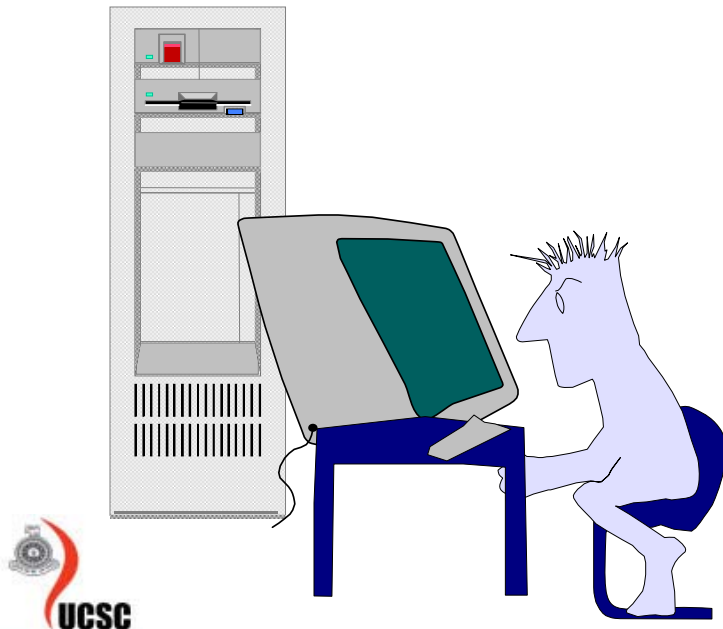# Database Design Process

Duration: 12hrs

Logical Database Design
Mapping ERD to Relational

Transforming (mapping) E-R diagrams to relations is a relatively straightforward process with a well-defined set of rule

Step 1: Map Regular Entities
       2: Map Weak Entities
       3: Map Binary Relationships
       4: Map Associated Entities
       5: Map Unary Relationships
       6: Map Ternary (and n-ary) Relationships
       7: Map Supertype/Subtype Relationships

1. Map Regular Entities

Each regular entity type in an ERD is transformed into a relation.

Entity	**Relation**
entity name	relation name
simple attribute	attribute of the relation
entity identifier	primary key of relation
composite attribute	component attributes
multi-valued attribute	new relation with PK

First Name

Emp No

Mid Initials

NID

Location

Emp Name

Dept Name

Last Name

Address

Phone

Dept No

Employee

Department

Salary

Employees

Gender

Employee (Emp_No, NID, Address,
Salary, Gender, DOB,
First_Name, Mid_Initials, Last_Name)

DOB

Department(Dept_No, Dept_Name, Phone)

FK/NN   NN

Dept_Location(Dept_No, Location)

2. Map Weak Entities

Each weak entity type in an ERD is transformed into a relation.

Entity	Relation
entity name	relation name
simple attribute	attribute of the relation
owner entity identifier	foreign key attribute
entity identifier (partial)	composite key together with PK of owner as FK
composite attribute	component attributes
multi-valued attribute	new relation with PK

BIT

Emp No

Employee

has

Dependent — Depd Name

Gender

DOB

Relation

Dependent(*Emp_No*, Depd_Name, Gender, DOB, Relation)

FK/NN

Employee (Emp_No, ….)

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3. Map Binary Relationships

Procedure depends on both the degree of the binary relationships and the cardinalities of the relationships

