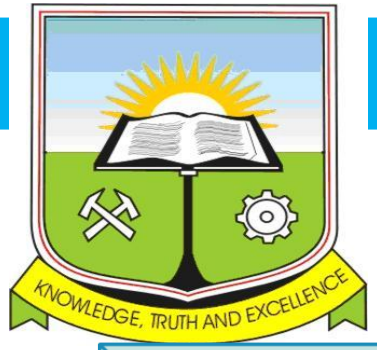


UNIVERSITY OF MINES AND TECHNOLOGY

Entity Relationship (ER) Model

BY: DR ERIC AFFUM

Read the following materials

CHAPTER 2

Gupta, S. B. and Mittal, A. (2017), Introduction to Database Management System, Laxmi Publications Pvt Ltd, New Delhi, India, 2nd Edition, 288 pp.

CHAPTER 3

Elmasri, R. (2017), Fundamentals of Database Systems, Pearson, London, U.K., 7th Edition, 1280 pp.

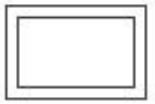
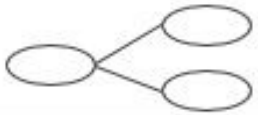
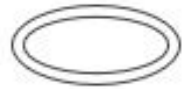
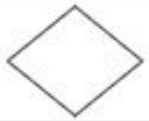
ER MODEL

- Entity Relationship model, a high – level data model that is useful in developing a conceptual design for a database.
- An entity is a real-world item or concept that exists on its own.
  - An entity may be an object with physical existence (ex. House, person)
  - Or with conceptual existence (ex. Course, job)

An entity set The set of all possible values for an entity.

- Weak entity set
- Strong entity set
- An entity type collection of entity that have the same attribute

ER DIAGRAM SYMBOLS

Entity Set	Strong Entity Set	
	Weak Entity Set	
Attributes	Simple Attribute	
	Composite Attribute	
	Single-valued Attribute	
	Multivalued Attribute	
	Derived Attribute	
	Null Attribute	
Relationship	Strong Relationship	
	Weak Relationship	

ER MODEL: ATTRIBUTES

An attribute is a property that describe an entity

A simple attribute is one component that is atomic. e.g. weight

A composite attribute has multiple components. e.g. Name (first name and last name)

Single-valued attribute is an entity attribute that holds exactly one value is a E.g. age

A multi-valued attribute has more than one value for a particular entity. E.g. College degree

ER MODEL

- A derived attribute is an attribute that can be derived from other attributes. E.g. Age can be derived from date of birth.
- A Stored attribute is an attribute from which other values of attributes can be derived from. E.g. Date of birth.

- Complex attribute has multivalued & composite component in it.
  - Multivalued attributes represent in {}
  - Composite attributes represent in ()
  - E.g. {College degree(college, year, degree, field)}

ER MODEL

An attribute or set of attributes that uniquely identifies a particular entity is a key.

A composite key is a key that is a composite of several attributes.

ER MODEL: RELATIONSHIP

A relationship type is a set of associations among entity types.

E.g. Teacher teaches student

teaches is the relationship between teacher and student

A relationship or relationship instance is an ordered pair consisting of particular related entities.

Degree of relationship is the number of entity type that participate in a relationship

ER MODEL: RELATIONSHIP

Unary relationship exist when there is only one entity

Binary relationship exist when there two entity types participate in the relationship.

Ternary relationship exist when there is association among three entities

A role name indicates the purpose of an entity in a relationship.

ER MODEL: Cardinality ratio

Cardinality ratio:

Number of relationship instances that an entity can participate in

A **1:1** or one-to-one relationship from entity type *S* to entity type *T* is one in which an entity from S is related to at most one entity from T and vice versa.

