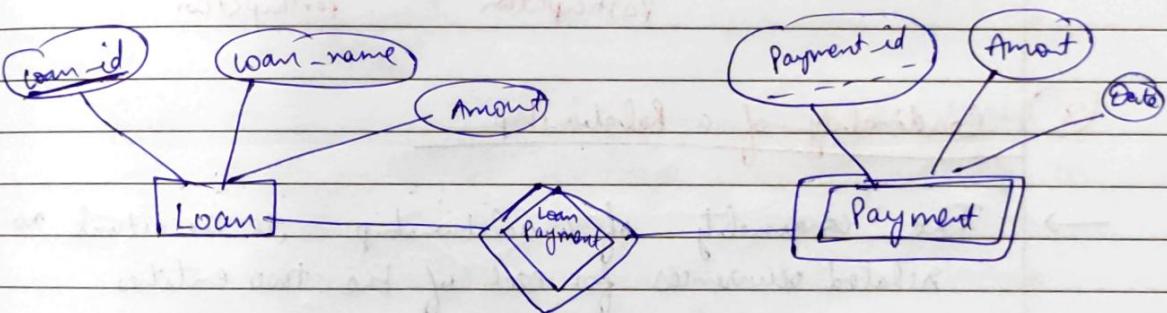
Primary Key

loan_id	loan_name	amount	Payment id	Amount	loan_date
L1	Education	10000	1	1000	1/2/19
L2	Home	20000	1	2000	1/2/19
L3	Education	10000	1	1000	1/2/19

Strong Entity

Weak Entity

L1	L2	L3



①

Total & Partial ParticipationTotal Participation

- Every entity in the entity set participates in at least one relationship in the relationship set
- Participation of entity set in the relationship is mandatory
- Entity cannot exist without relationship
- Indicated by double lines with relationship

Partial participation

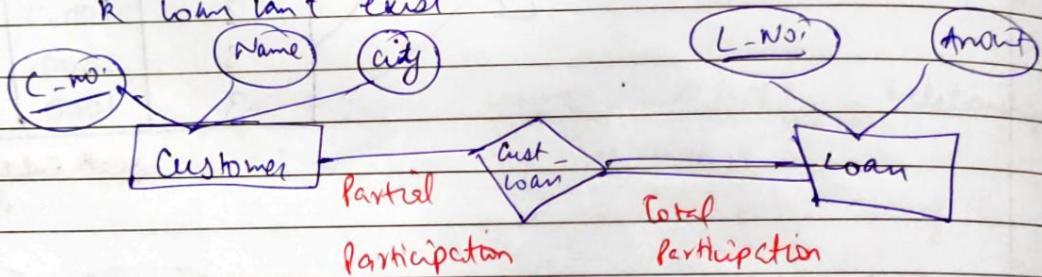
- Some entities may not participate in any relationship in the relationship set
- Participation of entity set in relationship is optional
- Entity can exist without relationship
- Indicated by single line connecting with relationship

egCustomer - loan relationship

C. No.	Name	City
C1	Raj	Delhi
C2	Rohan	Mumbai
C3	Mohan	Patiale

L. No.	Amt
L1	10000
L2	20000
L3	30000

→ Har bank R. customer ko zeroori nahi loan lena
 but har loan ko ek customer chahiye.
 R. loan can't exist

8. Cardinality of a Relationship

→ The cardinality of a relationship is the actual no. of related occurrences for each of the two entities

→ Every relation has 2 characteristics.

