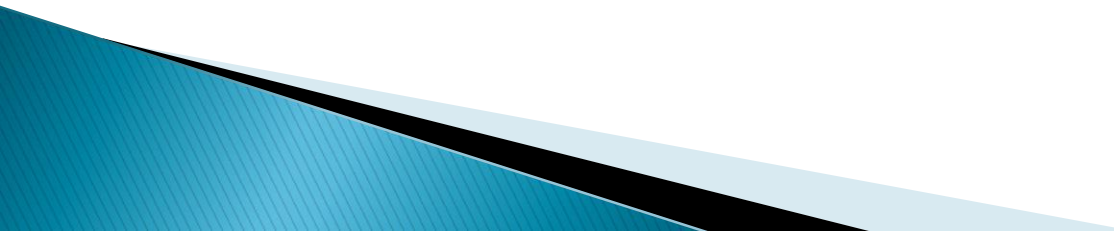


Entity–Relationship Diagram



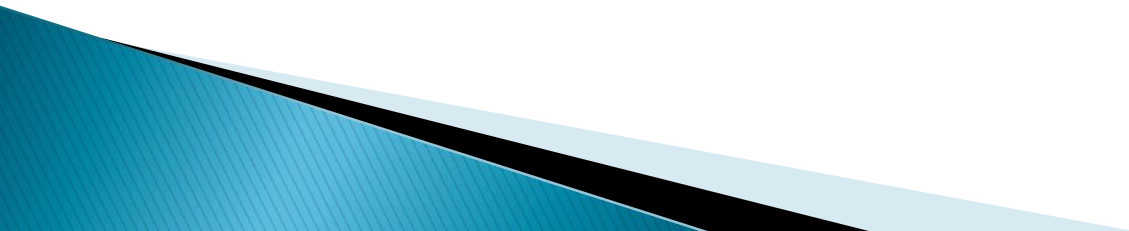
Purpose of ER Model

- To express the logical properties of the database in an enterprise schema
 - ER diagram are used to express logical structure of the model
 - ER model is used mainly as a design tool and documentation for the system
 - It describes the environment in terms of entities
- 

Relational Database ER

Entities:

To interpret the relational database, perceive the real world as a set of objects and relationships between these objects as entities



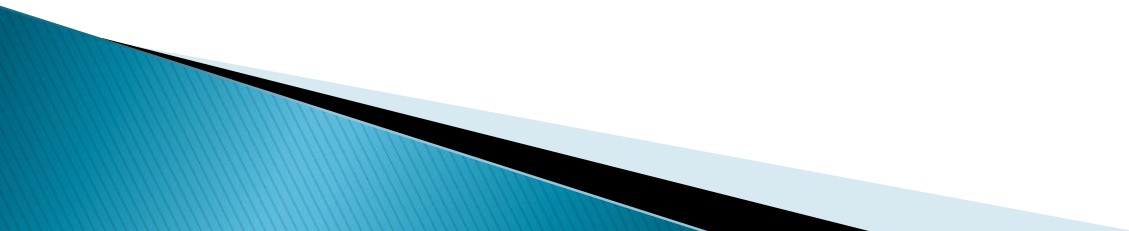
Entity Relationship

Entity Set

- An entity set is a set of entities of the same type that share the same properties or attributes

Attributes

- Attributes are descriptive properties possessed by each member of an entity set



Entity Relationship ...(contd.)

- Attribute types:
 - Simple & Composite
 - Eg Simple: Empno Composite : Ename - fname,mname,lname
 - Single-valued & Multi-valued
 - E.g Single: Studno Multi-Valued : Phone no
 - Derived
 - E.g Age: Age could be derived from date of Birth

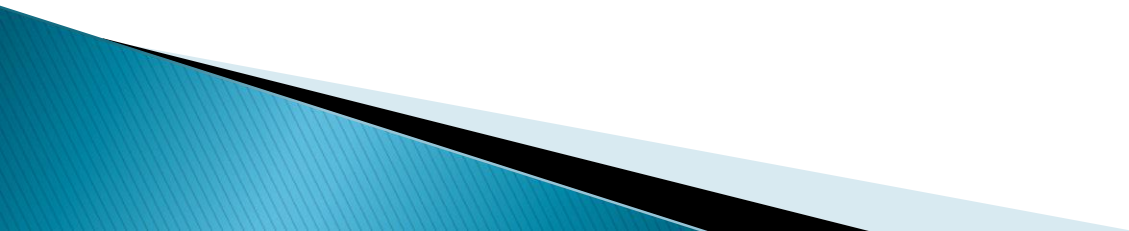
Entity Relationship ...(contd.)