- Map Binary One-to-Many Relationships
- Map Binary Many-to-Many Relationships
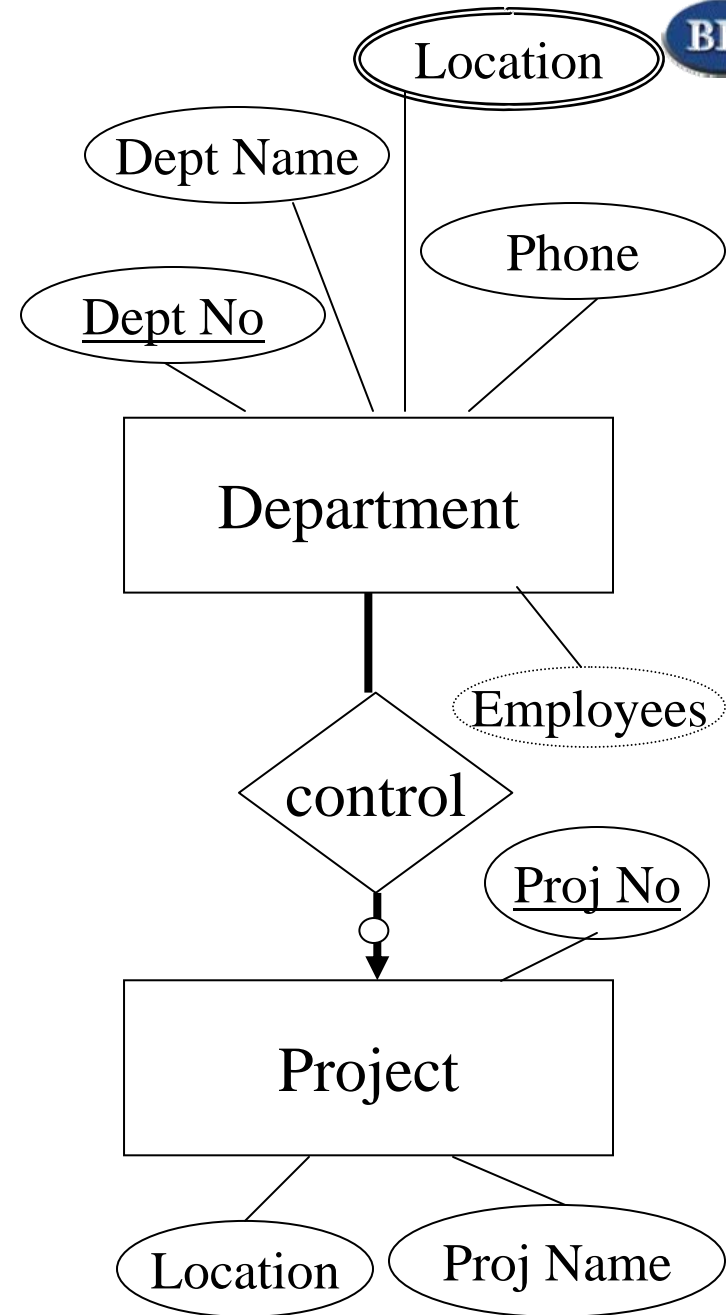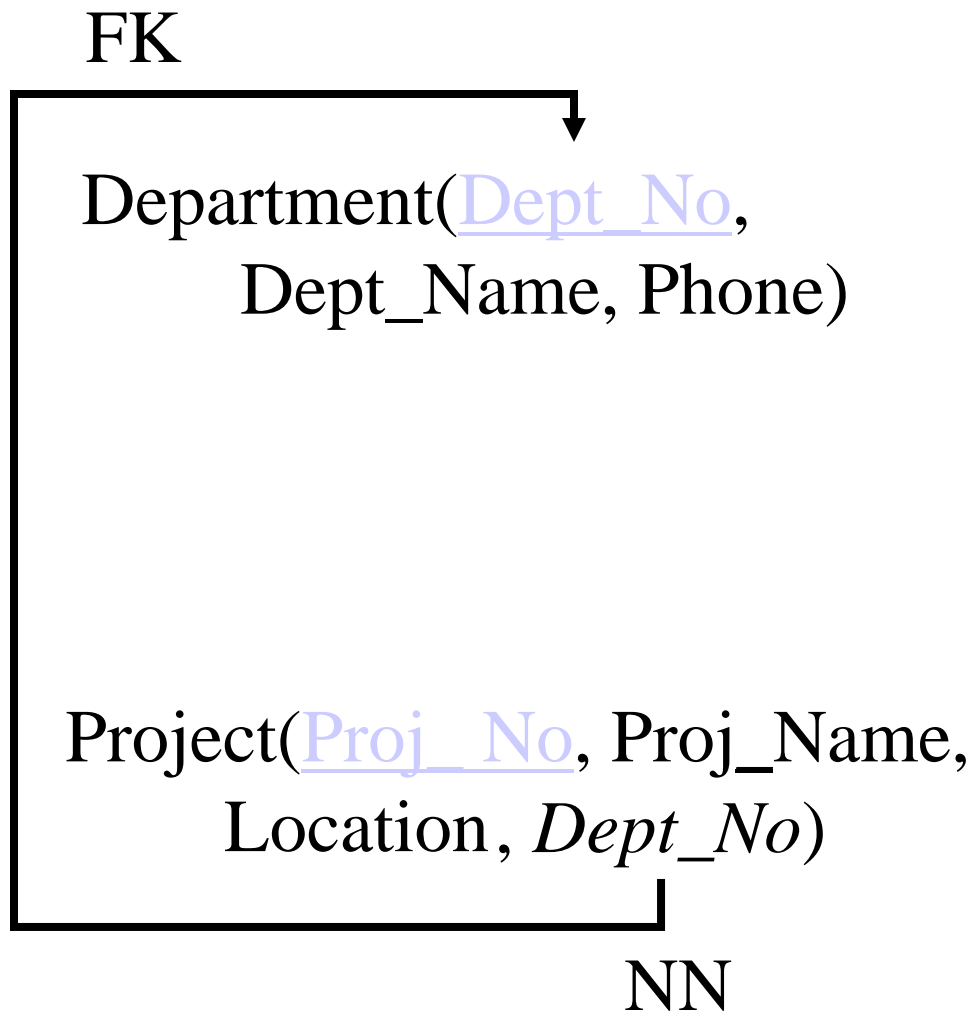- Map Binary One-to-One Relationships
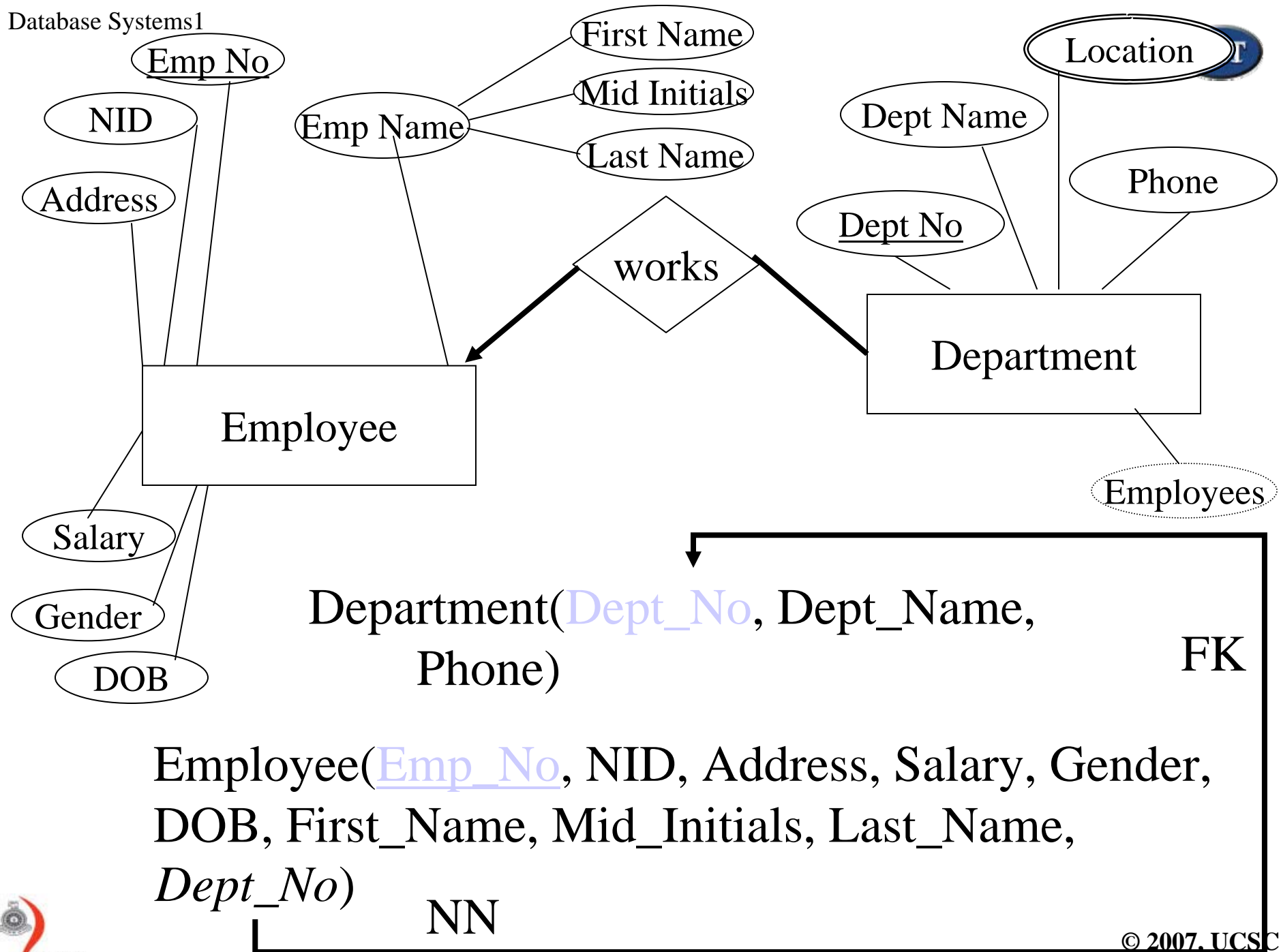
Map Binary One-to-Many Relationships

