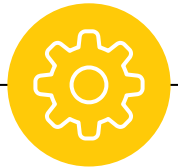
Welcome



SQL Essentials

Roadmap


RDBMS
ER Model
SQL Server
DDL
DML
Operator
Function
SQL Clause
Join data
Sub Query
Best
Practice

What we will explore today?

Database

- What is RDBMS?
- What is DBMS?
- Database Schema
- Database Instance

Entity Relation Model

- What is ER Model?
- What is Entity?
- Cardinality?
- Relationships
- Convert ER model to schema

What is Database?

- **Database** is an **organized collection of data**, typically **store** & **accessed** electronically from a computer system or electronic device.

Database example

- A database that stores student and course information

STUDENT

Name	Student_number	Class	Major
Smith	17	1	CS
Brown	8	2	CS

COURSE

Course_name	Course_number	Credit_hours	Department
Intro to Computer Science	CS1310	4	CS
Data Structures	CS3320	4	CS
Discrete Mathematics	MATH2410	3	MATH
Database	CS3380	3	CS

SECTION

Section_identifier	Course_number	Semester	Year	Instructor
85	MATH2410	Fall	07	King
92	CS1310	Fall	07	Anderson
102	CS3320	Spring	08	Knuth
112	MATH2410	Fall	08	Chang
119	CS1310	Fall	08	Anderson
135	CS3380	Fall	08	Stone

GRADE_REPORT

Student_number	Section_identifier	Grade
17	112	B
17	119	C
8	85	A
8	92	A
8	102	B
8	135	A

What kind of data is store in DB?

- Username, Password, Email, Address, Salary…
- Image, Videos…
- Almost everything “digital” can be storage on database

What is DBMS?

- A **database management system** is **software** for **managing databases**
- Control access to the databases
- Create, modify, delete databases
- Manipulate data (storage, retrieve, report)

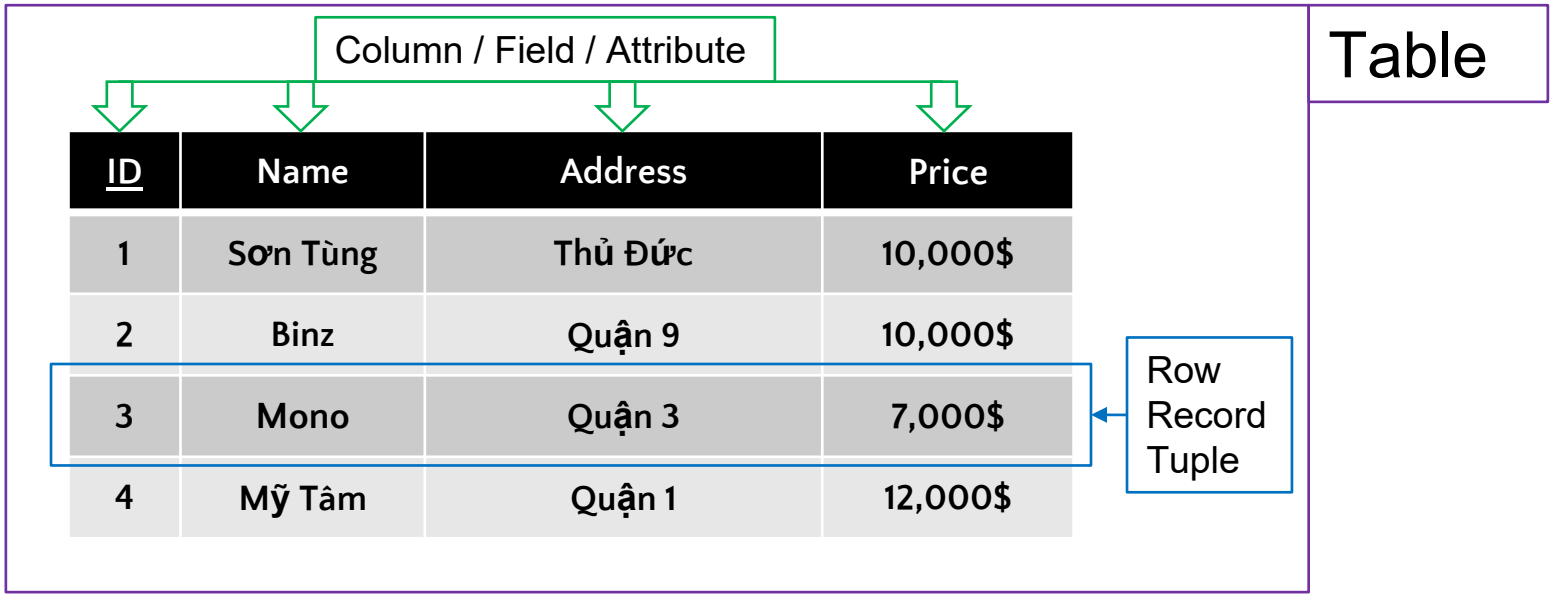
Type of DBMS

- Relational database.
- Object oriented database.
- Hierarchical database.
- Network database.

