Database Management System – 17
(ER- Relational Mapping)

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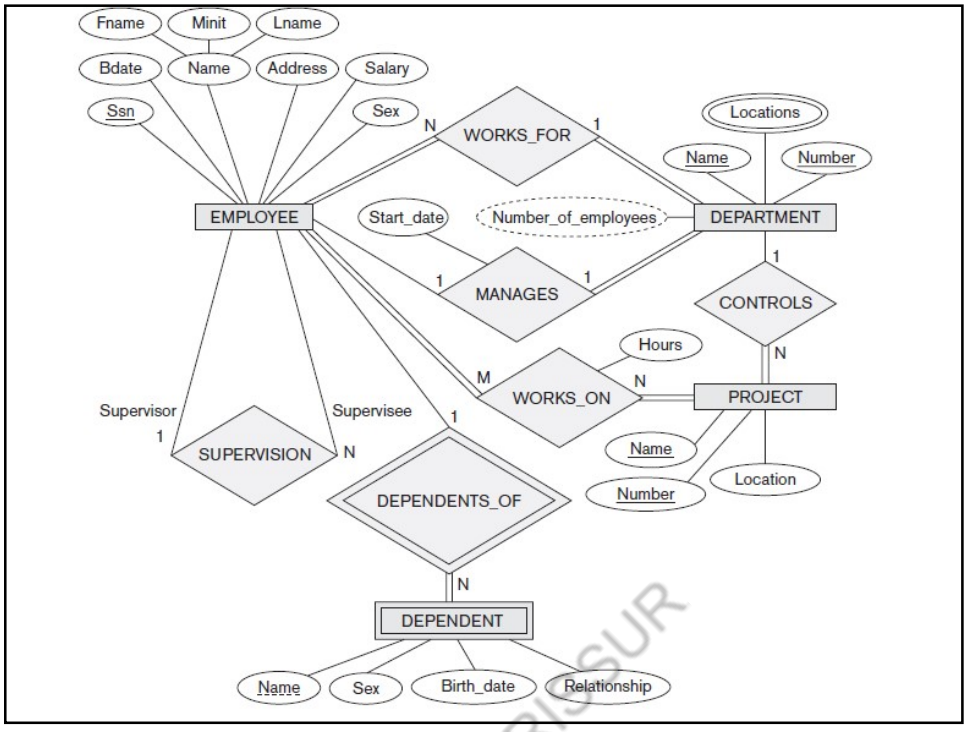
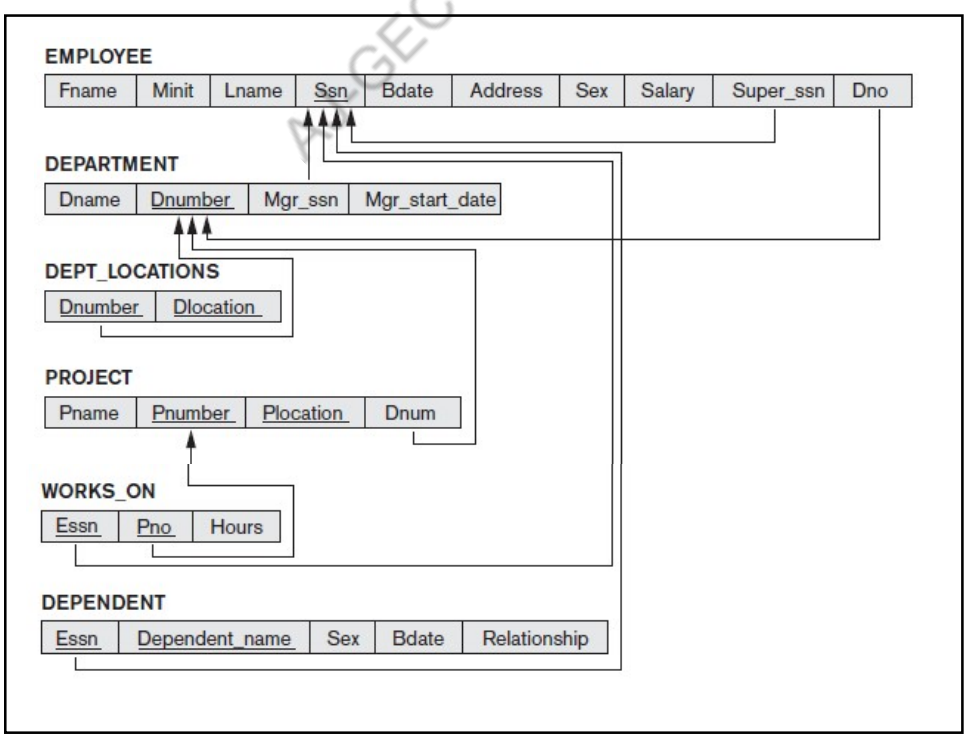
Outline