Create a relation for the two entity types participating in the relationships (step 1)

include PK of the entity in the one-side of the relationship as a foreign key in the relation of the many side of the relationship

include any attributes of the relationship to the relation of the many side

FK

Department(Dept_No,
    Dept_Name, Phone)

Project(Proj_ No, Proj_Name,
    Location, *Dept_No*)

NN

Emp No

NID

Address

Emp Name

First Name

Mid Initials

Last Name

Location

Dept Name

Phone

Dept No

works

Department

Employee

Salary

Gender

DOB

Employees

Department(Dept_No, Dept_Name, Phone)

FK

Employee(Emp_No, NID, Address, Salary, Gender, DOB, First_Name, Mid_Initials, Last_Name, *Dept_No*)
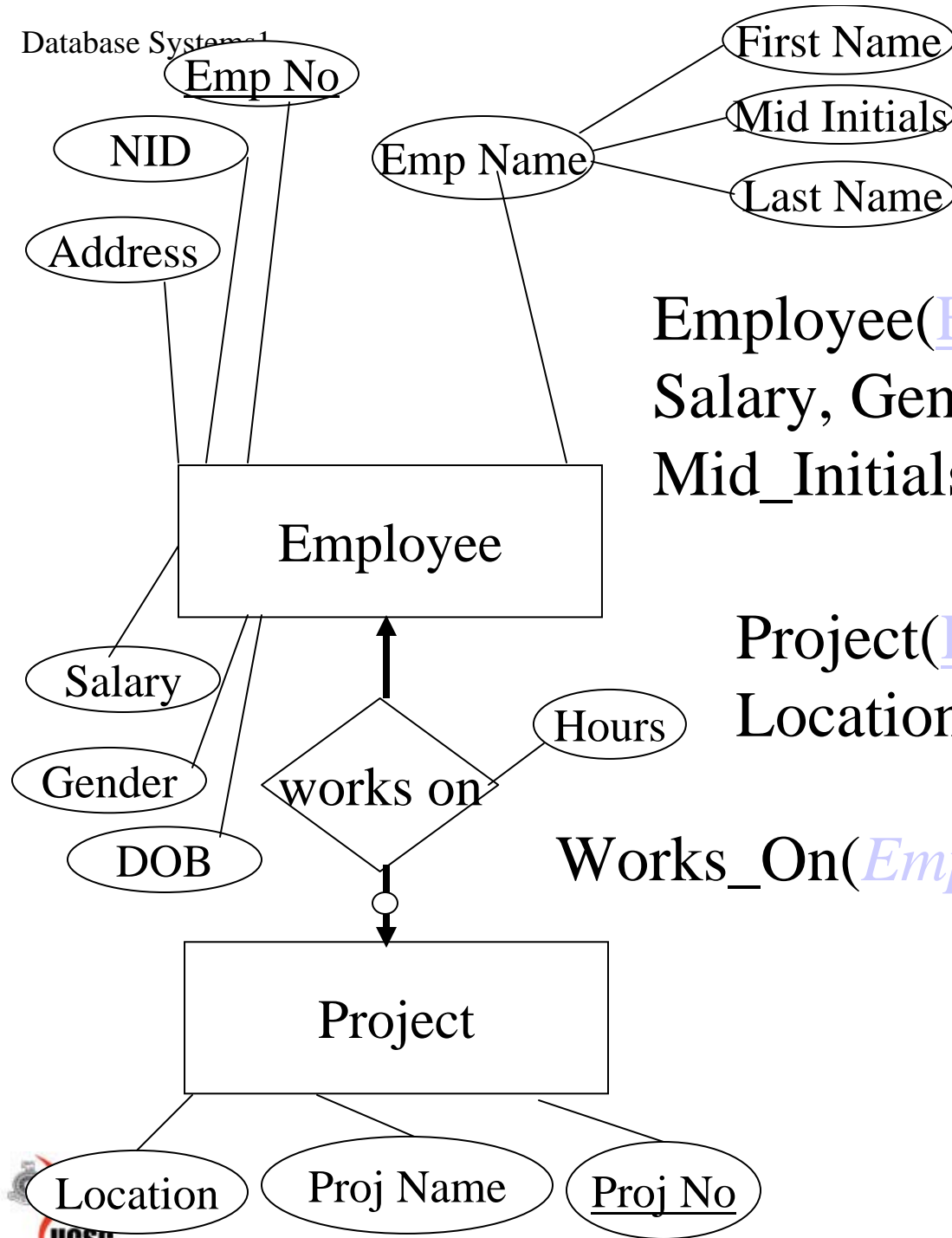
NN