What is RDBMS?

- RDBMS store data in form of table, table contains many columns & rows.
- Use “Query” to comunicate with DBMS we can **insert**, **delete**, **update** data in Database.

It's all about table



Relational database have many **tables.** Table contains many **columns & rows**

Database Schema

Singer (ID, Name, Address, Show)

ID	Name	Address	Price
1	Sơn Tùng	Thủ Đức	10,000$
2	Binz	Quận 9	10,000$
3	Mono	Quận 3	7,000$
4	Mỹ Tâm	Quận 1	12,000$

Schema is describe how the data should **look like**

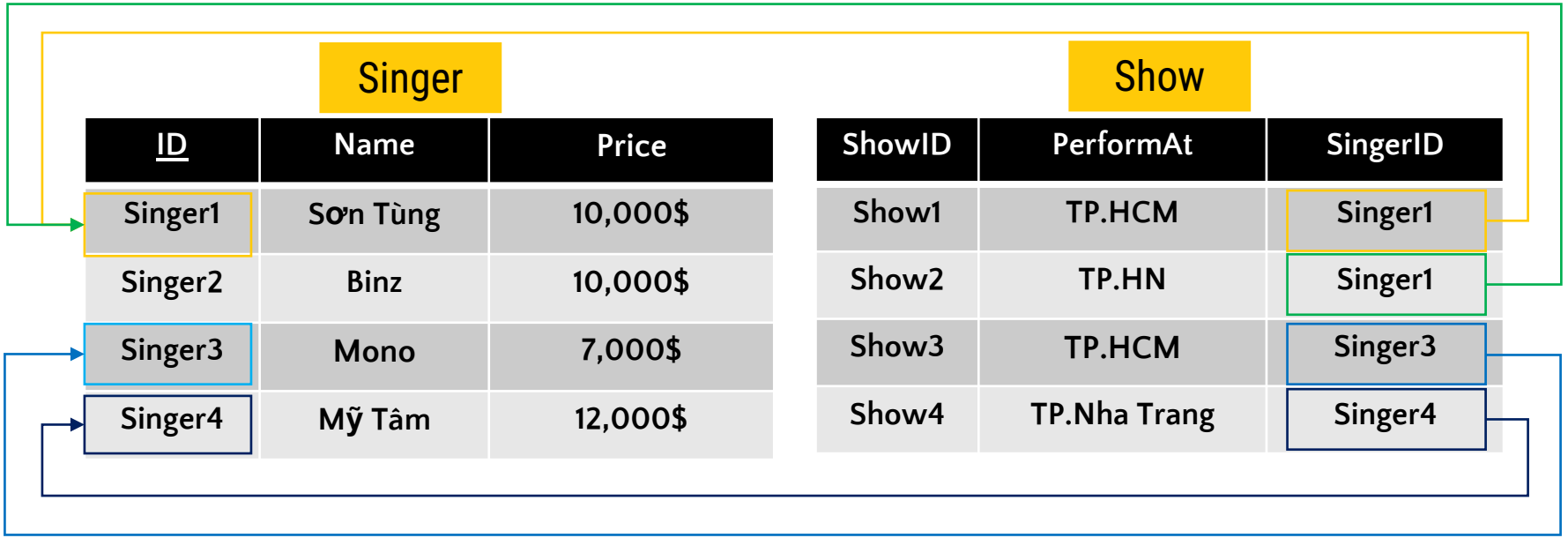
It's **not hold any data**

Instance

The data in the database: database state or snapshot or instance

ID	Name	Address	Price
1	Sơn Tùng	Thủ Đức	10,000$
2	Binz	Quận 9	10,000$
3	Mono	Quận 3	7,000$
4	Mỹ Tâm	Quận 1	12,000$

Relational database concept



Singer

ID	Name	Price
Singer1	Sơn Tùng	10,000$
Singer2	Binz	10,000$
Singer3	Mono	7,000$
Singer4	Mỹ Tâm	12,000$

Show

ShowID	PerformAt	SingerID
Show1	TP.HCM	Singer1
Show2	TP.HN	Singer1
Show3	TP.HCM	Singer3
Show4	TP.Nha Trang	Singer4

