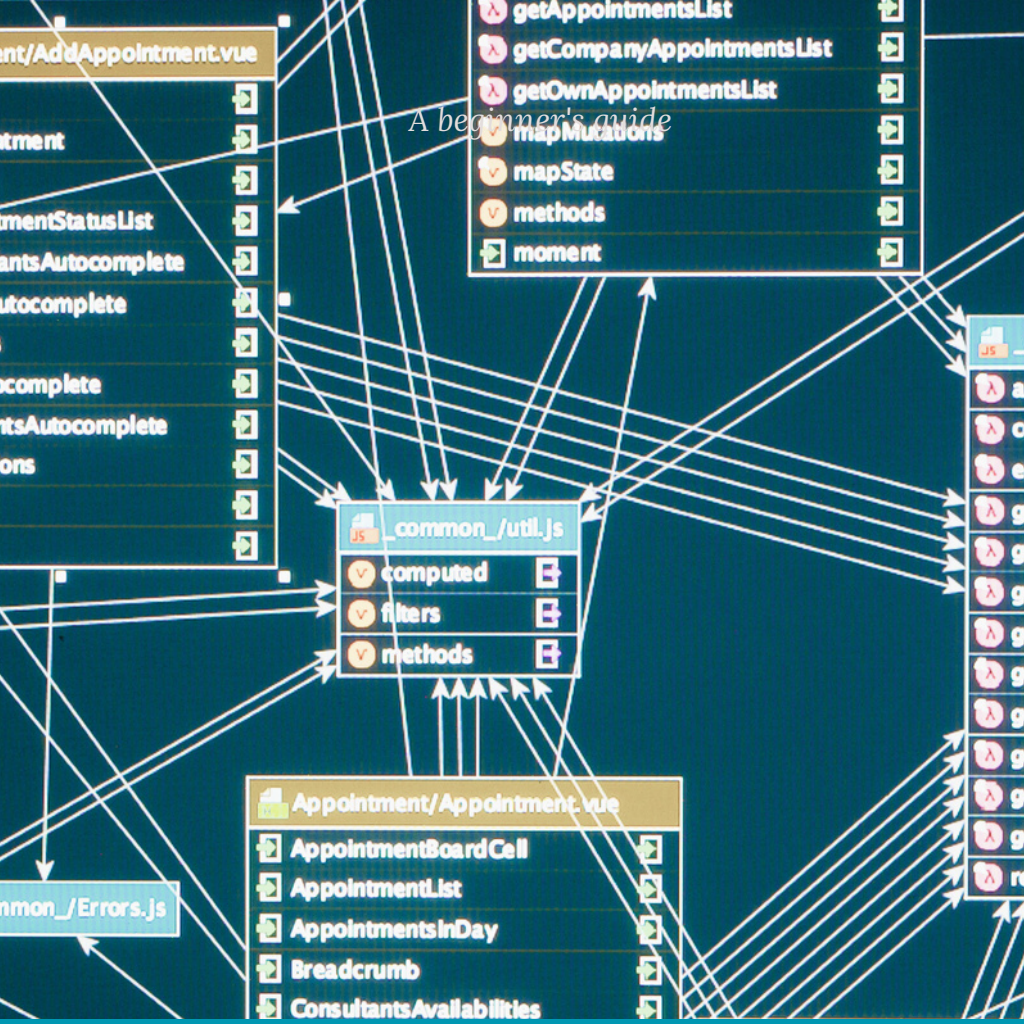

A beginner's guide

The Art of Visualizing Data

ENTITY RELATIONSHIP DIAGRAM

A beginner's guide

The Art of Visualizing Data

ENTITY RELATIONSHIP DIAGRAM

DEPARTMENT OF INFORMATION TECHNOLOGY AND COMMUNICATION
POLITEKNIK UNGKU OMAR

DEPARTMENT OF POLYTECHNIC EDUCATION AND COMMUNITY COLLEGES
MINISTRY OF HIGHER EDUCATION

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Thankful to Allah since by His mercy, we were able to finish the eBook titled A Beginner's Guide The Art of Visualizing Data Entity Relationship Diagram. We learned a lot of useful writing skills while putting this eBook together.

On this occasion, we want to express our sincere gratitude to all those who contributed to the creation, production, and publication of our eBook. All the guidance and knowledge that was shared helped us a lot in the effort to produce this eBook.

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Sincere appreciation also addressed to all parties who have been involved in making this eBook a success either directly or indirectly. We greatly appreciate all the help you have given because, without your help and support, this eBook could not be produced and published.

Preface

This eBook is designed to provide a basic guide for Information Technology (IT) students, especially in designing a logical data model by using an Entity Relationship Diagram (ERD).

In this eBook, we will introduce to readers the basic elements in designing ERD, the notation along with examples of Case Study and exercise questions.

Hopefully, this eBook will be beneficial to readers who would like to learn on basics of designing ERD in database development.

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Authors

NURIZAH BINTI MAHMOR
PPPT
JTMK, PUO
nurizah@puo.edu.my

MUNIRAH BINTI ABDULLAH
PPPT
JTMK, PUO
munirah@puo.edu.my

Contents

"You can have data without information, but you cannot have information without data."

Daniel Keys Moran

Chapter 1
Introduction to ERD

Chapter One
INTRODUCTION TO ERD

1.1 Conceptual, Logical and Physical Data Model

1 Conceptual Data Models

The highest-level view containing the least detail. Its value is showing overall scope of the model and portraying the system architecture.

2 Logical Data Models

Contains more detail than a conceptual model. More detailed operational and transactional entities are now defined. The logical model is independent of the technology in which it will be implemented.

3 Physical Data Models

One or more physical model may be developed from each logical model. The physical models must show enough technology detail to produce and implement the actual database.

1.2 What is an Entity Relationship Diagram?

Entity Relationship Diagram is referred to as an ERD. ER diagrams and entity relationship models are other names for these kinds of diagrams. An ERD depicts the connections among database entities, such as people, things, or concepts. The characteristics of these entities are frequently visualized via an ERD.

An ER diagram can be used to demonstrate the logical structure of databases by defining the entities, their properties, and the connections between them. **ERD is a logical data model**

1.3 Benefits of using ERD

They support database data visualization. This can make it simpler to comprehend how the data is related and to see any potential design issues.

They can support the dissemination of a database's design to others. When working with a group of developers or outlining a database's design, this can be useful.

No Data is clean, but most is useful
– Dean Abbot

1.3 History of ERD

1969

Charles Bachman develops the Data Structure Diagram (DSD), a precursor to the ERD

1976

Peter Chen publishes his paper "The Entity-Relationship Model: Toward a Unified View of Data," which introduces the ERD concept

1977

Chen publishes a revised version of his paper, which includes a more detailed description of the ERD model

1979

James Martin publishes his book Computer Data-Base Organization, which popularized the ERD model

1980s

ERDs become widely used in database design

1990s

ERD-based database design tools are developed

2000s and beyond

ERDs continue to be used in database design, although there is now a greater emphasis on agile development methodologies and NoSQL databases.