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Map Binary Many-to-Many Relationships

Create a relation for the two entity types participating in the relationships (step 1)

Create new relation and include PK of each of the two participating entity types as FK. These attributes become the PK (composite)

include any attributes of the relationship to the new relation

Emp No

NID

Address

First Name

Mid Initials

Last Name

Emp Name

FK/NN

Employee(Emp_No, NID, Address, Salary, Gender, DOB, First_Name, Mid_Initials, Last_Name, Dept_No)

Employee

Salary

Gender

DOB

Hours

works on

Project(Proj_No, Proj_Name, Location, Dept_No)

FK/NN

Works_On(Emp_No, Proj_No, Hours)

Project

Location

Proj Name

Proj No

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Database Systems1
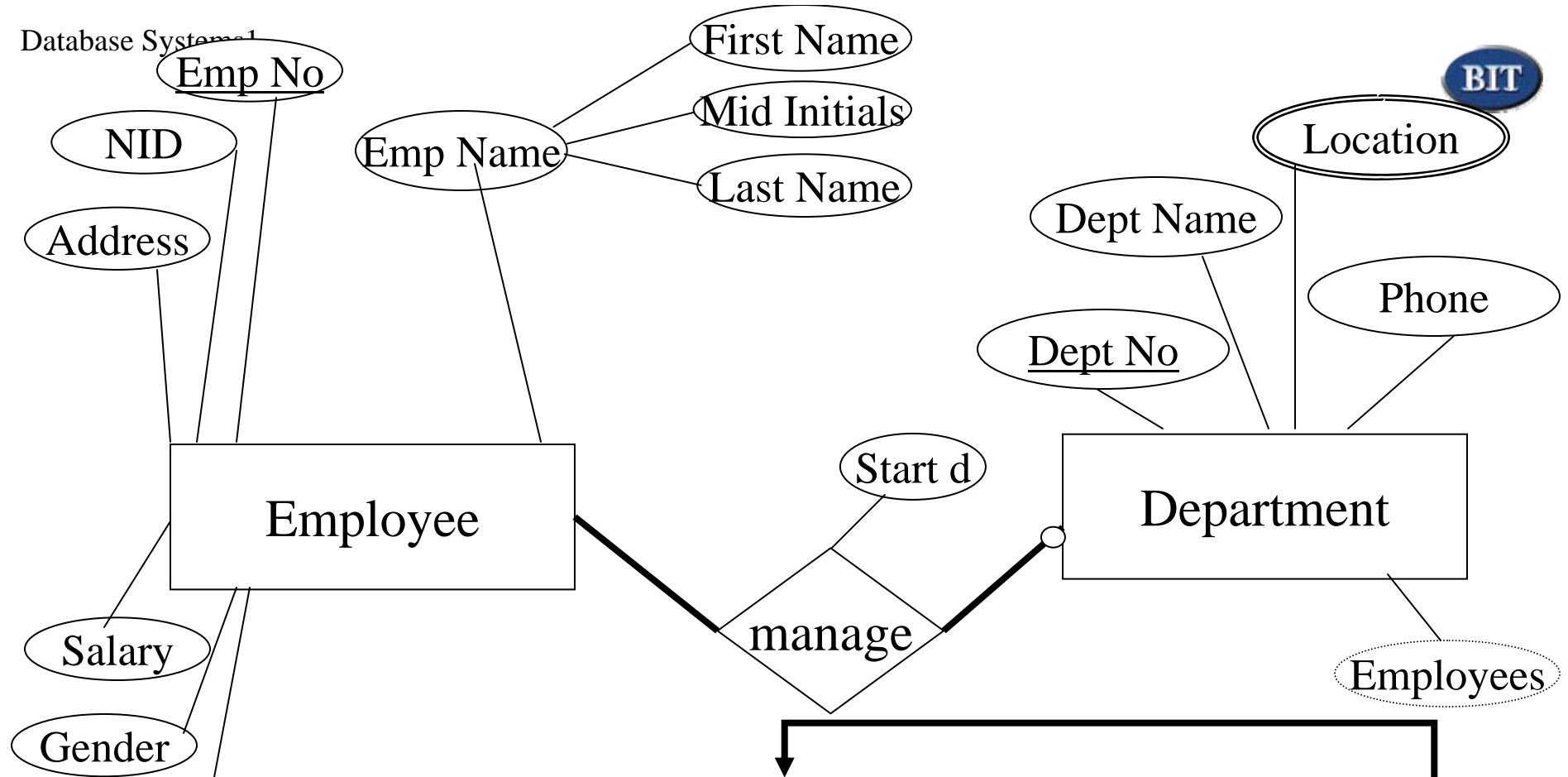
Map Binary One-to-One Relationships