Relationship

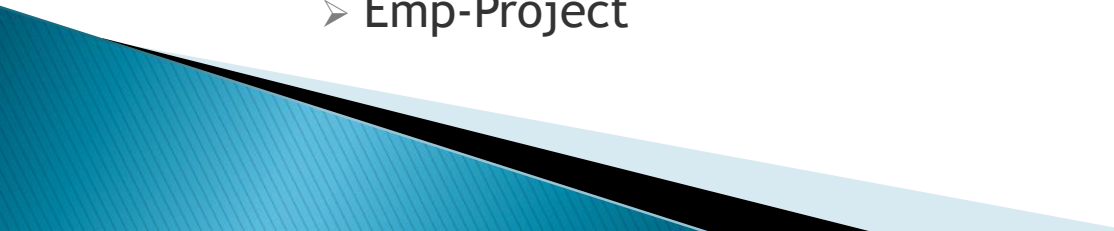
- A relationship is an association among several entities

Relationship Sets

- A relationship set is a set of relationships of a given type



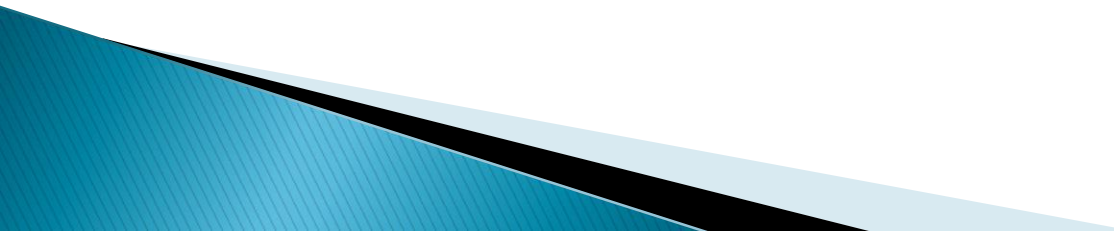
Mapping Cardinalities

- Mapping Cardinalities express the number of entities to which another entity can be associated via a relationship set
 - Following are the possible mapping cardinalities:
 - One-to-One
 - Student-Pen
 - One-to-Many
 - Class-Student
 - Many-to-One
 - Emp-Dept
 - Many-to-Many
 - Emp-Project
- 

Existence Dependencies

- If the existence of entity **x** depends on the existence of entity **y**, **x** is said to be existence dependent on **y**.
- Entity **y** is said to be a Dominant entity and **x** is said to be a subordinate entity