Chapter 2

Entities & Attributtes

Chapter Two
ENTITIES & ATTRIBUTES

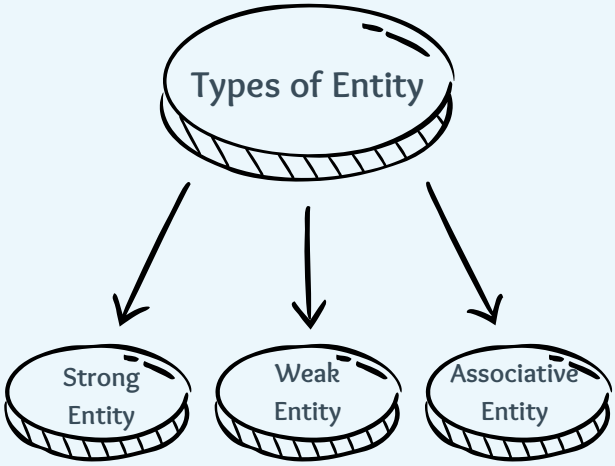
2.1 Components in Entity Relationship Diagram

Entities, which are objects or concepts that can have data stored about them. Entities refer to tables used in databases.

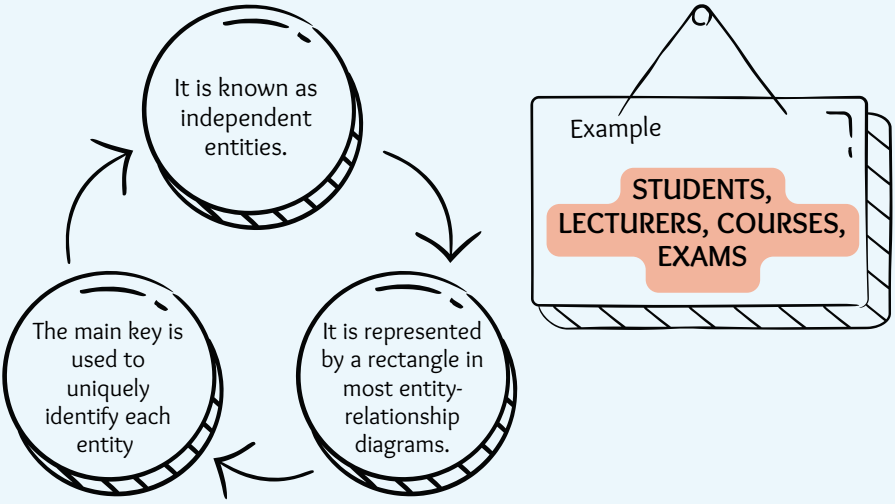
Attributes, which are properties or characteristics of entities.

The **relationships** between and among those entities.

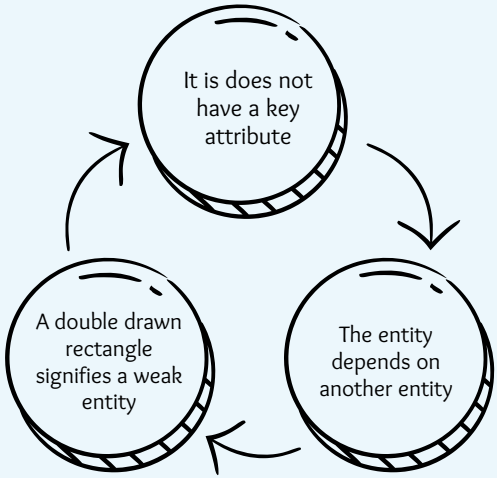
2.2 Types of Entity

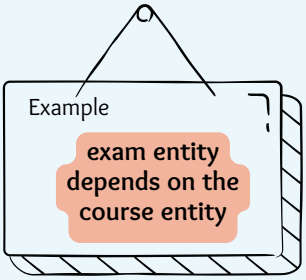


2.2.1 Strong Entity

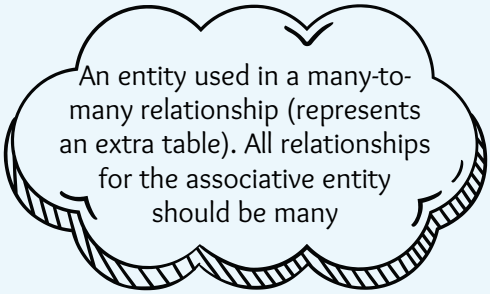


2.2.2 Weak Entity





2.2.3 Associative Entity



2.3 Attributes

Attributes are properties that describe an entity

2.3.1 Types of Attributes

1 Simple attribute

Those that cannot be further divided into sub-attributes.

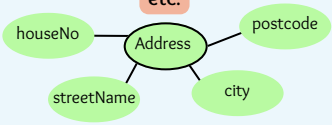
Ex : **studentID**

studentID

2 Composite attribute

It is a combination of more than one simple attributes

Ex : The **address** can consist of **house number**, **street name**, **city**, **etc.**



3 Single-valued attribute

It can only have a single value

Ex : **studentID**

studentID

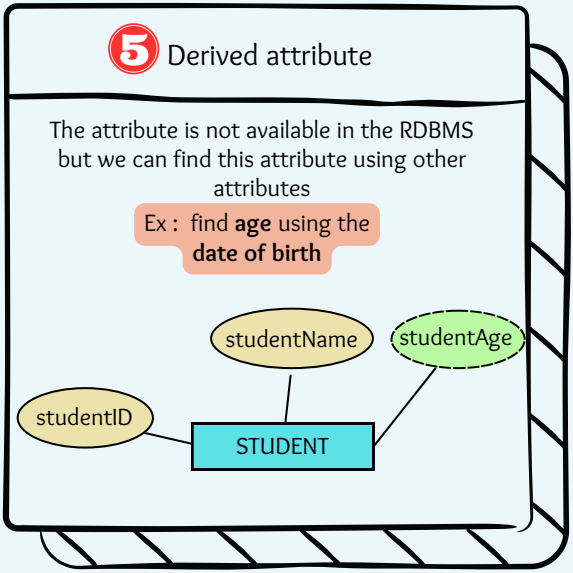
4 Multivalued attribute

There can be multiple values for this attribute

Ex : a person may have **multiple email addresses** or **phone numbers**

email

2.3.1 Types of Attributes



Chapter 3

Relationship & Cardinality

Chapter Three
RELATIONSHIP & CARDINALITY

3.1 What is Cardinality?

Cardinality of a relationship can be defined as the number of times an entity of an entity set participates in a relationship set.

Cardinality shows how the entities are connected to each other

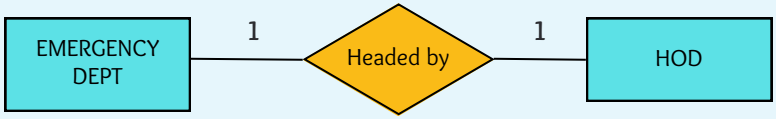
3.2 Types of Cardinality

3.2 Types of Cardinality (cont.)

One to One (1:1)

One entity is related to only one another entity

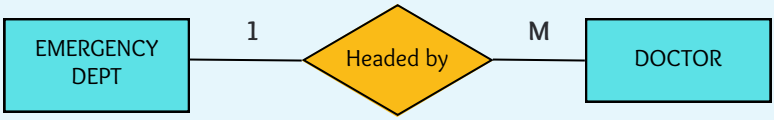
Example : In a particular hospital, the emergency department has one head of department. They both serve one-to-one relationships.



One to Many (1:M)

One entity has an event that occurs one time, while the other entity can have more than one repetition of the event.

Example : In a particular hospital, the emergency department has multiple doctors. They serve one-to-many relationships.



Many to Many (M:N)

When both entities have the same event or relationship happen more than once.

Example : In a particular company, multiple people work on multiple projects. They serve many-to-many relationships.

3.3 Relationship

In the Chen notation, a relationship is represented by a diamond (rhombus) containing the relationship's name.