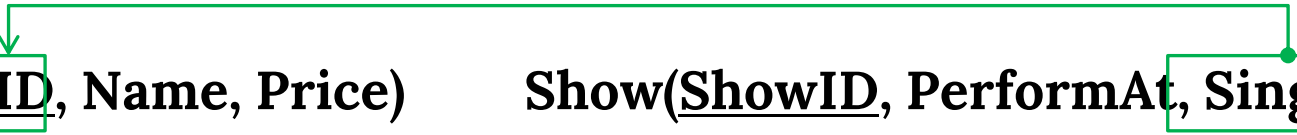
Database Schema

Singer

ID	Name	Price
Singer1	Sơn Tùng	10,000$
Singer2	Binz	10,000$
Singer3	Mono	7,000$
Singer4	Mỹ Tâm	12,000$

Show

ShowID	PerformAt	SingerID
Show1	TP. HCM	Singer1
Show2	TP. HN	Singer1
Show3	TP. HCM	Singer3
Show4	TP. Nha Trang	Singer4



Singer(ID, Name, Price) **Show(ShowID, PerformAt, SingerID)**

Why don't we just use one table?

ID	Name	Price
Singer1	Sơn Tùng	10,000$
Singer2	Binz	10,000$
Singer3	Mono	7,000$
Singer4	Mỹ Tâm	12,000$

ShowID	PerformAt	SingerID
Show1	TP. HCM	Singer1
Show2	TP. HN	Singer1
Show3	TP. HCM	Singer3
Show4	TP. Nha Trang	Singer4

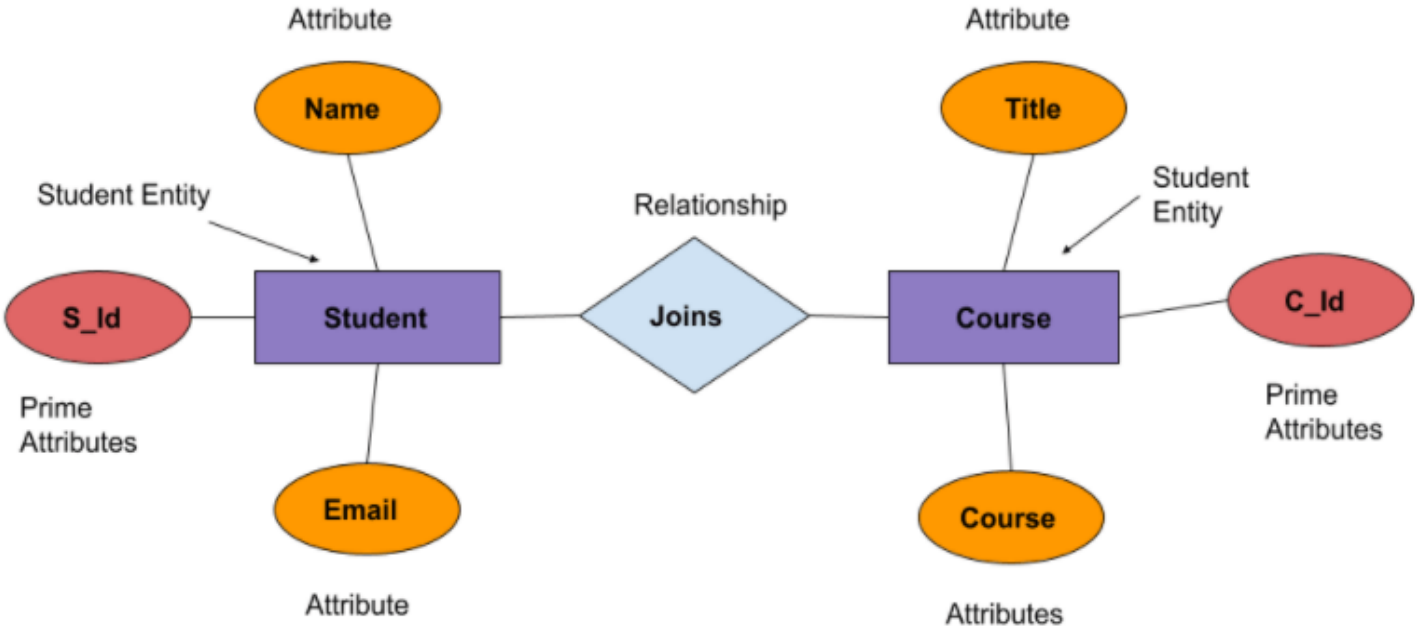
ShowID	PerformAt	SingerID	Name	Price
Show1	TP. HCM	Singer1	Sơn Tùng	10,000$
Show2	TP. HN	Singer1	Sơn Tùng	10,000$
Show3	TP. HCM	Singer3	Mono	7,000$
Show4	TP. Nha Trang	Singer4	Mỹ Tâm	12,000$

Some specific system use RDBMS

- MySQL
- PostgreSQL
- MariaDB
- Microsoft SQL Server
- Oracle Database
- etc...