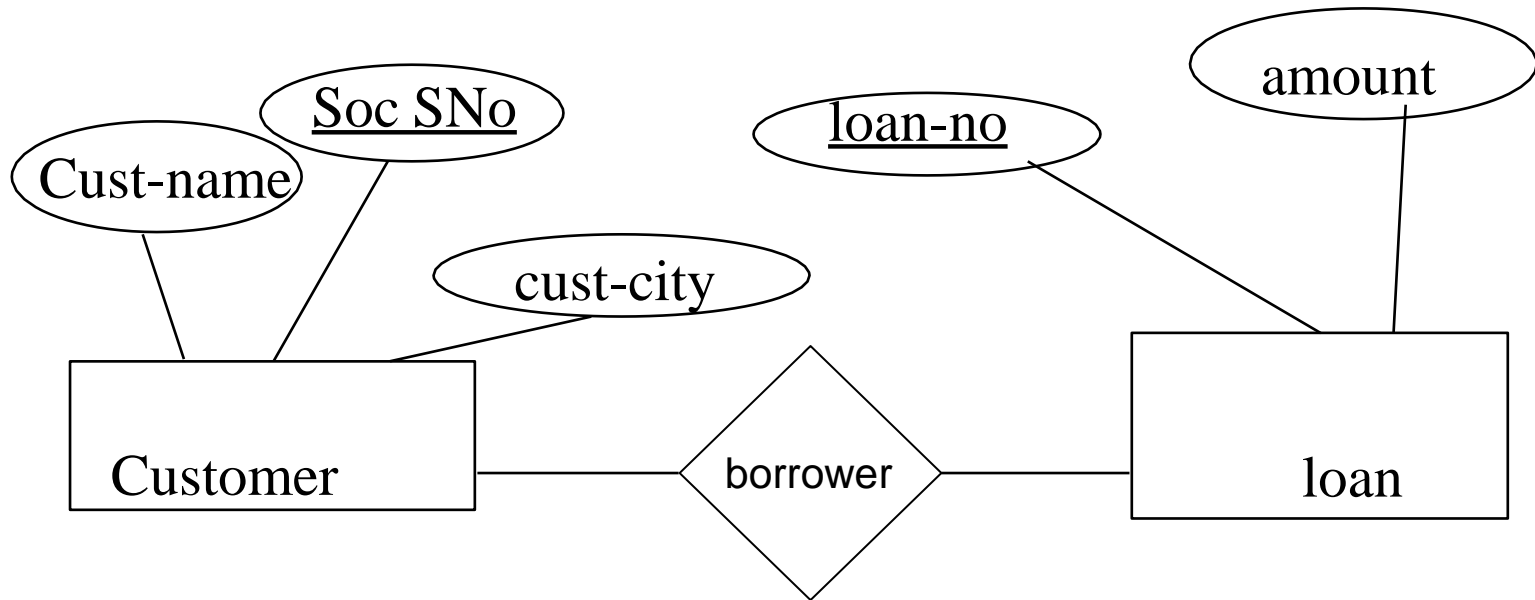
Participation of an entity set in a relation

- **Total**: The participation of an entity set E in a relationship set R is said to be total if every entity in E participates in at least one relationship R
 - **Partial**: Part of the set of entities participate in some relationship
- 

ER Diagram

- Overall logical structure of a database can be expressed graphically by an ER diagram
 - Rectangles: entity sets
 - Ellipses: attributes
 - Diamonds: relationship sets
 - Double Lines: total participation
 - Dashed Ellipse: derived attribute
 - Double Ellipse: multivalued attributes
 - Lines: link attribute to entity sets and entity sets to relationship set
 - Double Rectangle: weak entity
 - Attribute with an underline: primary key

ER Diagram ...(contd.)



Relational Database ER

- Identifying Entities
 - Given a system description you can identify entities by:
 - Select all nouns
 - Eliminate one's not necessary

Relational Database ER...(contd.)

- Entities are classified as:
 - **DOMINANT ENTITIES:** An entity that does not depend on another entity for its existence is a dominant or strong entity
 - **WEAK ENTITIES:** An entity that depends on some other entity for its existence

Relational Database ER...(contd.)

- If the weak entity does not have a primary key of its own then you can use a combination of the primary key of the dominant entity & an attribute of the weak entity as the primary key of the weak entity

- **WEAK ENTITY:**

For example: KEY_PERSON_NAME cannot uniquely identify a key person. Hence SUPP_CODE & KEY_PERSON_NAME can be used as a key.

Relational Database ER ...(contd.)

- Entities are linked to each other through relationships. Hence a relationship is an association between 2 entities.

- eg:

Entity

Relationship

Entity

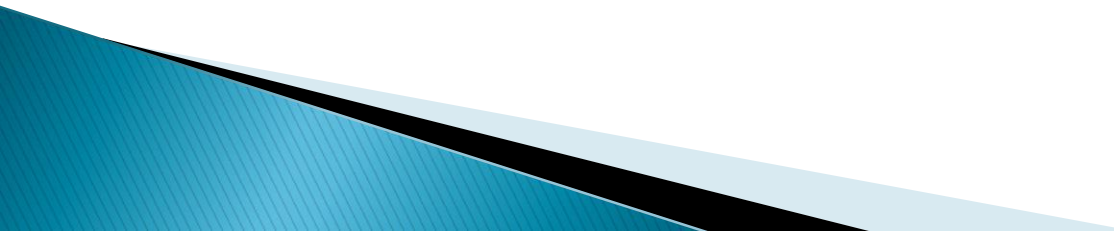
Supplier

supplies

Items

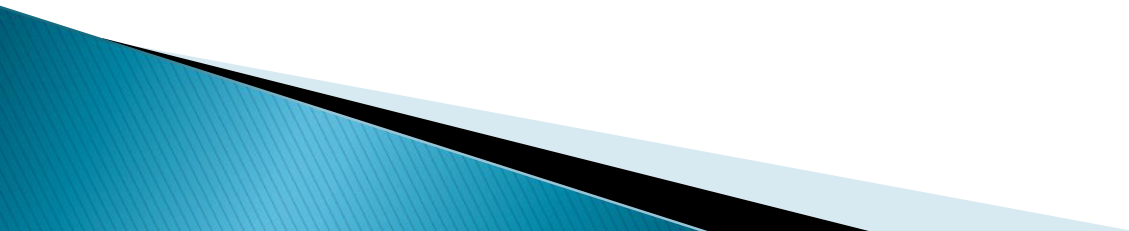


Relational Database ER

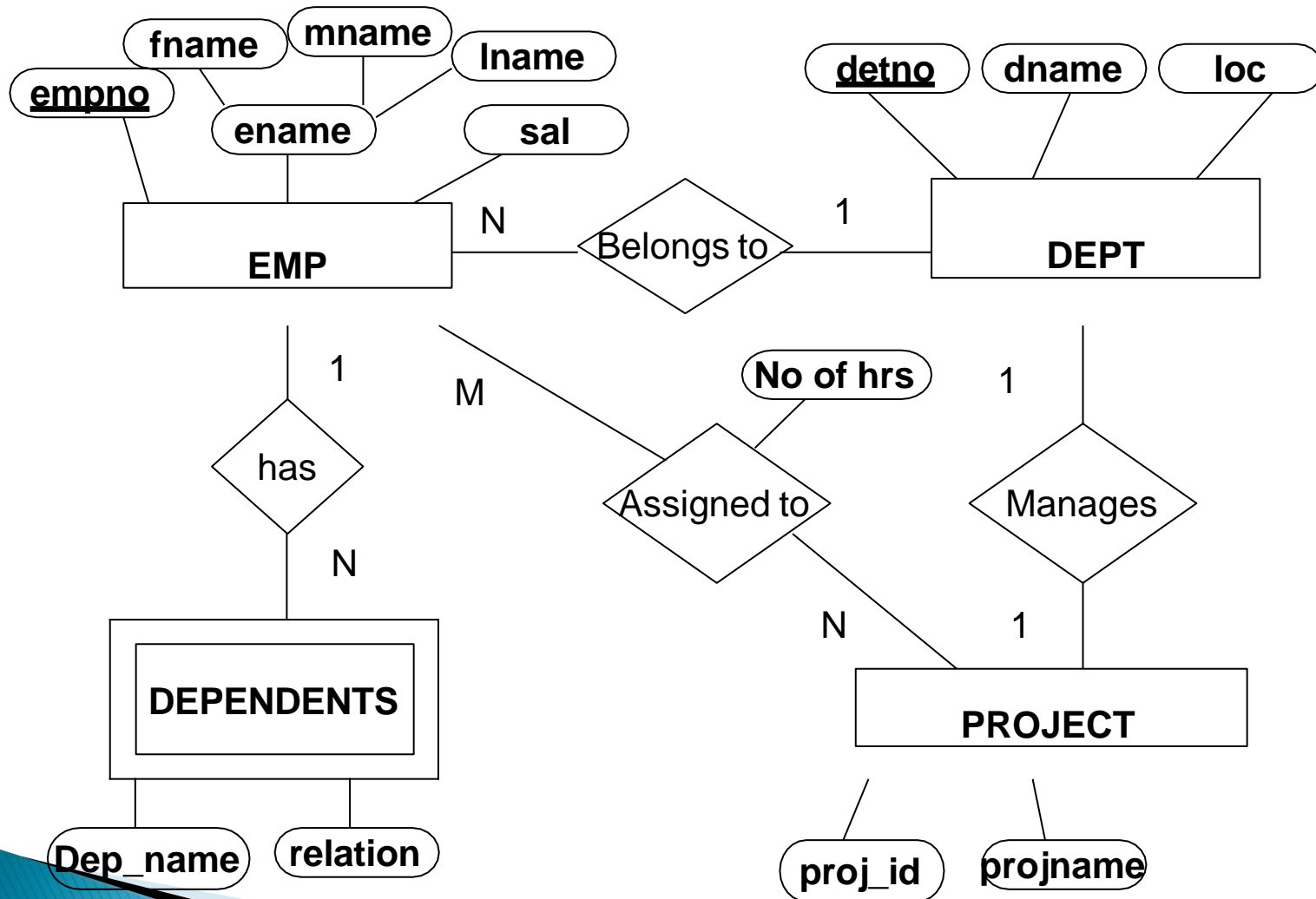
- 1-1
Supplier-----Key Person
 - 1-M
Dept-----Emp
 - M-1
Emp-----Dept
 - M:M
Student----Subjects
- 