ER-to-Relational Mapping Algorithm

- Step 1: Mapping of Regular Entity Types
- Step 2: Mapping of Weak Entity Types
- Step 3: Mapping of Binary 1:1 Relation Types
- Step 4: Mapping of Binary 1:N Relationship Types
- Step 5: Mapping of Binary M:N Relationship Types
- Step 6: Mapping of Multivalued attributes
- Step 7: Mapping of N-ary Relationship Types





ER to Relational Mapping

- Seven-step algorithm
- Convert the basic ER model constructs
  - Entity types (strong and weak)
  - Binary relationships (with various structural constraints)
  - n-ary relationships
  - attributes (simple, composite, and multivalued)
- **Relations**

ER-to-Relational Mapping Algorithm

- Step 1: Mapping of Regular Entity Types
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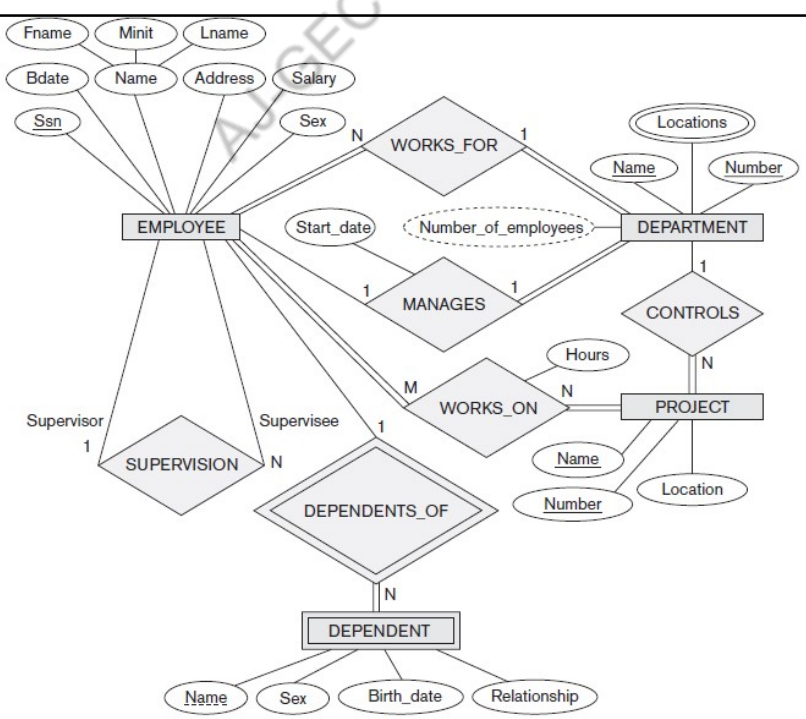
Step 1: Mapping of Regular Entity Types

- For each regular (strong) entity type E in the ER schema
- ***Create a relation R*** that includes all the simple attributes of E
- Choose one of the key attributes of E as the ***primary key*** for R
- If the chosen key of E is ***composite***, the set of simple attributes that form it will together form the primary key of R