What is ER Model?

The ER model describes data as entities, relationships, and attributes

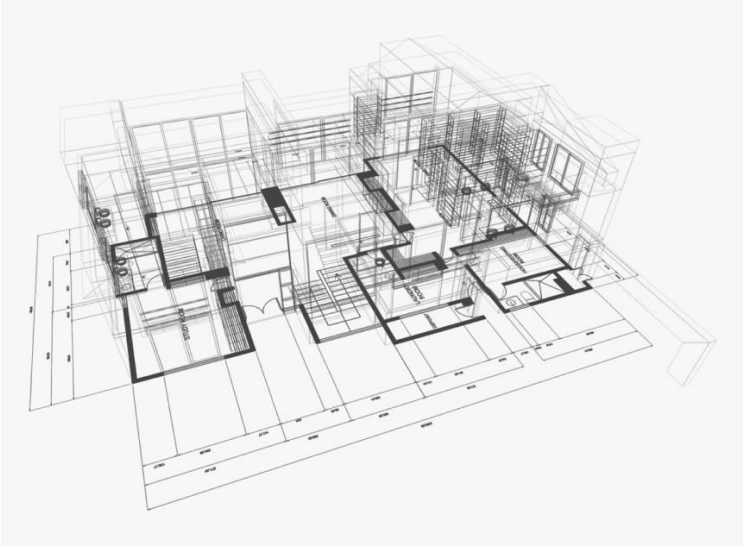


What is ER Model?

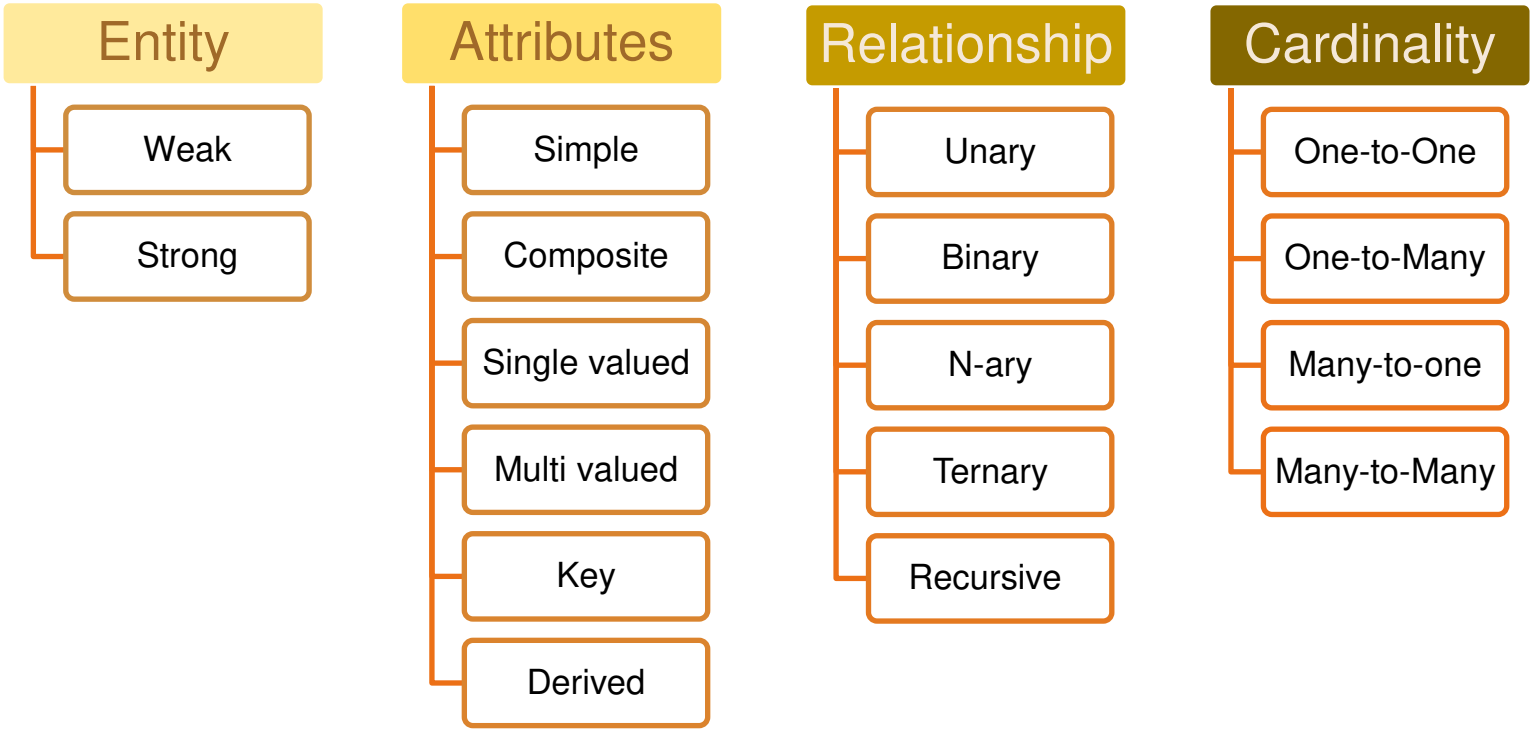
ER model is a **conceptual design** for the database. Representation of **relationships between data.**