Relational Database ER...(contd.)

- Once the entities & relationship between the entities is identified you can represent them in a ER diagram



ER Example

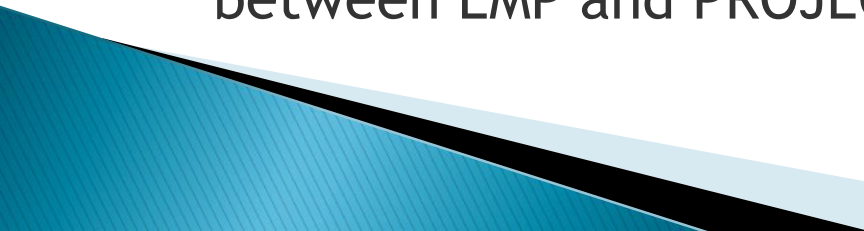


Relational Database ...(contd.) ER

- This schema has 3 entity types

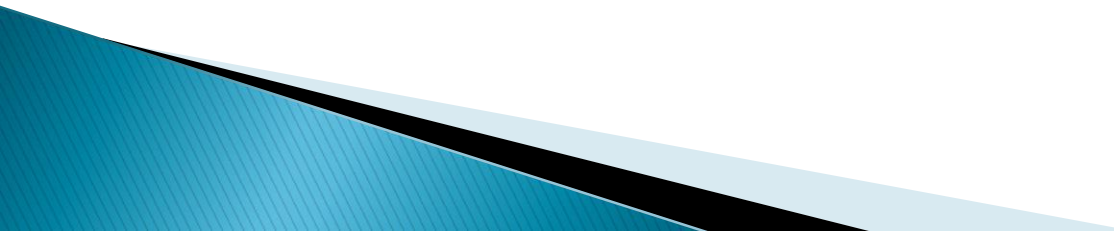
- EMPLOYEE
- DEPT
- PROJECT

& one weak entity type DEPENDENT

- There is M:N relationship between PROJECT and EMP entity sets
 - There is a 1:1 relationship between DEPT and PROJECT
 - There is a 1:M relationship between DEPT and EMP entity sets
 - No of hrs is an attribute on the relation “assigned to” between EMP and PROJECT
- 

ER to Relational Mapping

Step 1:

- For regular entity E, create relation R including simple attributes and simple component of a composite attribute
 - Choose one of the key attribute as a primary key for all strong entities
- 

ER to Relational Mapping...(contd.)

Step 1:

EMP

p . k				
<u>empno</u>	fname	mname	lname	sal

DEPT

p. k		
<u>deptno</u>	dname	loc

PROJECT

p . k	
<u>Proj_id</u>	projname

DEPENDEN

Super key

T		
empno	Dep_name	relation

ER to Relational Mapping...(contd.)

Step 2:

- For each weak entity type W in the ER schema with owner entity type E, we create a relation R and include all simple attributes of W as attributes of R
- In addition, we include as foreign key attributes of R, the primary key attributes of the relation that corresponds to the owner entity type E.
- The primary key of R is the combination of the primary key of the owner & the partial key of the weak entity type W

ER to Relational Mapping...(contd.)