BIT

Specialised case of One-to-Many
Create a relation for the two entity types participating in the relationships (step 1)

Include PK of one of the relations as a foreign key of the other relation (include in optional side of the relationship that has mandatory participation in the 1:1)

include any attributes of the relationship to the same relation

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Employee(Emp_No, NID, Address, Salary, Gender, DOB, First_Name, Mid_Initials, Last_Name, Dept_No)

Department(Dept_No, Dept_Name, Phone, *Manager* Start_D)
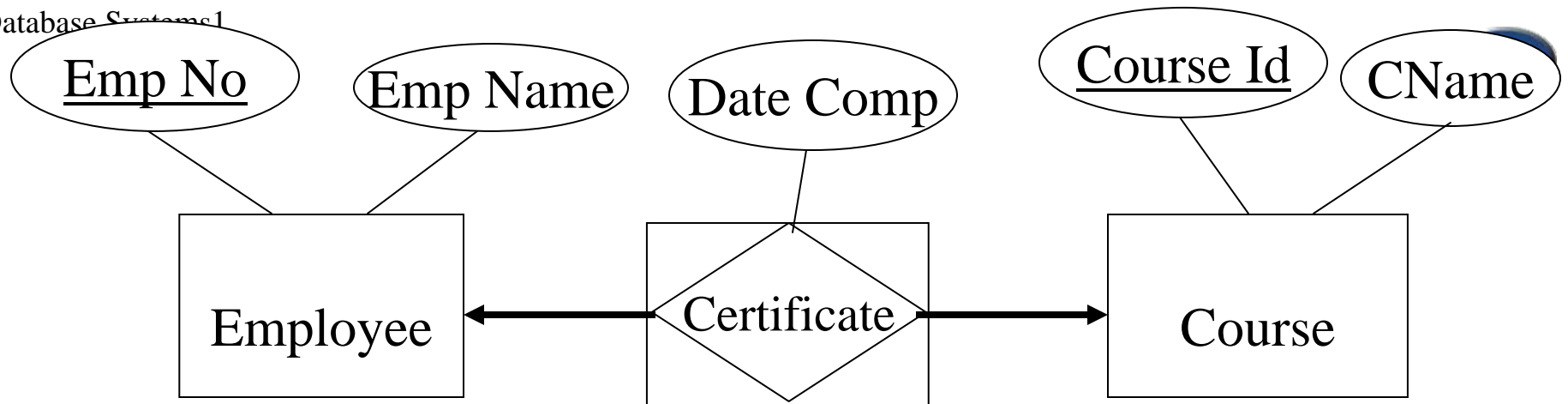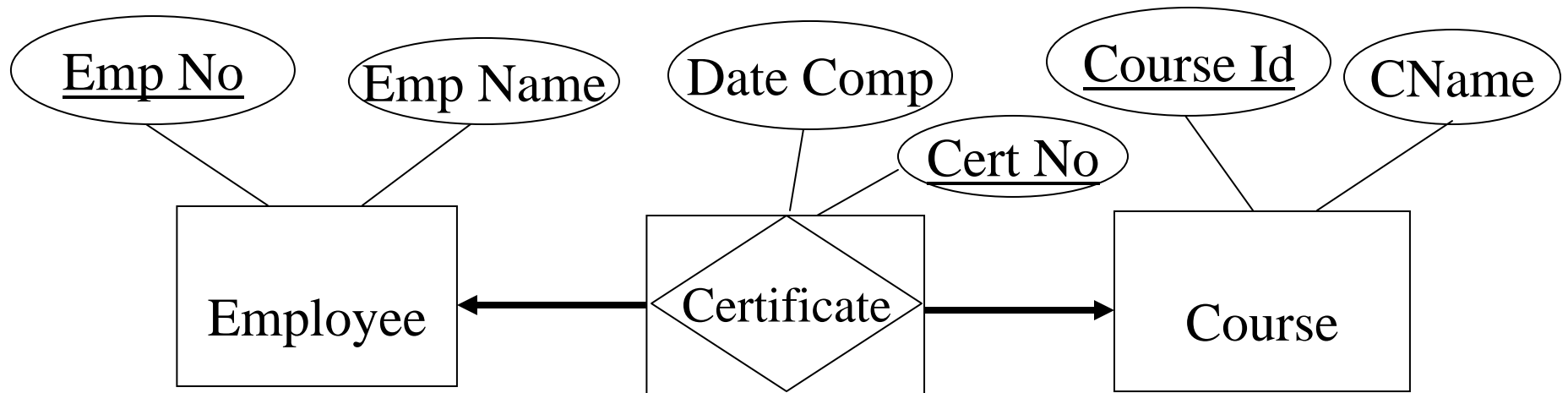
FK

NN

4. Map Associative Entities

Essentially the same steps as mapping M:N, except if there is a special identifier for associative entity