Strong Relationship

A strong relationship shows a direct link between two entities

Weak Relationship

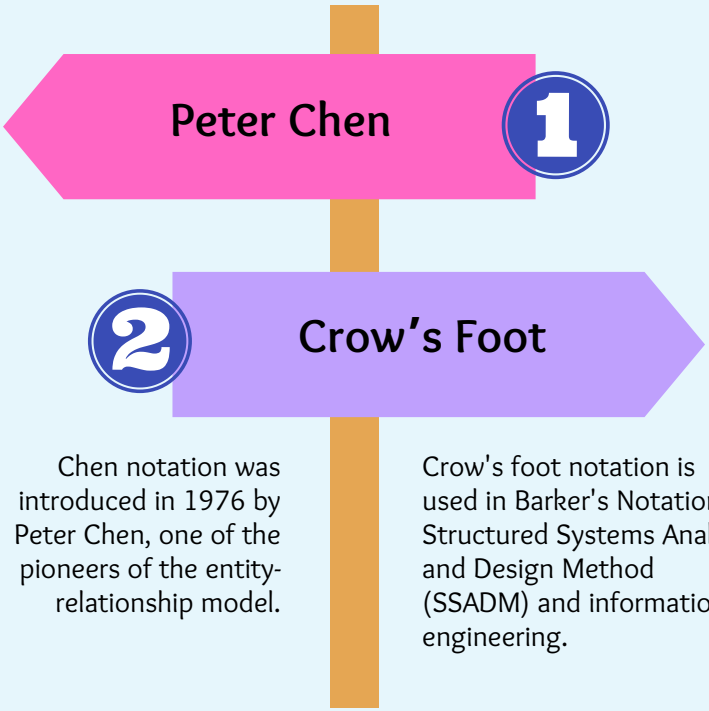
A weak relationship is between a weak entity and the parent entity

Chapter 4

Entity Relationship Diagram Notation

Chapter Four
ENTITY RELATIONSHIP DIAGRAM NOTATION

4.1 Types ERD Notation

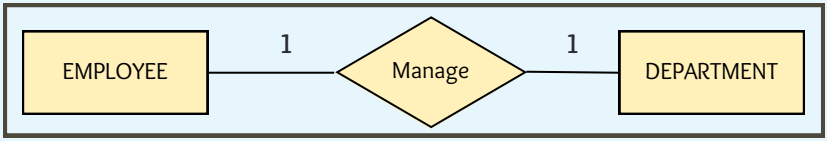


4.2 Peter Chen Notation

Entity	Entity	Attributes	Attributes
Weak Entity	Weak Entity	Key Attributes	Key Attributes (PK)
Relationship	Relationship	Foreign Key Attributes	Foreign Key Attributes (FK)
Weak Relationship	Weak Relationship	Derived Attributes	Derived Attributes
Associative Entity	Associative Entity	Multivalue Attributes	Multivalue Attributes
———	Mandatory Relationship	- - - - - - - - - - -	Optional Relationship

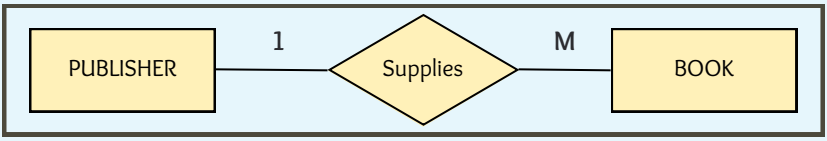
Cardinality

One to One (1:1)



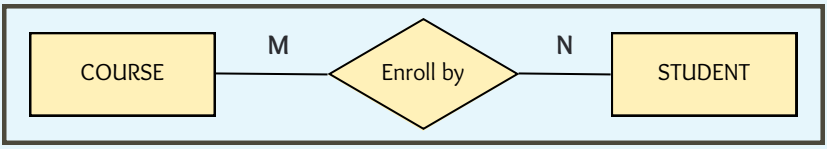
One EMPLOYEE will manage one DEPARTMENT

One to Many (1:M)



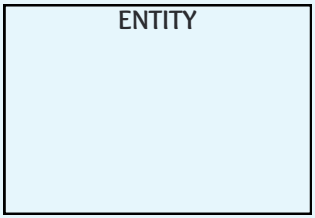
One PUBLISHER supplies Many BOOK

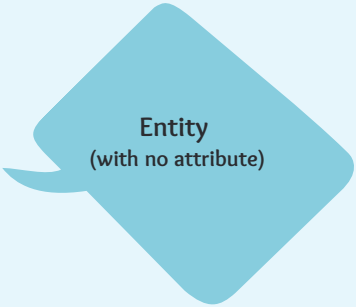
Many to Many (M:N)

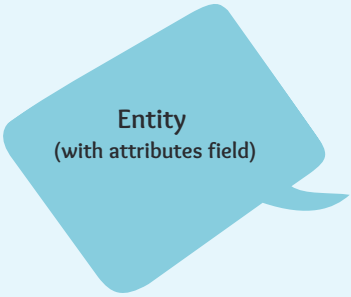


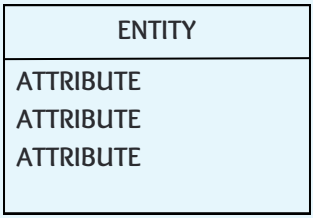
Many COURSE enroll by many STUDENT

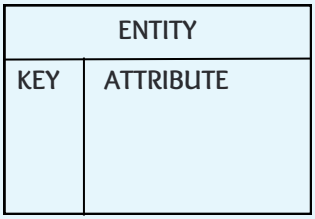
4.3 Crows Foot Notation

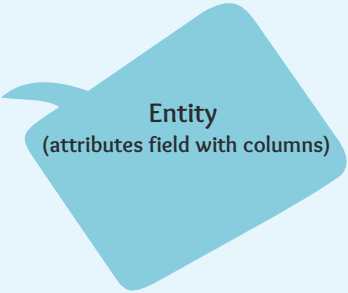


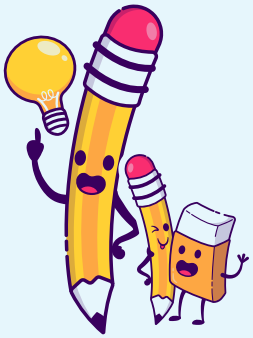








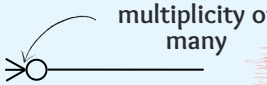




4.3 Crows Foot Notation

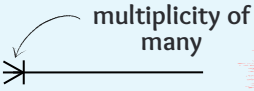
Relationship (Cardinality)

1



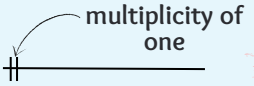
Zero or Many

2



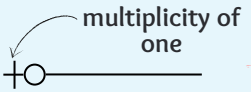
One or More

3



One and only one

4

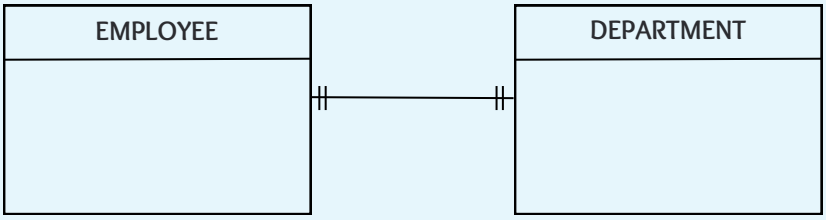


Zero or one

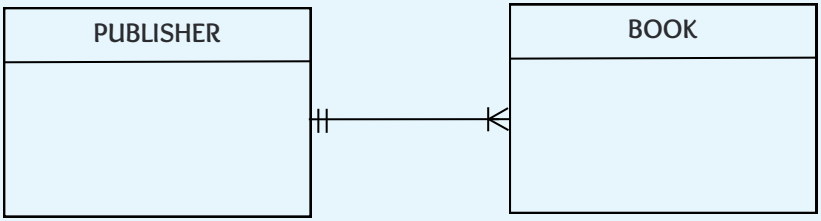
4.3 Crows Foot Notation

Example (Cardinality)