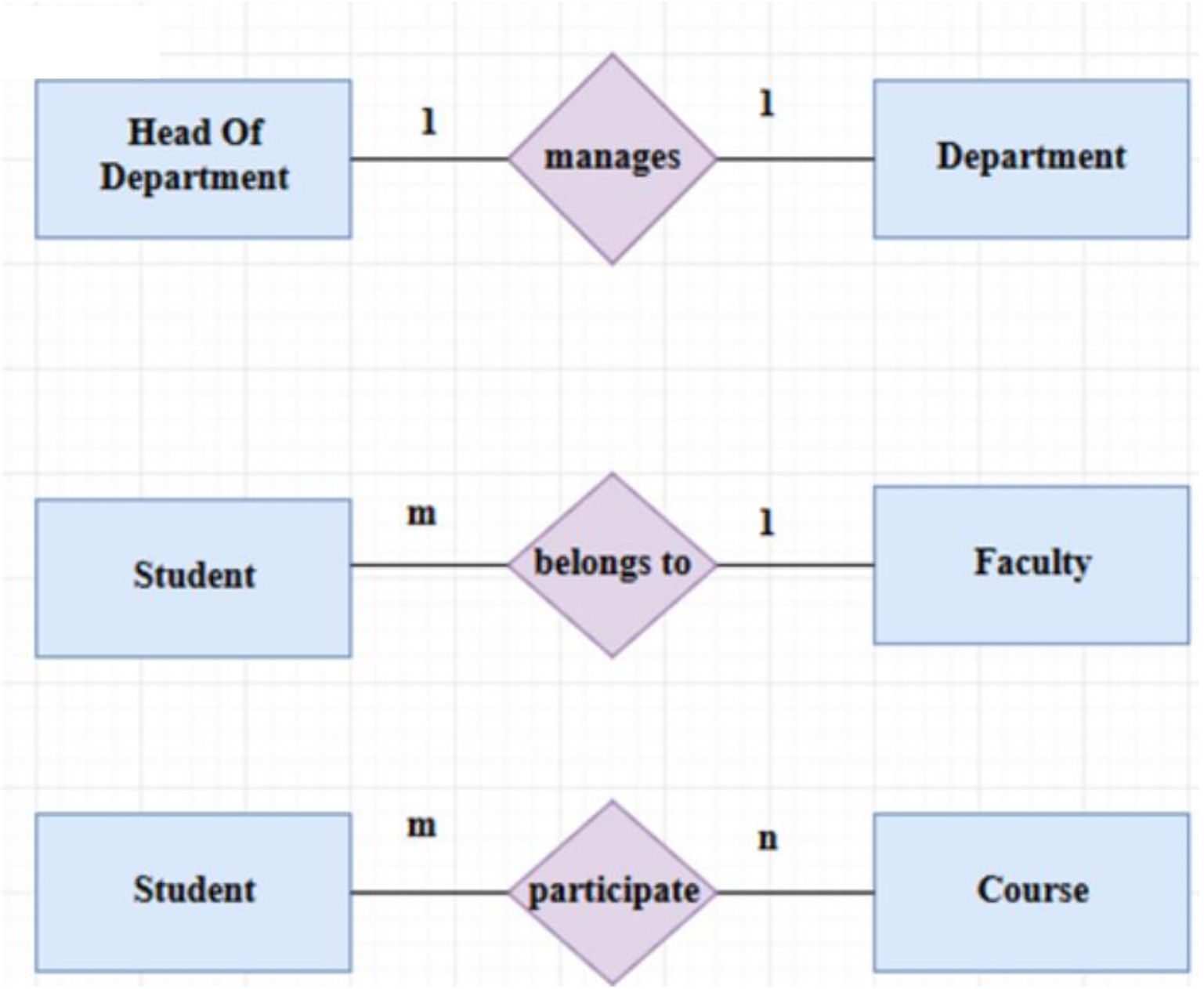
An ***N*:1** or many-to-one relationship from entity type *S* to entity type *T* is one in which an entity from *T* can be related to two or more entities from *S*.

A **1:*N*** or one-to-many relationship from entity type *S* to entity type *T* is one in which an entity from *S* can be related to two or more entities from *T*.