Step 2:

EMP

P.k

f. k

<u>empno</u>	fname	mname	lname	sal	<u>deptno</u>
--------------	-------	-------	-------	-----	---------------

P.k

DEPT

f. k

<u>deptno</u>	dname	loc
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P.k

PROJECT

<u>Proj_id</u>	Proj_name	deptno
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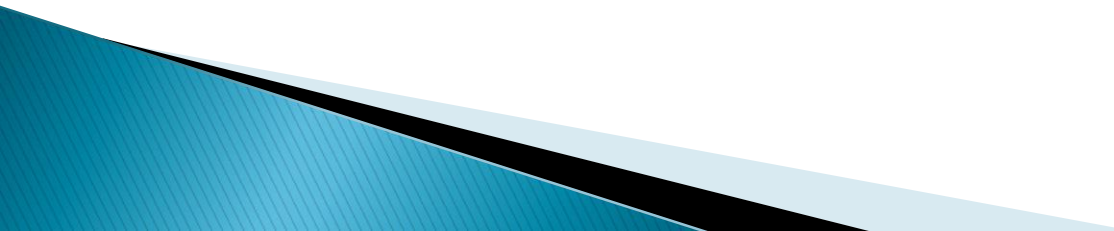
DEPENDENT

Super key

empno	Dep_name	relation
-------	----------	----------

ER to Relational Mapping...(contd.)

Step 3:

- For each binary 1:1 relationship type R, we identify the relations S and T that correspond to the entity types participating in R
 - We choose one of the relations S, say & include as a foreign key in S the primary key of T. Choose an entity type with total participation in R in the role of S.
 - We include all the simple attributes of the 1:1 relationship R as attributes of S
- 

ER to Relational Mapping...(contd.)

Step 3:

EMP	P . k				f. k
<u>empno</u>	fname	mname	lname	sal	<u>deptno</u>

P . k	DEPT	
<u>deptno</u>	dname	loc
P . k	PROJECT	
<u>Proj_id</u>	Proj_name	<u>deptno</u> f. k

Super key	DEPENDEN	
	T	
empno	Dep_name	relation

ER to Relational Mapping...(contd.)

Step 4:

- For each regular (nonweak) binary 1:N relationship type R, we identify the relation S that represents the participating entity type at the N-side of the relationship type. We include as foreign key in S the primary key of relation T that represents the other entity type participating in R; this is because each entity instance on the N-side is related to at most one entity instance on 1 side of relationship type.

ER to Relational Mapping...(contd.)

Step 4:

EMP					
P .k			F .k		
<u>empno</u>	fname	mname	lname	sal	<u>deptno</u>

DEPT		
P .k		
<u>deptno</u>	dname	loc

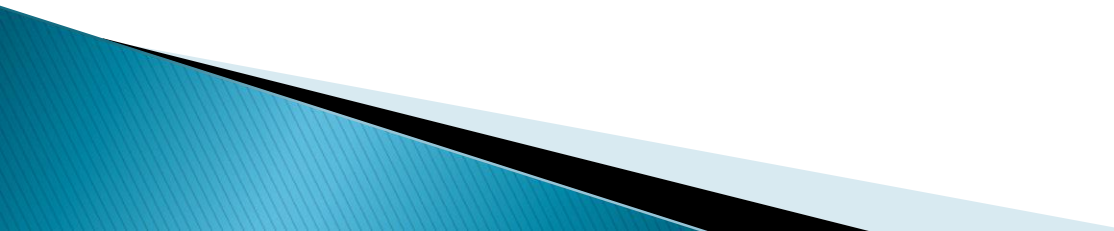
PROJECT		
P .k		
<u>Proj_id</u>	Proj_name	<u>deptno</u>

f. k

DEPENDEN		
Super key		
empno	Dep_name	Trelation

ER to Relational Mapping...(contd.)

Step 5:

- For each binary M:N relationship type R, we create a new relation S to represent R.
 - We include as foreign key attributes in S the primary keys of the relations that represent the participating entity types.
 - The combination will form the primary key of S. We also include any simple attributes of the M:N relationship type as attributes of S.
- 

ER to Relational Mapping...(contd.)

Step 5:

EMP

P.k

F.k

<u>empno</u>	fname	mname	lname	sal	<u>deptno</u>
--------------	-------	-------	-------	-----	---------------

DEPT

P.k

<u>deptno</u>	dname	loc
---------------	-------	-----

PROJECT

P.k

f.k

<u>Proj_id</u>	Proj_name	<u>deptno</u>
----------------	-----------	---------------

Super key

EMP_PROJ

Empno	<u>Proj_id</u>	No_of_hrs
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Super key

DEPENDENT

empno	Dep_name	relation
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