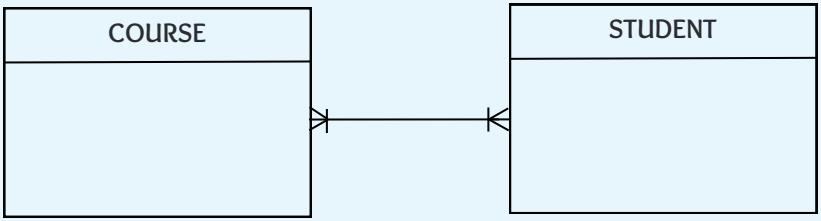
One to One (1:1)



One to Many (1:M)



Many to Many (M:N)



Chapter 5

Case Study & Exercise

Chapter Five
CASE STUDY & EXERCISE

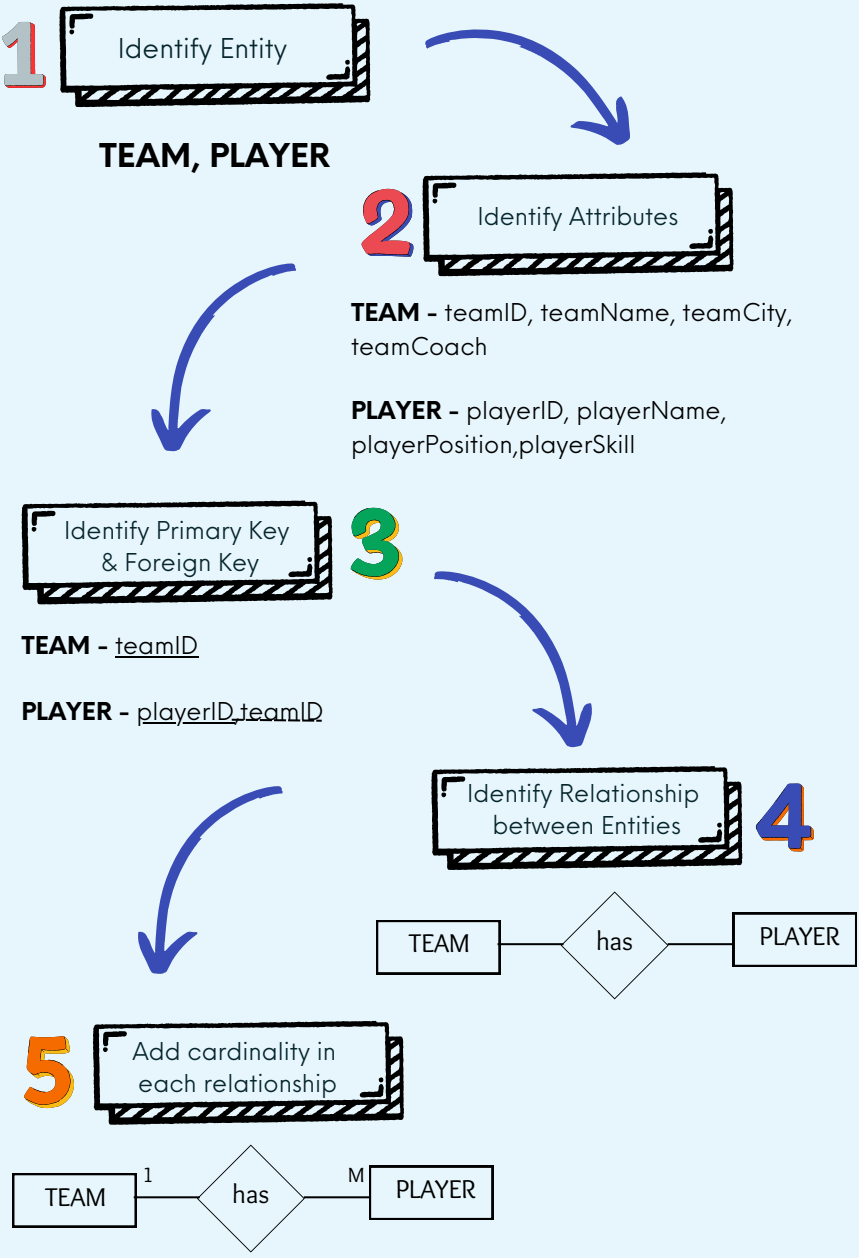
5.1 Case Study 1

Suppose you are given the following requirements for a simple database for the MSSM Hockey League (MHL):

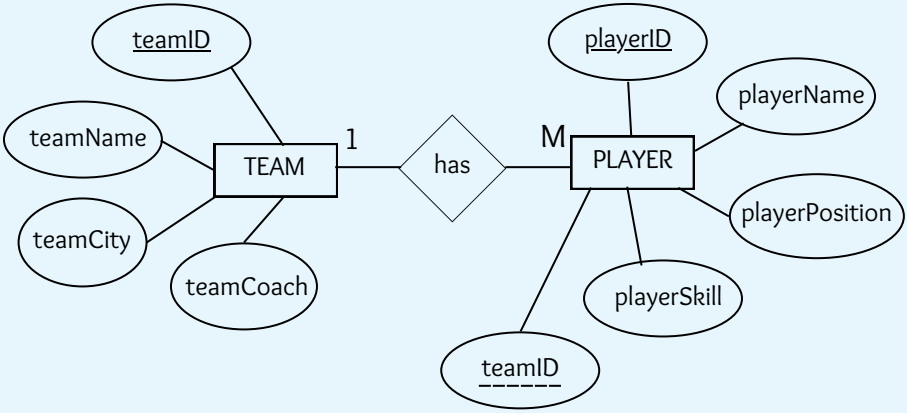
- the MHL has many teams,
- each team has a name, a city, a coach, and a set of players,
- each player belongs to only one team,
- each player has a name, a position (such as left wing or goalie), a skill level, and a set of injury records,

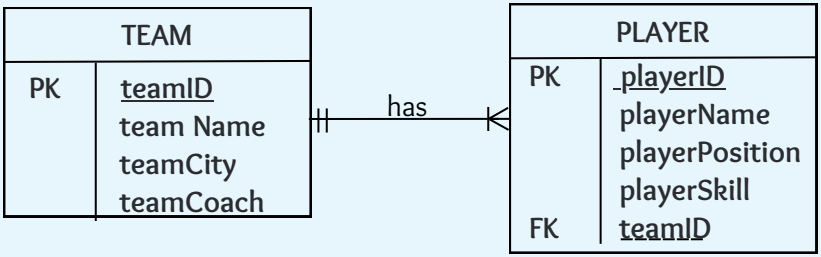
Construct a clean and concise ER diagram for the MHL database.

5.1.1 Step by Step to Draw ERD



5.1.1 Step by Step to Draw ERD (cont)





5.2 Case Study 2

A painter can paint many paintings; each paining is painted by one painter. A gallery can have many paintings. A painting can be exhibited by a gallery.