After Step 1

EMPLOYEE

Fname	Minit	Lname	Ssn	Bdate	Address	Sex	Salary

DEPARTMENT

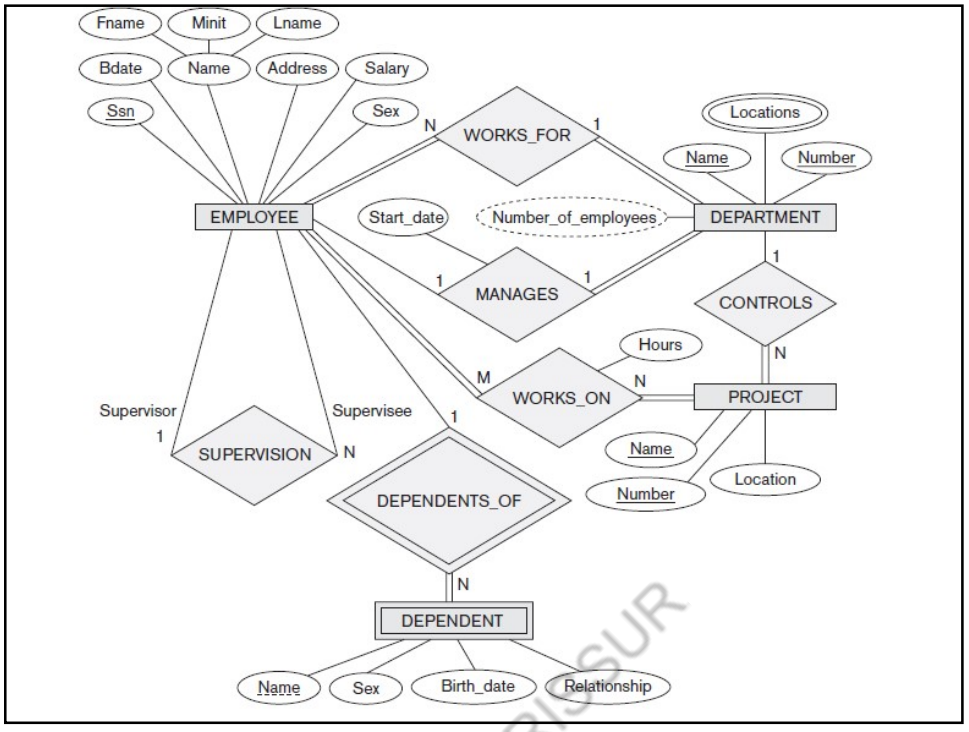
Dname	Dnumber

PROJECT

Pname	Pnumber	Plocation

Step 2: Mapping of Weak Entity Types

- For each ***weak entity type W*** with owner entity type E
- ***Create a relation R*** and include all simple attributes of W as attributes of R
- In addition, include as ***foreign key*** attributes of R the primary key attribute(s) of the relation(s) that correspond to the owner entity type(s) **(E)**
- ***Primary key*** of R is the ***combination*** *of* the primary key(s) of the owner(s) and the partial key of the weak entity type W, if any