Create new associative relation for the associative entity and include PK of each of the two participating entity types as FK. These attributes become the PK (composite) if there is no identifier assigned. Otherwise the PK is the identifier of the associative entity

include any attributes of the relationship to the new relation

Certificate(*Emp_No*, *Course_Id*, Date_Comp)
　　　　FK/NN　　FK/NN

Certificate(Cert_No, *Emp_No*, *Course_Id*, Date_Comp)
　　　　　　　FK/NN　　FK/NN

5. Map Unary Relationships

Procedure depends on both the degree of the binary relationships and the cardinalities of the relationships

- Map Unary One-to-Many Relationships
- Map Unary Many-to-Many Relationships
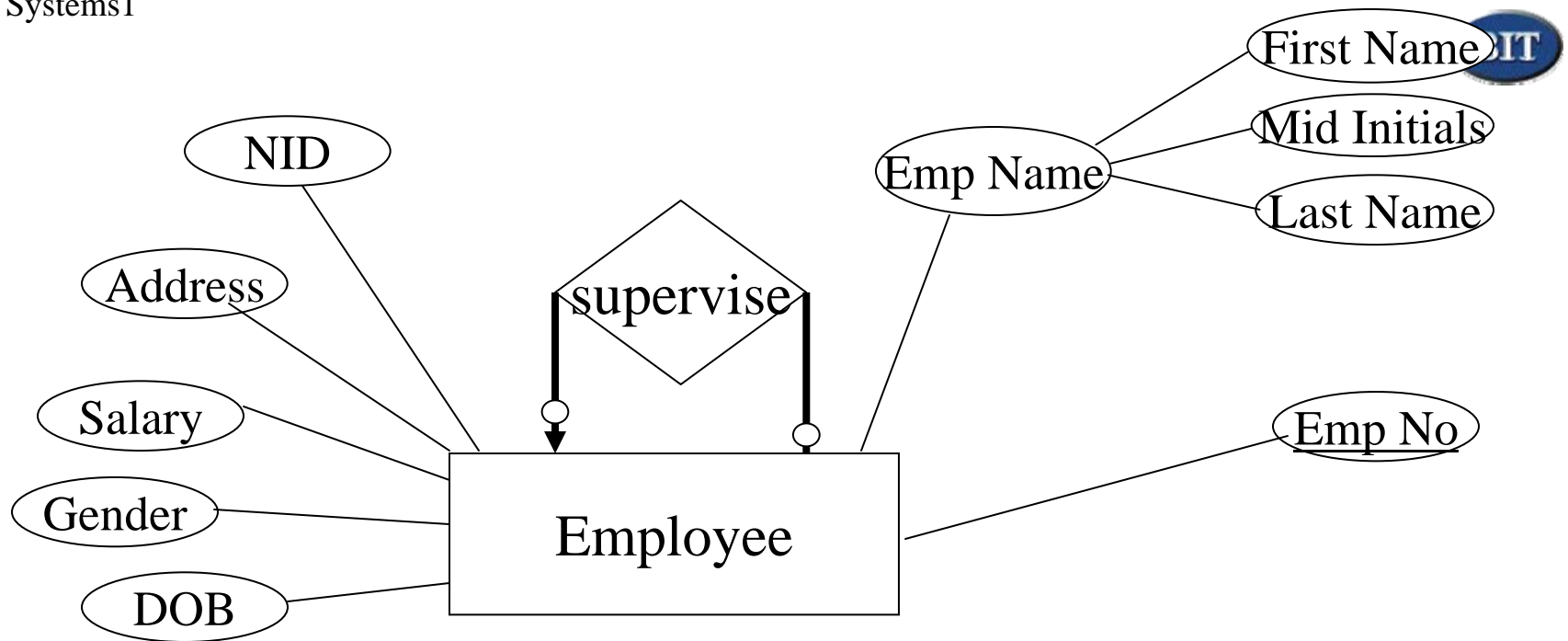- Map Unary One-to-One Relationships

Map Unary One-to-Many Relationships

Create a relation for the entity type (step 1)