5.2.1 Step by Step to Draw ERD

1

Identify Entity

PAINTER, PAINTING, GALLERY

2

Identify Attributes

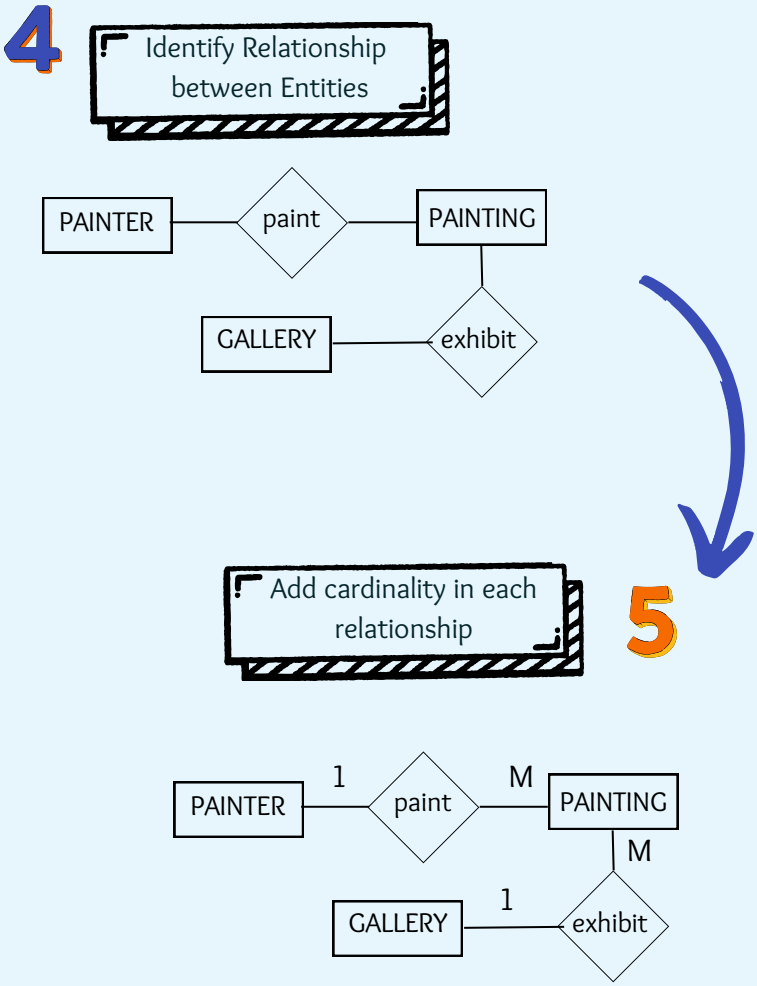
- no attributes specify based on the statement in Case Study
- may insert basic attributes for each entity such as their ID and name

3

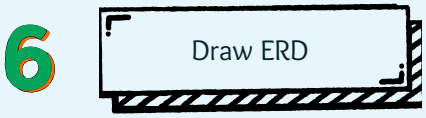
Identify Primary Key & Foreign Key

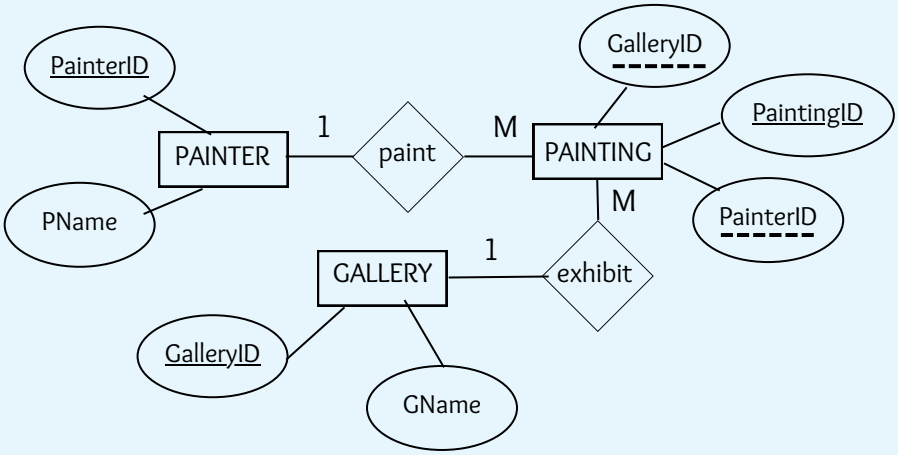
PAINTER - PainterID
GALLERY - GalleryID
PAINTING - PaintingID

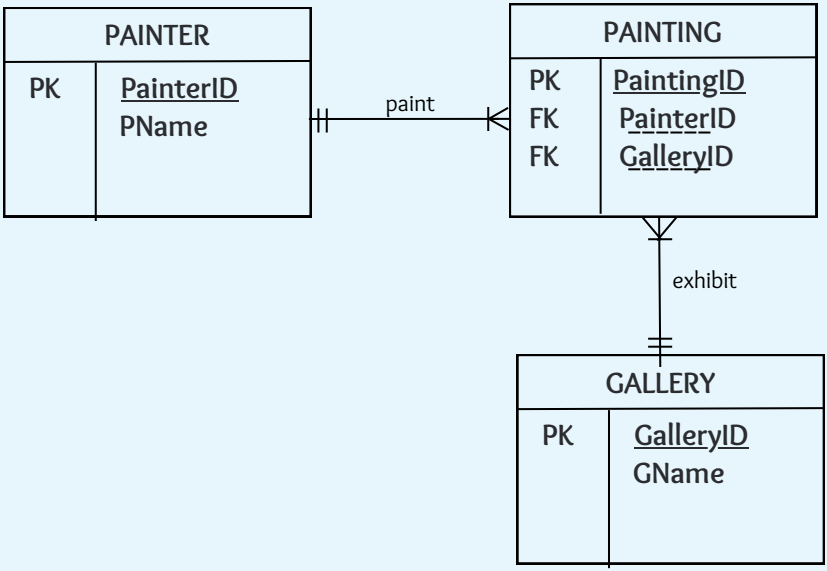
5.2.1 Step by Step to Draw ERD (cont)



5.2.1 Step by Step to Draw ERD (cont)







5.3 Case Study 3

Based on the relational data model given, draw ERD.