After Step 2

DEPENDENT

Essn	Dependent_name	Sex	Bdate	Relationship

EMPLOYEE

Fname	Minit	Lname	Ssn	Bdate	Address	Sex	Salary

DEPARTMENT

Dname	Dnumber

PROJECT

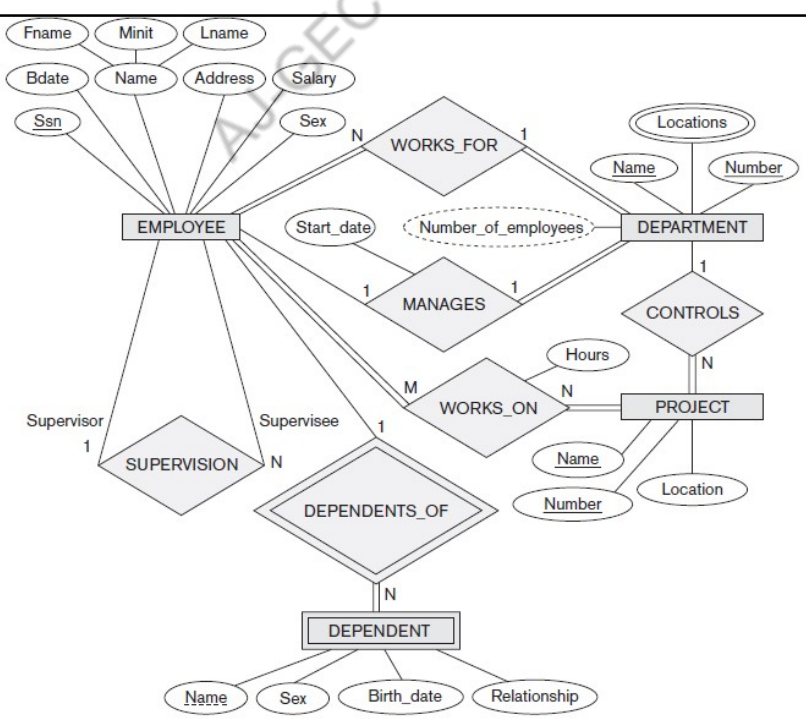
Pname	Pnumber	Plocation

Step 3: Mapping of Binary 1:1 Relation Types

- For each binary 1:1 relationship type R in the ER schema
- Identify the relations S and T that correspond to the entity types participating in R
- Three possible approaches:

(1) Foreign Key approach:

- Choose one of the relations-S
- Include a foreign key in S the primary key of T
- It is better to choose an entity type with *total participation* in R in the role of S



After Step 3

- 1:1 relation MANAGES is mapped by choosing the participating entity type DEPARTMENT to serve in the role of S, because its participation in the MANAGES relationship type is total

EMPLOYEE

Fname	Minit	Lname	Ssn	Bdate	Address	Sex	Salary

DEPARTMENT

Dname	Dnumber

PROJECT

Pname	Pnumber	Plocation

DEPENDENT

Essn	Dependent_name	Sex	Bdate	Relationship

DEPARTMENT

Dname	Dnumber	Mgr_ssn	Mgr_start_date

Step 3: Mapping of Binary 1:1 Relation Types

(2) Merged relation option:

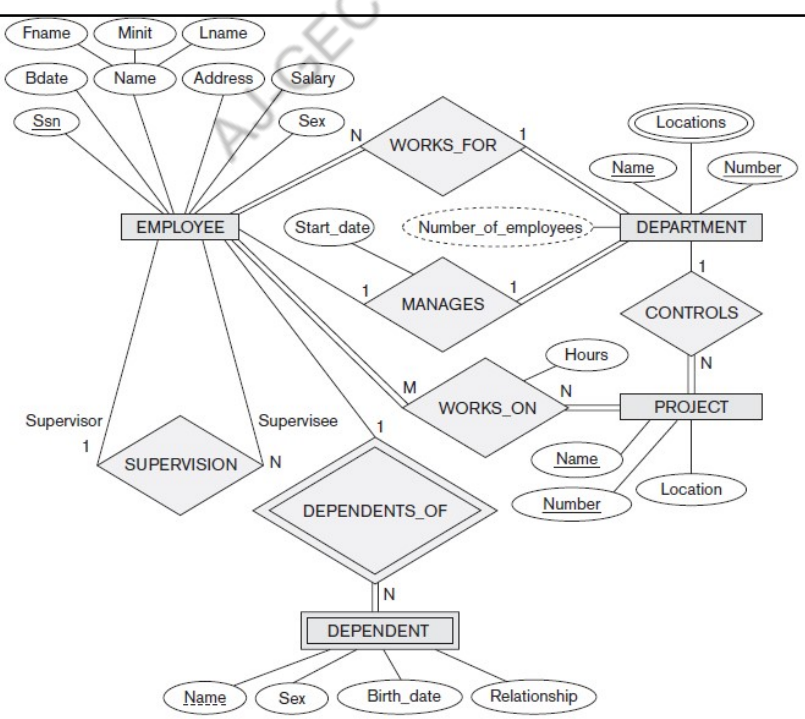
- Merging the two entity types and the relationship into a single relation
- Appropriate when *both participations are total*