include PK of the entity as a foreign key within the same relation

include any attributes of the relationship to the relation of the many side

Employee(Emp_No, NID, Address, Salary, Gender, DOB, First_Name, Mid_Initials, Last_Name, Dept_No, *Supervisor*)
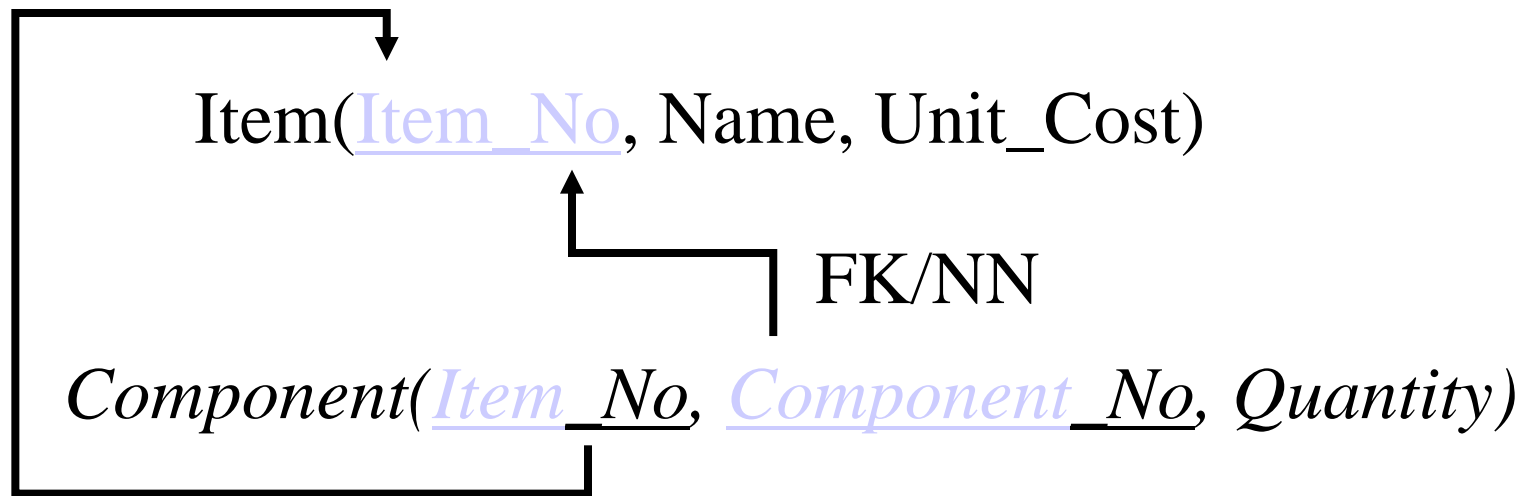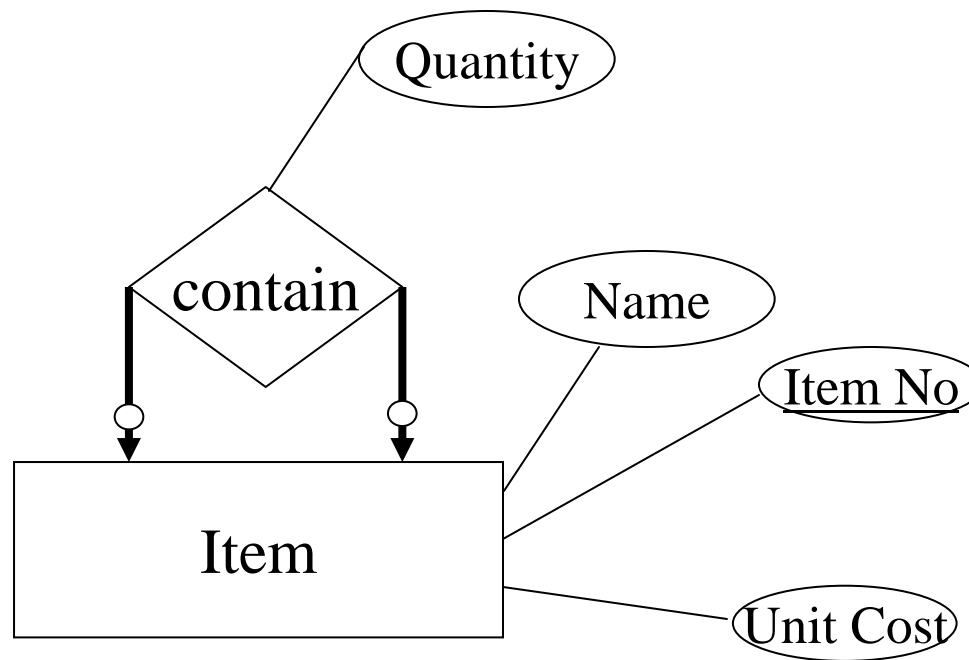
FK/Null

Map Unary Many-to-Many Relationships

Create a relation for the entity type (step 1)

Create new relation and include PK of the entity type as FK twice. These attributes become the PK (composite)

include any attributes of the relationship to the new relation

Quantity

contain

Name

Item No

Item

Unit Cost

Item(Item_No, Name, Unit_Cost)

FK/NN

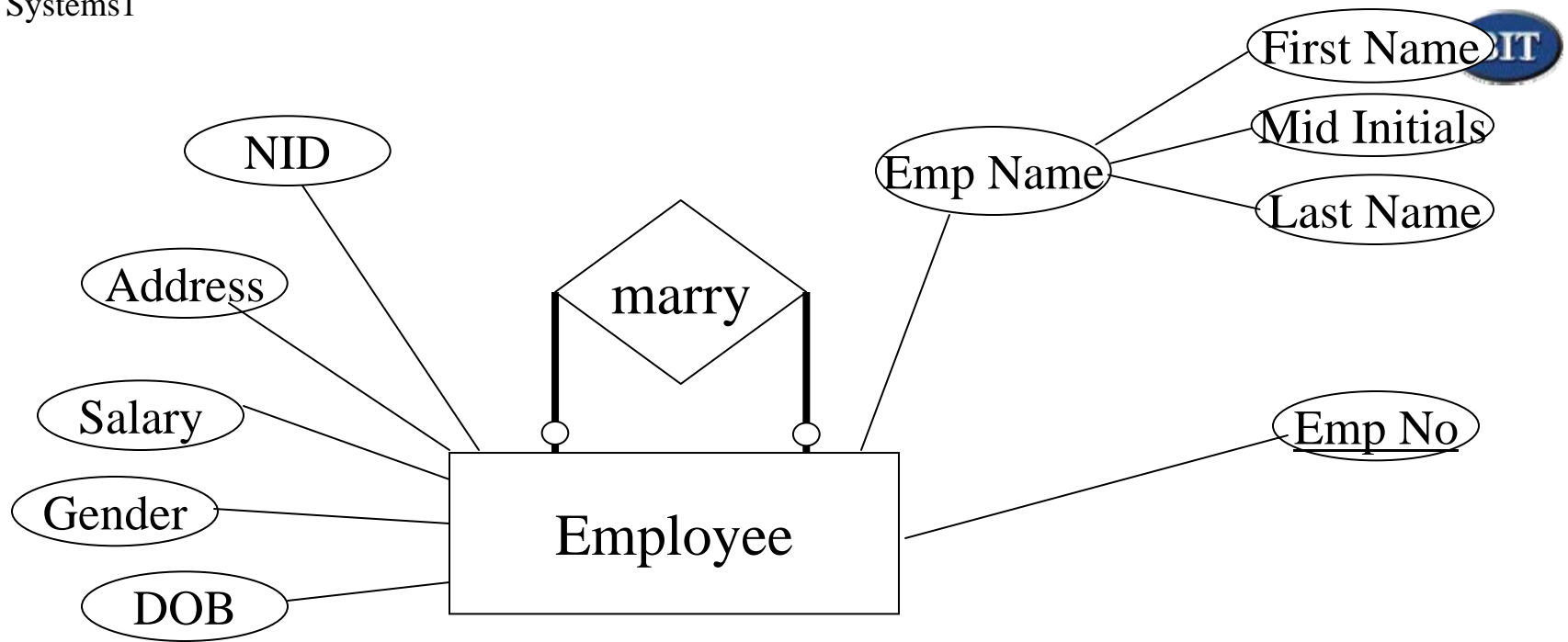Component(Item_No, Component_No, Quantity)