CUSTOMER

CustomerID	CustomerName	ICNo	Address	TelNo
001	Ali Abu	780202-01-0012	Gombak	03-45784515
002	Fatimah Karim	741212-12-4515	Shah Alam	03-45454512
003	Dew Ling Ling	780216-71-5858	Klang	03-45451875
004	Ahmad Mohamad	480615-07-8564	Cheras	03-85479657

RENTAL

RentalID	CustomerID	VideoID	RentDate	Quantity	TotalPayment
011	001	024	02/02/02	2	NULL
012	003	022	01/02/02	2	NULL
013	002	021	30/01/02	1	NULL
014	001	025	02/08/02	1	NULL

VIDEO

VideoID	Title	RentFee	YearReleased
021	Aladdin	4.00	1990
022	Phenomenon	6.00	1998
023	The Eye	7.00	2002
024	Star Wars	6.00	2000
025	Embun	7.00	2002

5.3.1 Step by Step to Draw ERD

1 Identify Entity

- CUSTOMER
- RENTAL
- VIDEO

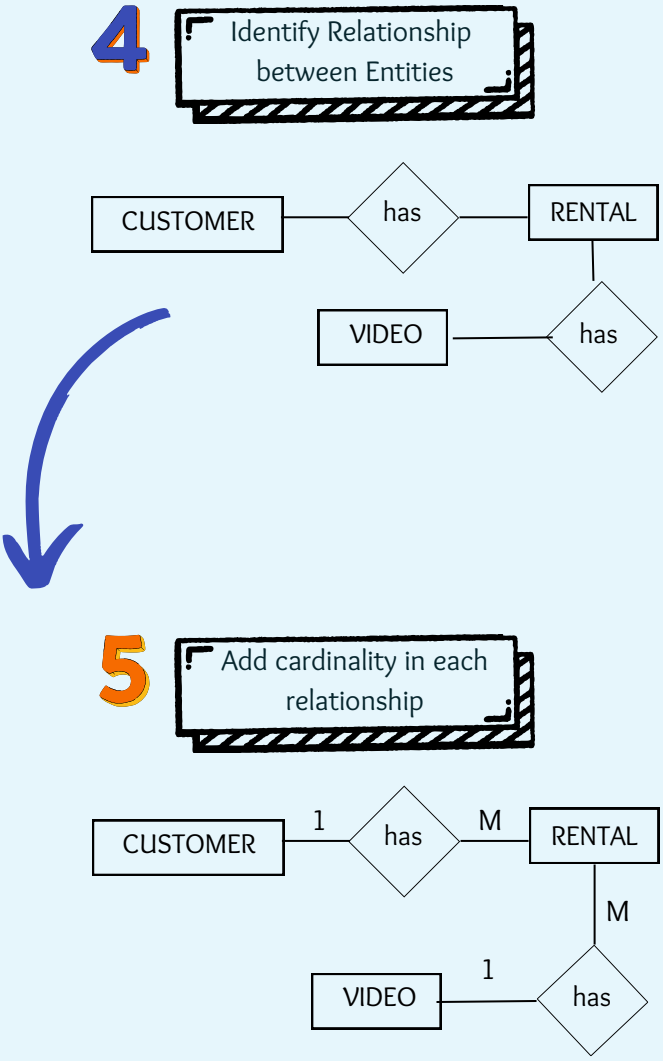
2 Identify Attributes

- **CUSTOMER** - CustomerID, CustomerName, ICNo, Address, TelNo
- **RENTAL** - RentalID, CustomerID, VideoID, RentDate, Quantity, TotalPayment
- **VIDEO** - VideoID, Title, RentFee, YearRelease

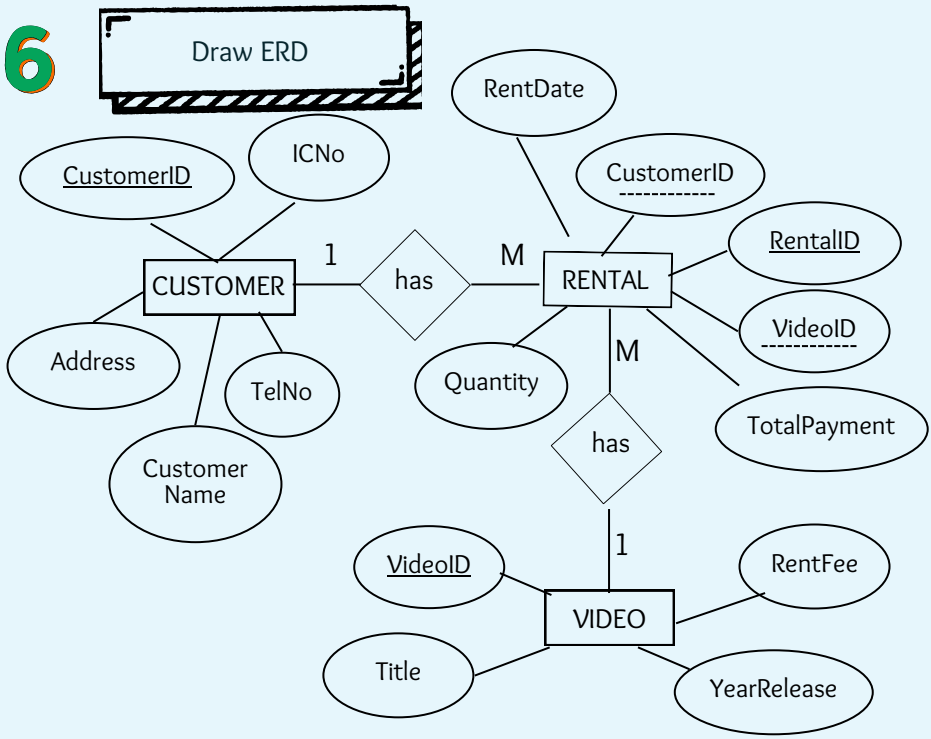
3 Identify Primary Key & Foreign Key

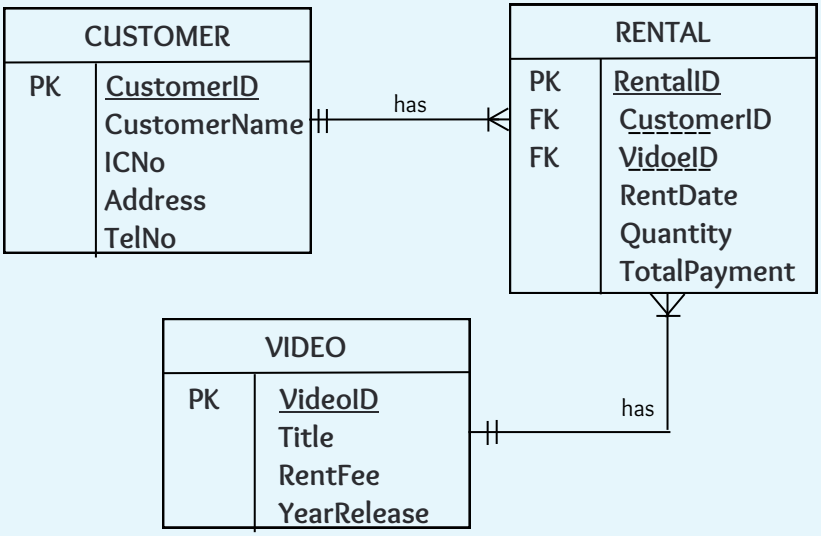
- **CUSTOMER** - CustomerID
- **RENTAL** - RentalID, CustomerID, VideoID
- **VIDEO** - VideoID

5.3.1 Step by Step to Draw ERD (cont)



5.3.1 Step by Step to Draw ERD (cont)





5.4 Case Study 4

Construct an E-R diagram for a hospital with a set of patients and a set of medical doctors.