ER MODEL

An ***N:M*** or many-to-one relationship from entity type *S* to entity type *T* is one in which an entity from *S* can be related to two or more entities from *T*, and an entity from *T* can be related to two or more entities from *S*. A ratio, such as 1:1, 1:*N*, *N*:1, and *N:M*, gives a cardinality constraint or numeric restriction on the possible relationships.

Cardinality Ratio



PRACTICALS

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ER DIAGRAM

SCENARIO ONE

A Country Bus Company owns a number of busses. Each bus is allocated to a particular route, although some routes may have several busses. Each route passes through a number of towns. One or more drivers are allocated to each stage of a route, which corresponds to a journey through some or all of the towns on a route. Some of the towns have a garage where busses are kept and each of the busses are identified by the registration number and can carry different numbers of passengers, since the vehicles vary in size and can be single or double-decked. Each route is identified by a route number and information is available on the average number of passengers carried per day for each route. Drivers have an employee number, name, address, and sometimes a telephone number

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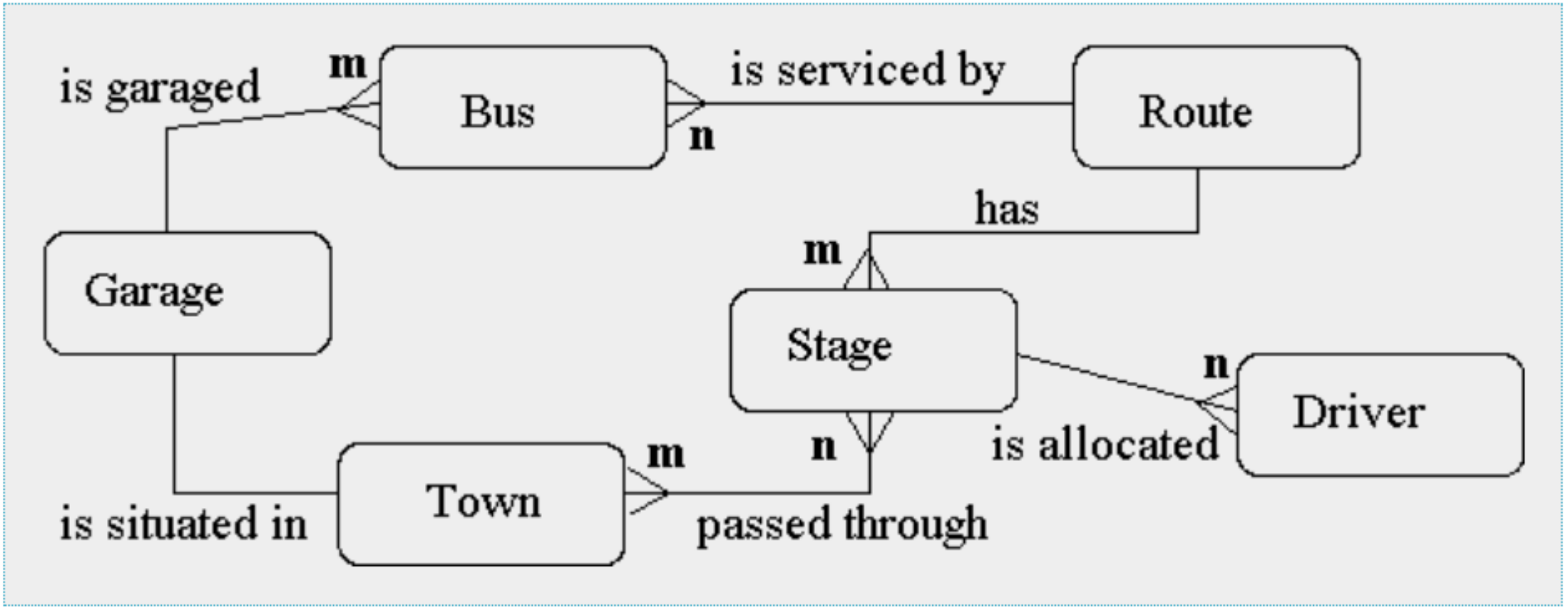
Entities

- Bus - Company owns busses and will hold information about them.
- Route - Buses travel on routes and will need described.
- Town - Buses pass through towns and need to know about them
- Driver - Company employs drivers, personnel will hold their data.
- Stage - Routes are made up of stages
- Garage - Garage houses buses, and need to know where they are.