FK/NN

Map Unary One-to-One Relationships

Create a relation for the entity type (step 1)

include PK of the entity as a foreign key within the same relation

include any attributes of the relationship to the relation of the many side

First Name

IT

Mid Initials

Emp Name

Last Name

NID

Address

marry

Salary

Emp No

Gender

Employee

DOB

Employee(Emp_No, NID, Address, Salary, Gender, DOB, First_Name, Mid_Initials, Last_Name, Dept_No, *Marry*)
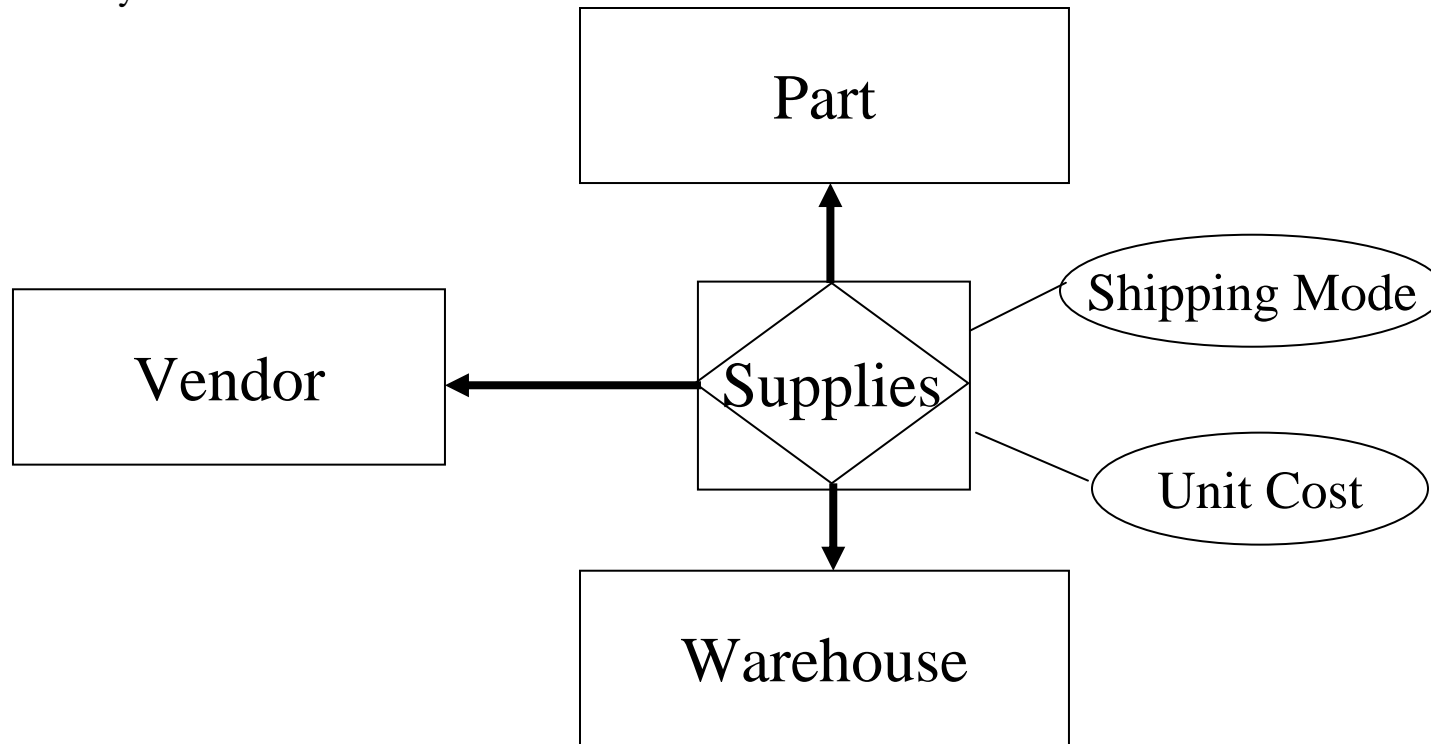   FK/Null

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6. Map Ternary (and n-ary) Relationships

Convert a ternary relationship to an associative entity

Create a new associative relation for the associative entity. The default PK consists of three PK attributes of the participating entity types (in some cases additional attributes are needed to form a PK) as FK

include any attributes of the relationship to the new relation

Warehouse(warehouse_no, ….)
Vendor(vendor_no, ….)
Part(part_no, ….)
Supply(warehouse_no, vendor_no, part_no,
        Shipping_mode, Unit_Cost)

7. Map Supertype/Subtype Relationships

The relational model does not directly support supertype/subtype relationships

There are various strategies that database designers can use to represent these relationships with the relational data model