5.4.1 Step by Step to Draw ERD

1

Identify Entity

PATIENT, DOCTOR

2

Identify Attributes

PATIENT- patientID, patientName

DOCTOR- doctorID,doctorName

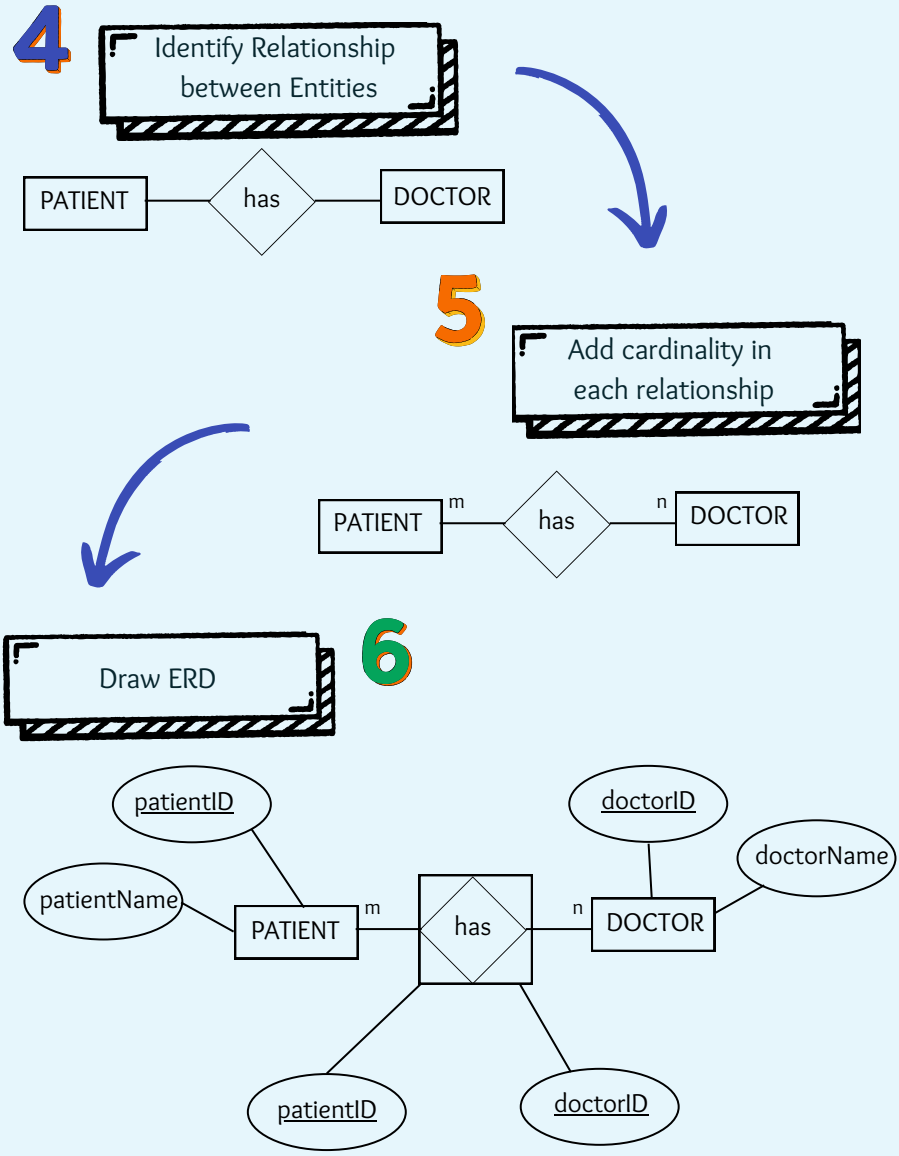
3

Identify Primary Key & Foreign Key

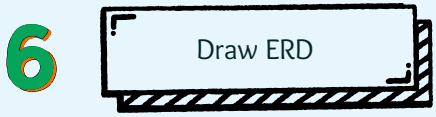
TEAM - patientID

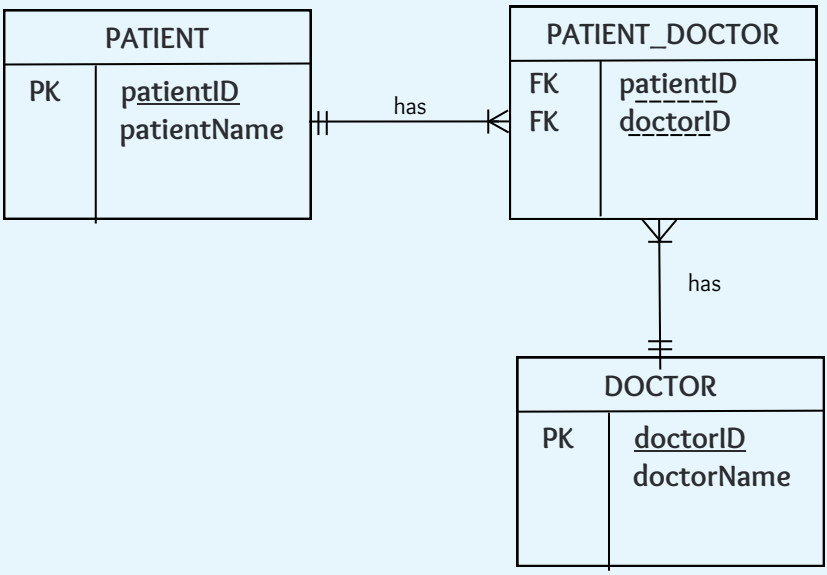
PLAYER - doctorID

5.4.1 Step by Step to Draw ERD (cont)



5.4.1 Step by Step to Draw ERD (cont)



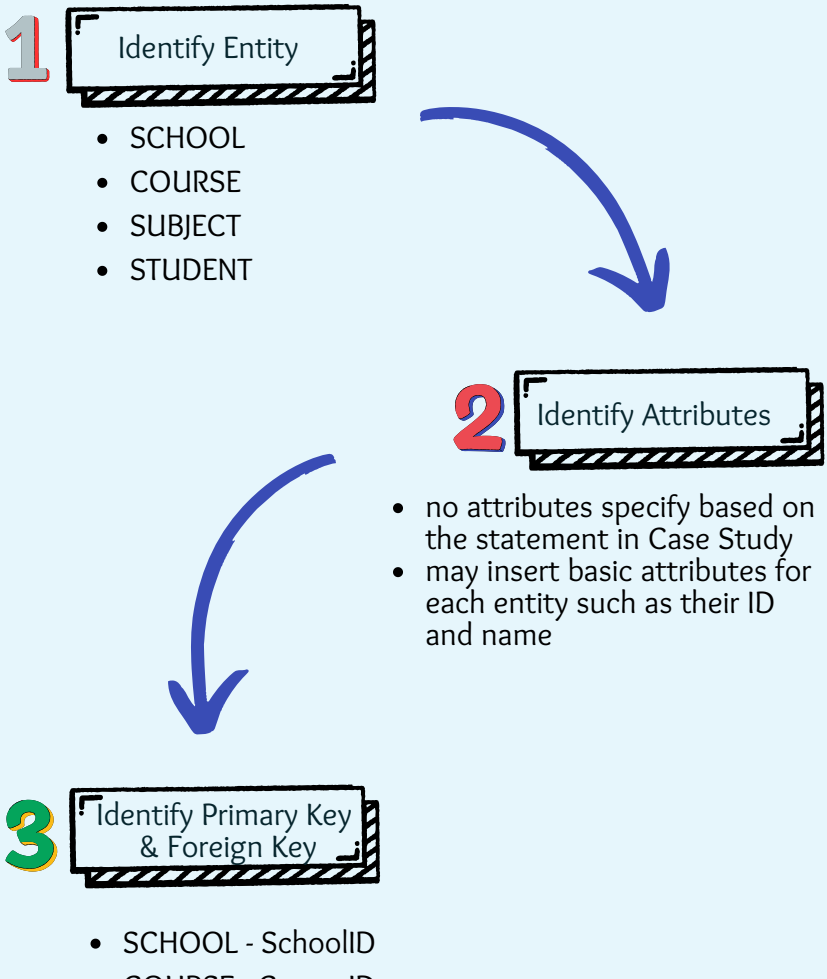


5.5 Case Study 5

The XYZ College at Jalan Raja Laut, Kuala Lumpur wants to create a database to keep track of students' registration. The president of the college gives you the following description of the college requirements:

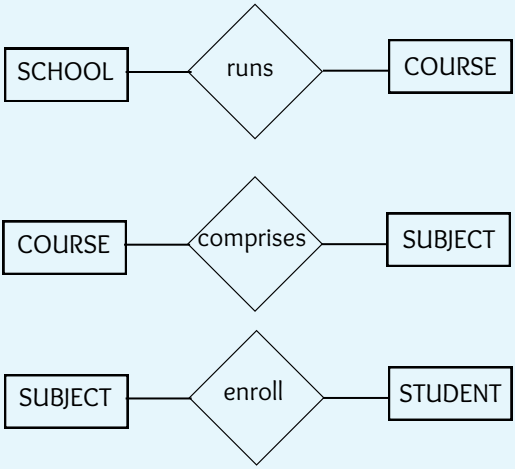
- The college has several schools such as School of Language and Management, School of Information Technology, and School of Multimedia. An Academic Director administers each school.
- Each school runs a few courses such as Diploma in Computer Graphic Design, Diploma in IT (Software Technology) and Diploma in Multimedia Application (Programming).
- Each course comprises of many subjects and one subject may be offer to more than one courses.
- Each student can enroll in multiple subjects during a given semester.

5.5.1 Step by Step to Draw ERD

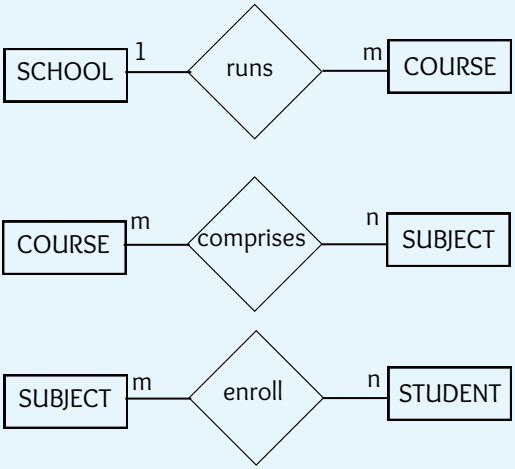


5.5.1 Step by Step to Draw ERD (cont)

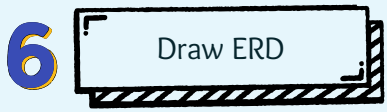
4 Identify Relationship between Entities

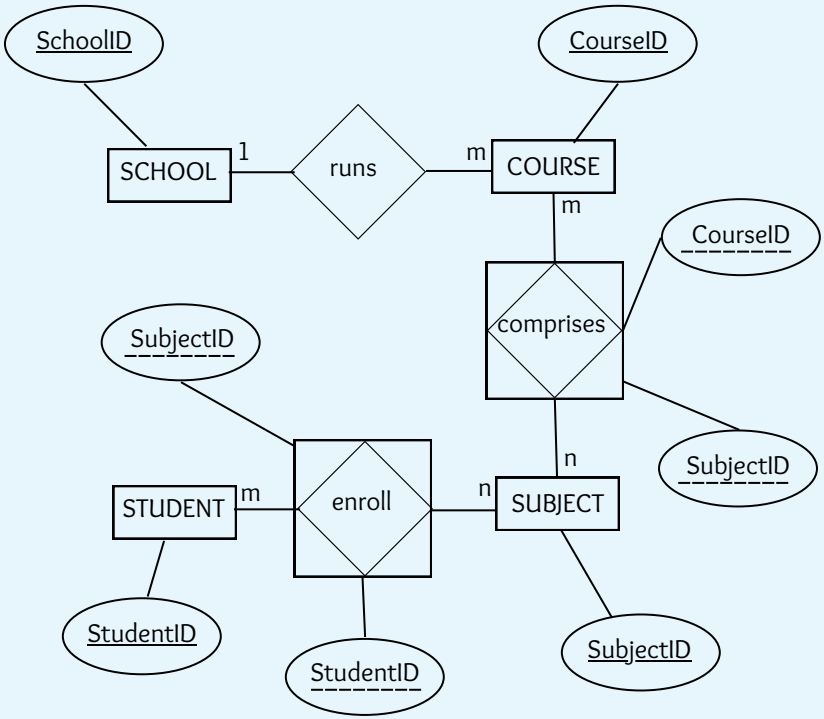


5 Add cardinality in each relationship

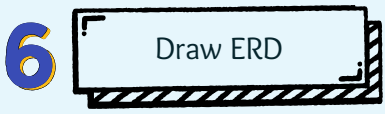


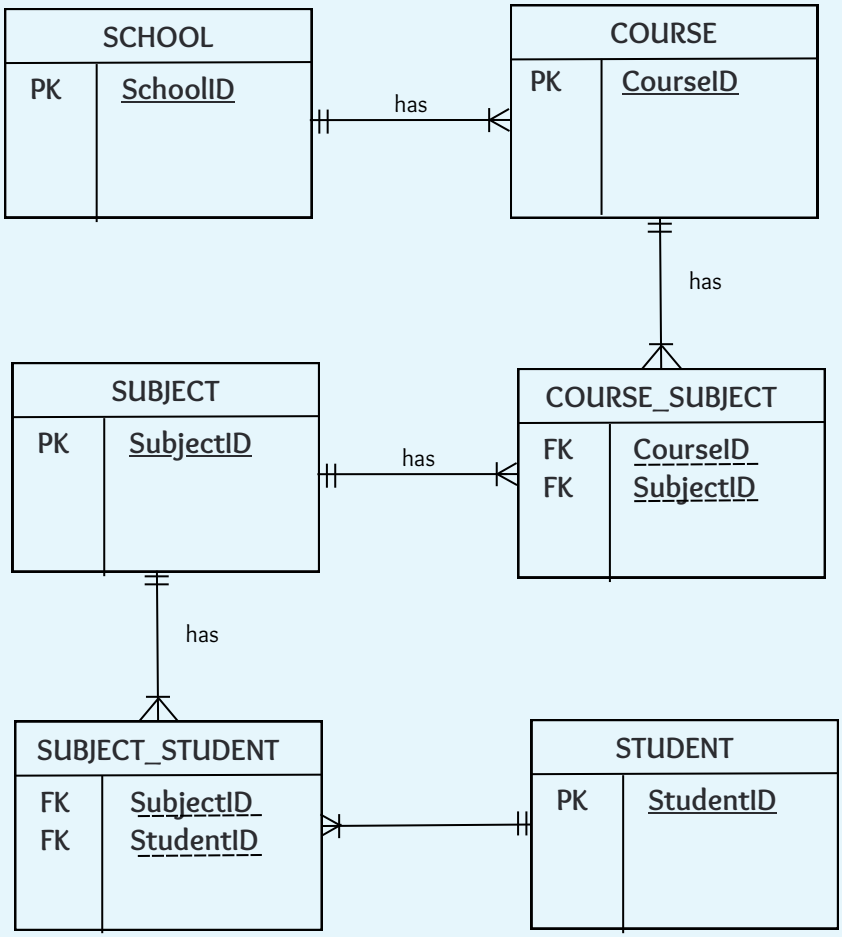
5.5.1 Step by Step to Draw ERD (cont)





5.5.1 Step by Step to Draw ERD (cont)





5.6 EXERCISE

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