(3) Cross-reference or relationship relation option:

- Set up a third relation R for the purpose of cross-referencing the primary keys of the two relations S and T representing the entity types

Step 4: Mapping of Binary 1:N Relationship Types

- For each regular binary ***1:N*** relationship type R
- Identify the ***relation S*** that represent the participating entity type at the ***N-side*** of the relationship type
- Include as ***foreign key in S*** the ***primary key of the relation T*** that represents the other entity type participating in R
- Include any ***simple attributes*** of the 1:N relation type as attributes of S



After step 4

- WORKS_FOR, CONTROLS and SUPERVISION

EMPLOYEE

Fname	Minit	Lname	Ssn	Bdate	Address	Sex	Salary

DEPARTMENT

Dname	Dnumber	Mgr_ssn	Mgr_start_date

PROJECT

Pname	Pnumber	Plocation

DEPENDENT

Essn	Dependent_name	Sex	Bdate	Relationship

EMPLOYEE

Fname	Minit	Lname	Ssn	Bdate	Address	Sex	Salary	Dno

PROJECT

Pname	Pnumber	Plocation	Dnum

EMPLOYEE

Fname	Minit	Lname	Ssn	Bdate	Address	Sex	Salary	Super_ssn	Dno

After Step 4

EMPLOYEE

Fname	Minit	Lname	Ssn	Bdate	Address	Sex	Salary	Super_ssn	Dno

DEPARTMENT

Dname	Dnumber	Mgr_ssn	Mgr_start_date

PROJECT

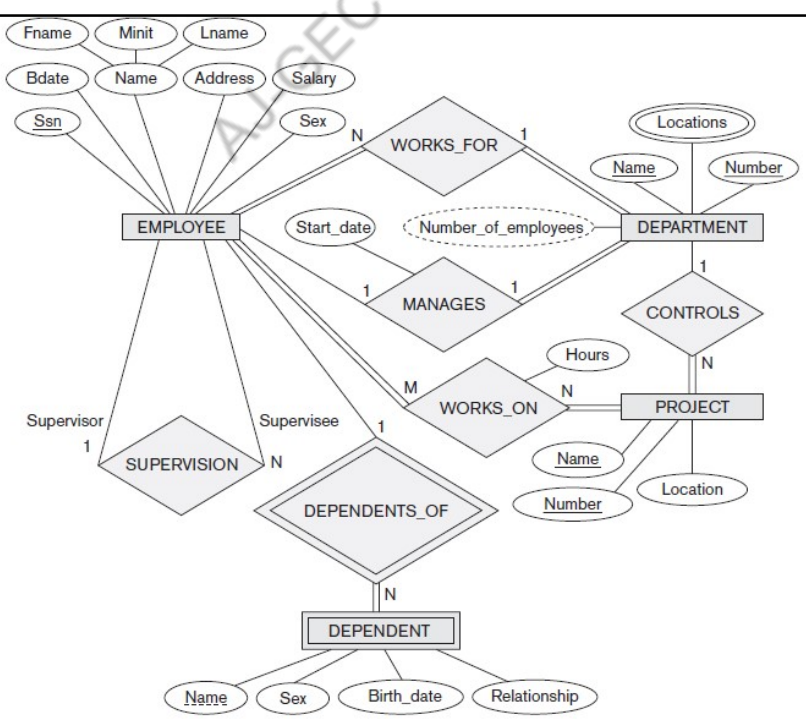
Pname	Pnumber	Plocation	Dnum

DEPENDENT

Essn	Dependent_name	Sex	Bdate	Relationship

Step 5: Mapping of Binary M:N Relationship Types

- For each regular binary M:N relationship type R
- Create a ***new relation S*** to represent R
- Include as ***foreign key attributes in S*** the primary keys of the relations that represent the participating entity types
- Their combination will form the ***primary key of S***
- Also include any simple attributes of the M:N relationship type (or simple components of composite attributes) as attributes of S