- (1) Cardinality
- (2) Connectivity

Connectivity of a Relationship

→ Connectivity of a relationship describes mapping of associated entity instances in the relationship. The values of connectivity are "one" or "many"

(i) One to one (1:1)

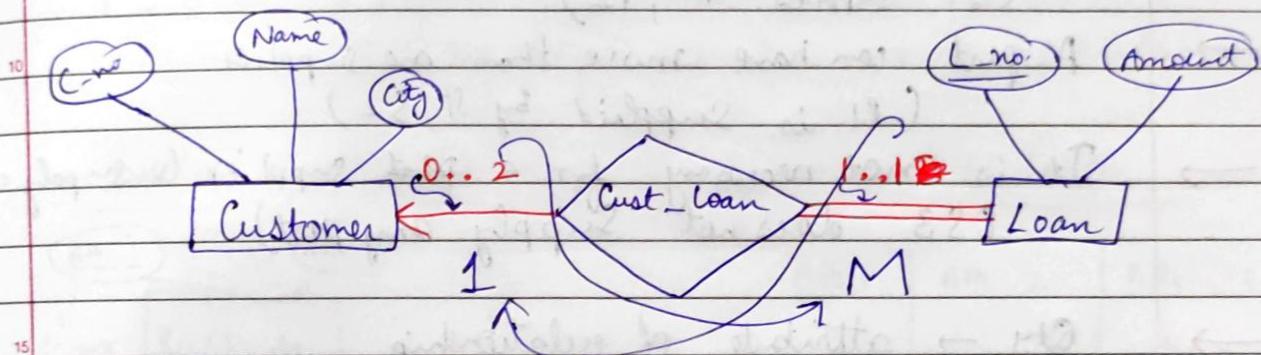
(ii) One to many (1:M)

(iii) Many to one (M:1)

(iv) Many to many (M:M)

Cardinality : An edge b/w an entity set & a relationship set can have an associated minimum and maximum cardinality shown in the form $l \cdots h$, where l is minimum & h is maximum cardinality

g) Same customer - loan eg of previous page



→ $0 \dots 2$: like C2 has taken no loan
 \Rightarrow not necessary for every customer to take loan

2 → C1 has taken 2 loans

\Rightarrow max 2 loans can be taken

→ $1 \dots 1$: for ~~one~~ loan, min 1 customer is needed & max also 1 customer is needed

→ A minimum value of 1 indicates total participation of entity set in the relationship set

A minimum value of 0 indicates partial participation of entity set in the relationship set

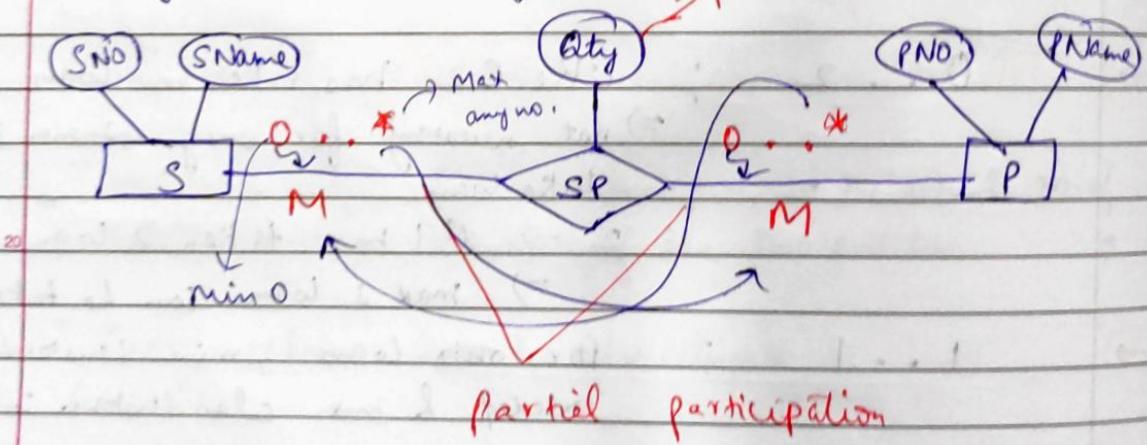
The label $1 \dots *$ on an edge is equivalent to a double line (total participation)

→ Supplier - Part Relationship

Sno.	Name	100	Part No.	PNName
S1	Rohan	100	P1	Pen
S2	Mohan	100	P2	Pencil
S3	Soham	100	P3	Eraser