Relationships

- A bus is allocated to a route and a route may have several buses.
- Bus-route (m:1) is serviced by
- A route comprises of one or more stages.
- route-stage (1:m) comprises
- One or more drivers are allocated to each stage.
- driver-stage (m:1) is allocated
- A stage passes through some or all of the towns on a route.
- stage-town (m:n) passes-through
- A route passes through some or all of the towns
- route-town (m:n) passes-through
- Some of the towns have a garage
- garage-town (1:1) is situated
- A garage keeps buses and each bus has one `home' garage
- garage-bus (m:1) is garaged

ER DIAGRAM


is garaged
m
Bus
is serviced by
n
Route
has
m
Garage
Stage
n
Driver
is allocated
m
n
Town
is situated in
passed through

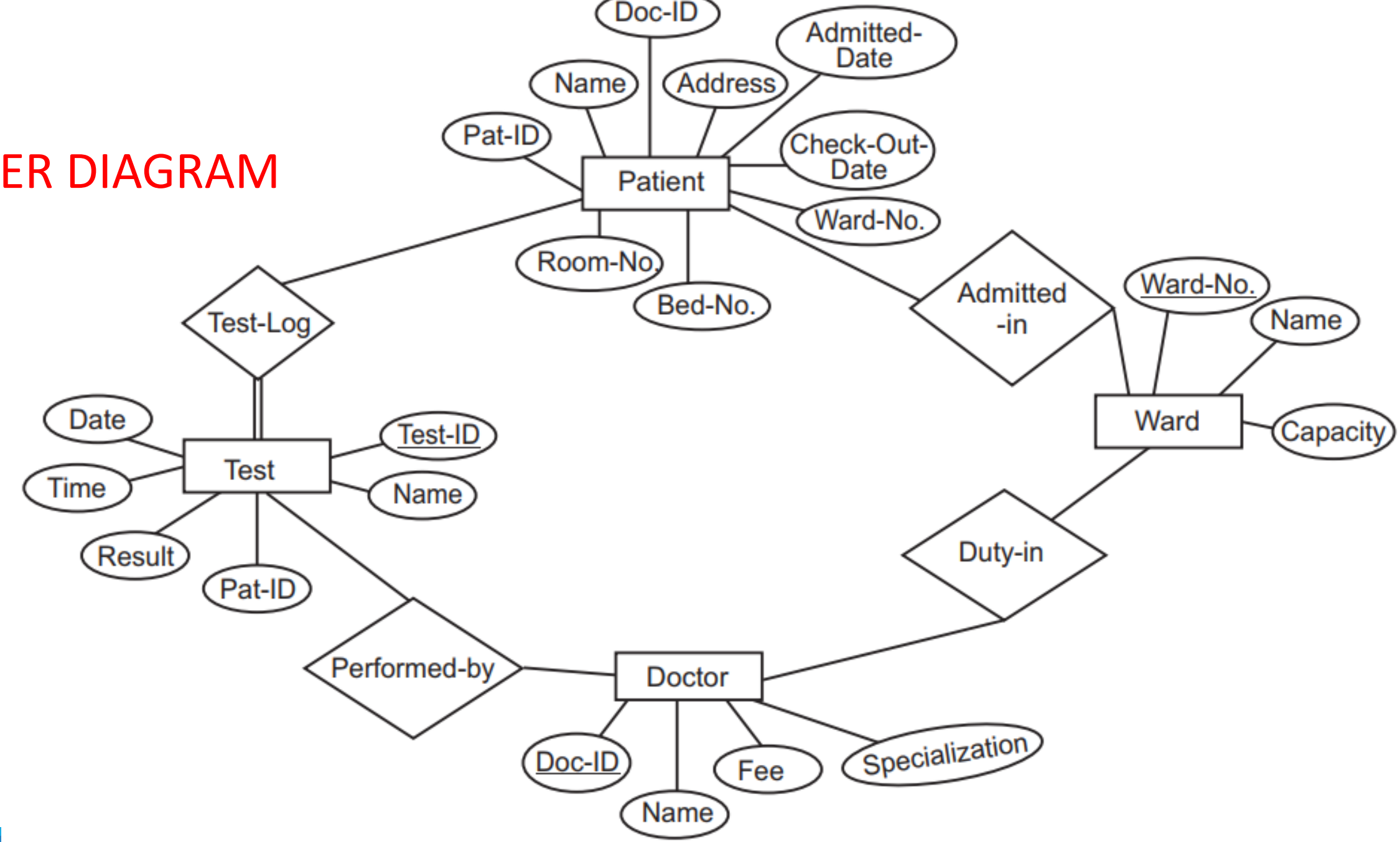
Attributes

- Bus (reg-no,make,size,deck,no-pass)
- Route (route-no,avg-pass)
- Driver (emp-no,name,address,tel-no)
- Town (name)
- Stage (stage-no)
- Garage (name,address)

SCENARIO TWO

Construct an ER diagram for a hospital with a set of patients and a set of medical doctors. Associate with each patient, a log of various test and examinations conducted.

ER DIAGRAM


Doc-ID
Admitted-Date
Name
Address
Pat-ID
Check-Out-Date
Patient
Ward-No.
Room-No.
Bed-No.
Test-Log
Admitted-in
Ward-No.
Name
Ward
Capacity
Date
Test-ID
Test
Time
Name
Result
Pat-ID
Duty-in
Performed-by
Doctor
Doc-ID
Fee
Specialization
Name

EXERCISES

?

ER DIAGRAM

SCENARIO THREE

Use an entity relationship diagram to depict the following requirements for a restaurant:

The restaurant employs a number of chefs. A record is kept of each chef's name, address, phone number and salary.

Each chef can prepare a number of meals. The name of the meals and the price of the meal are recorded.

SCENARIO THREE

Each meal consists of a number of ingredients. The name of the ingredient and quantity required for a particular meal is recorded.