After Step 5

WORKS_ON

Essn	Pno	Hours

EMPLOYEE

Fname	Minit	Lname	Ssn	Bdate	Address	Sex	Salary	Super_ssn	Dno

DEPARTMENT

Dname	Dnumber	Mgr_ssn	Mgr_start_date

PROJECT

Pname	Pnumber	Plocation	Dnum

DEPENDENT

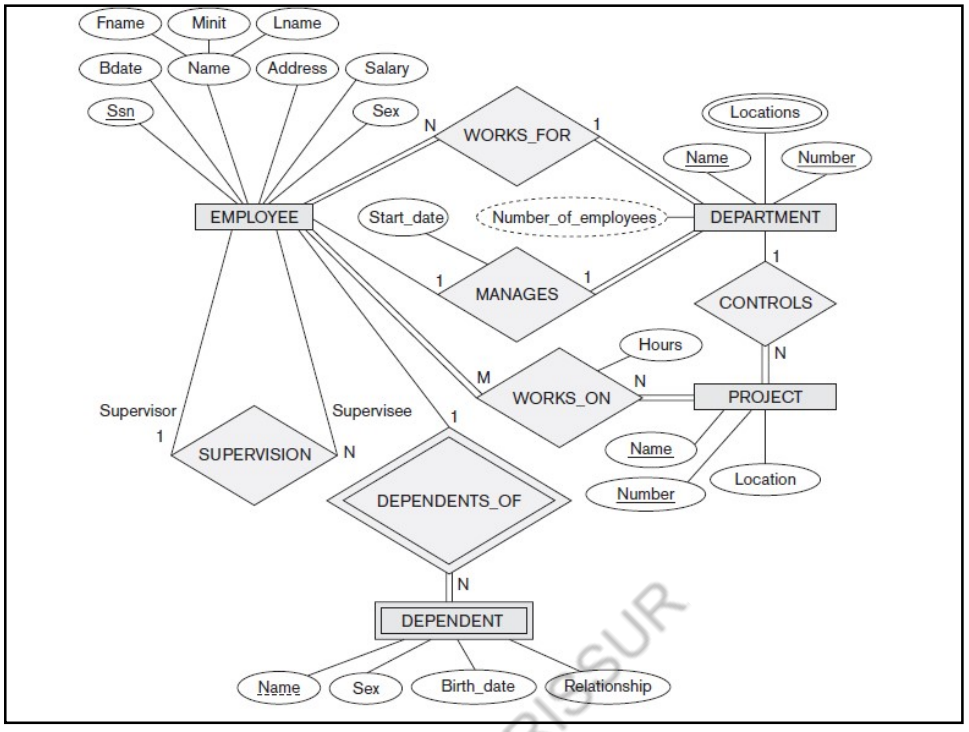
Essn	Dependent_name	Sex	Bdate	Relationship

WORKS_ON

Essn	Pno	Hours

Step 6: Mapping of Multivalued attributes

- For each multivalued attribute A
- Create a ***new relation R***
- Include ***an attribute*** corresponding to **A**
- Plus the primary key attribute K - as a ***foreign key in R*** -of the relation that represents the entity type of relationship type that has A as an attribute
- The ***primary key of R*** is the combination of A and K
- If the multivalued attribute is ***composite***, we include its simple components