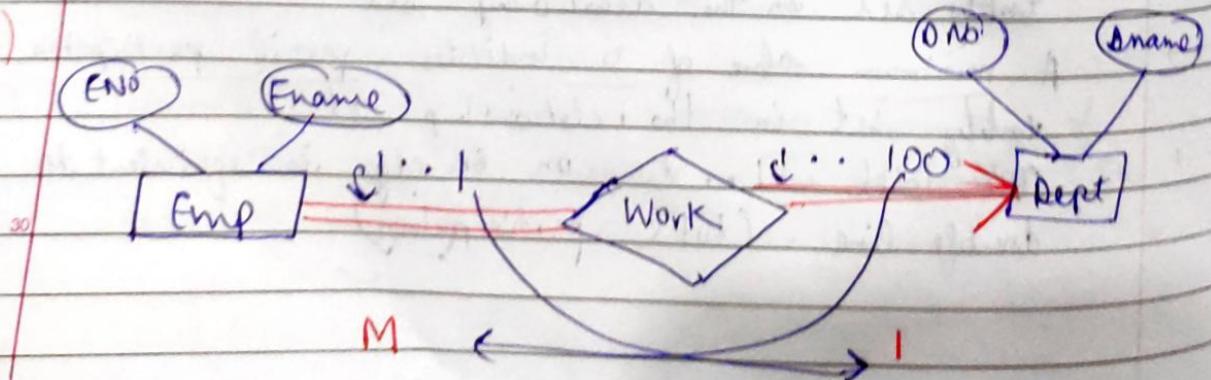
- A supplier can supply more than one part (S1 supplies P1, P2)
- A part can have more than one supplier (P1 is supplied by S1, S2)
- It is not necessary for a part to supply a part (S3 does not supply any part)

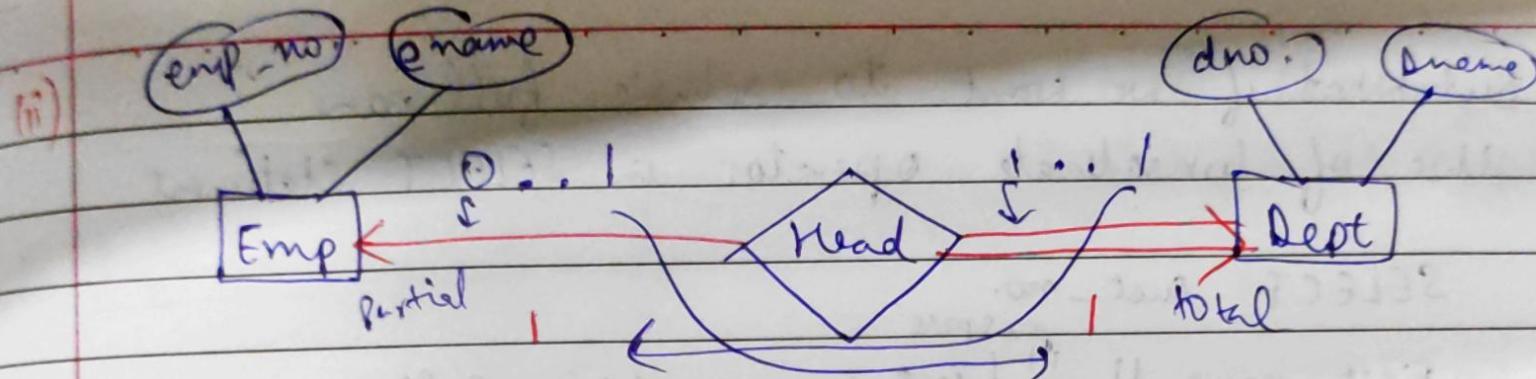
→ 15 QTY → attribute of relationship



→ 25 Emp - Dept Relationship

(1)





0..1 0 => one employee ka head hona zoror nahi
 1 => 1 employee only (department. Ka head hskta h)

1..1 => 1 => 1 department ka ~~at~~ ek head chahiye
 1 => 1 department ka max ek hi head hskta h.