These meals are ordered by customers. A record is kept of the customer's name, address, and phone number.

A record is kept of the time and date the meal is ordered.

SCENARIO FOUR

A college offers students a variety of courses, but a student can only take one course at a given time. For a course to run it must have more than five students enrolled on it.

Each course contains a variety of subjects and a given subject can appear on a number of courses. A popular subject may be taught by many lecturers but each lecturer specializes in only one subject.

SCENARIO FIVE

A company database needs to store information about employees (identified by ssn, with salary and phone as attributes), departments (identified by dno, with dname and budget as attributes), and children of employees (with name and age as attributes).

Employees *work in departments; each department is managed by an* employee; a child must be identified uniquely by *name when the parent (who is an* employee; assume that only one parent works for the company) is known.

Draw an ER diagram that captures this information.

SCENARIO SIX

Galleries keep information about artists, their names (which are unique), birthplaces, age,and style of art. For each piece of artwork, the artist, the year it was made, its unique title, its type of art (e.g., painting, lithograph, sculpture, photograph), and its price must be stored. Pieces of artwork are also classified into groups of various kinds, for example, portraits, still lifes; a given piece may belong to more than one group.

SCENARIO SIX CONT'D

Each group is identified by a name (like those just given) that describes the group. Finally, galleries keep information about customers. For each customer, galleries keep that person's unique name, address, total amount of dollars spent in the gallery (very important!), and the artists and groups of art that the customer tends to like.

Draw the ER diagram for the database.

Thanks