After Step 6

DEPT_LOCATIONS

Dnumber	Dlocation

EMPLOYEE

Fname	Minit	Lname	Ssn	Bdate	Address	Sex	Salary	Super_ssn	Dno

DEPARTMENT

Dname	Dnumber	Mgr_ssn	Mgr_start_date

DEPT_LOCATIONS

Dnumber	Dlocation

PROJECT

Pname	Pnumber	Plocation	Dnum

WORKS_ON

Essn	Pno	Hours

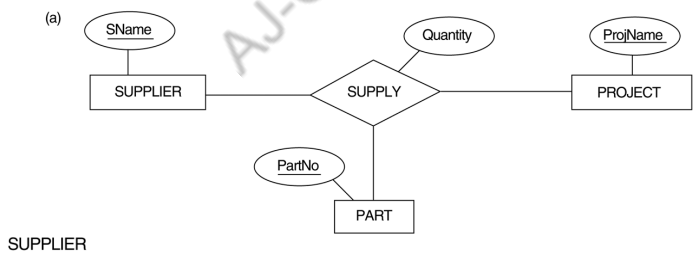
DEPENDENT

Essn	Dependent_name	Sex	Bdate	Relationship

Step 7: Mapping of N-ary Relationship Types

- For each n-ary relationship type R, where n>2
- Create ***a new relationship S*** to represent R
- Include as ***foreign key attributes in S*** the primary keys of the relations that represent the participating entity types
- Also include any ***simple attributes*** of the n-ary relationship type (or simple components of composite attributes) as attributes of S

After Step 7



SUPPLIER

SNAME	. . .

PROJECT

PROJNAME	. . .

PART

PARTNO	. . .

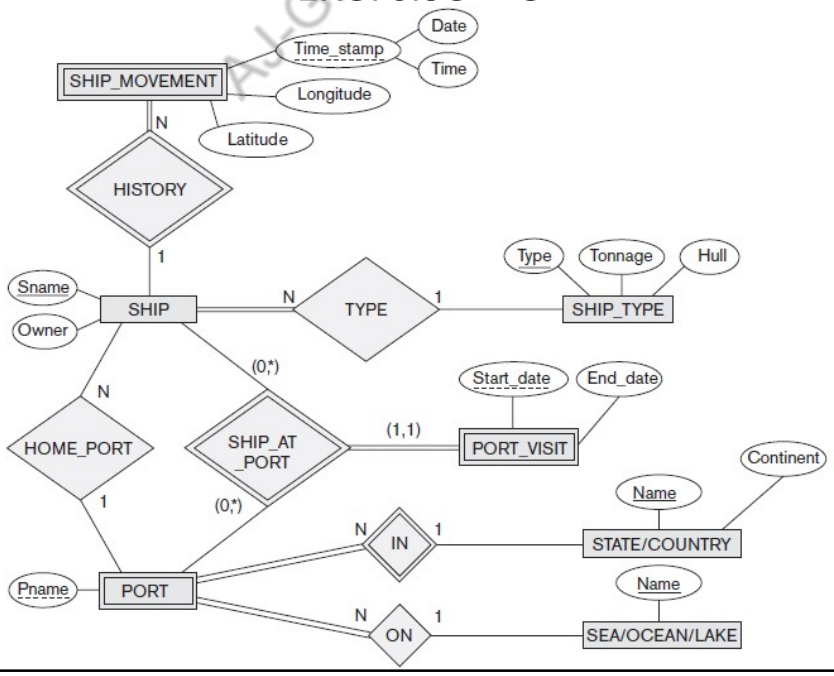
SUPPLY

SNAME	PROJNAME	PARTNO	QUANTITY

ER – Relational Model

ER MODEL	RELATIONAL MODEL
Entity type	*Entity* relation
1:1 or 1:N relationship type	Foreign key (or *relationship* relation)
M:N relationship type	*Relationship* relation and *two* foreign keys
n-ary relationship type	*Relationship* relation and *n* foreign keys
Simple attribute	Attribute
Composite attribute	Set of simple component attributes
Multivalued attribute	Relation and foreign key
Value set	Domain
Key attribute	Primary (or secondary) key

Exercise – 3



Reference

- Elmasri R. and S. Navathe, Database Systems: Models, Languages, Design and Application Programming, Pearson Education 6th edition and 7th edition

Thank you