Why we need it?

- ER Model **visualize** the **design** and form the **overall view** of the database



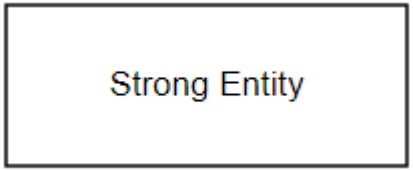
ER Model


Entity
Weak
Strong
Attributes
Simple
Composite
Single valued
Multi valued
Key
Derived
Relationship
Unary
Binary
N-ary
Ternary
Recursive
Cardinality
One-to-One
One-to-Many
Many-to-one
Many-to-Many

ER Model – Entity

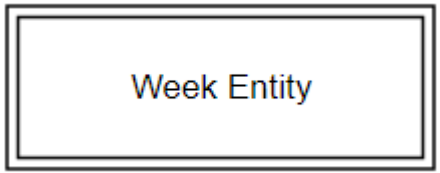
Strong Entity

- Has primary key
- **NOT depend** on other entity

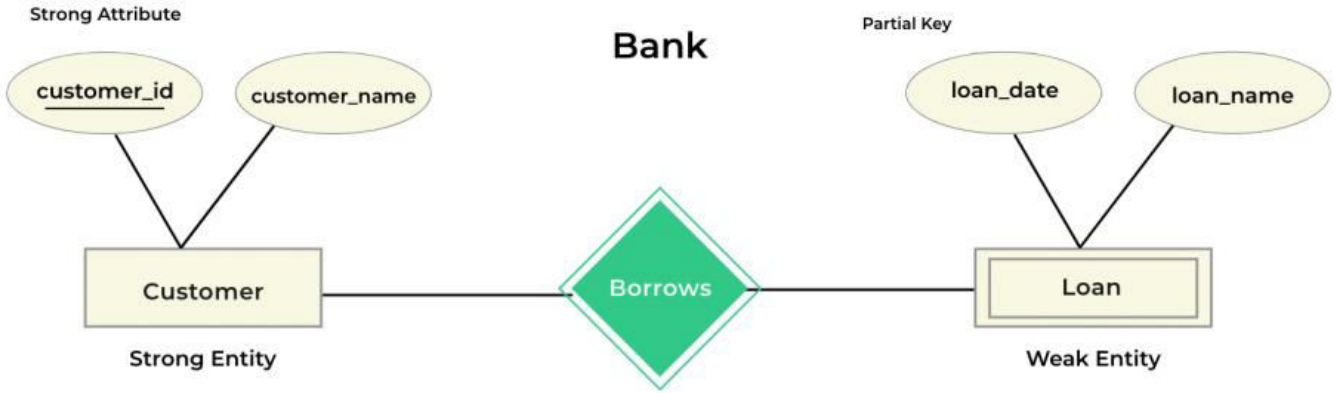


Week Entity

- Has partial discriminator key
- **Depend** on other entity

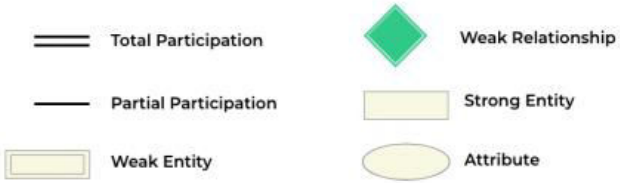


Entity

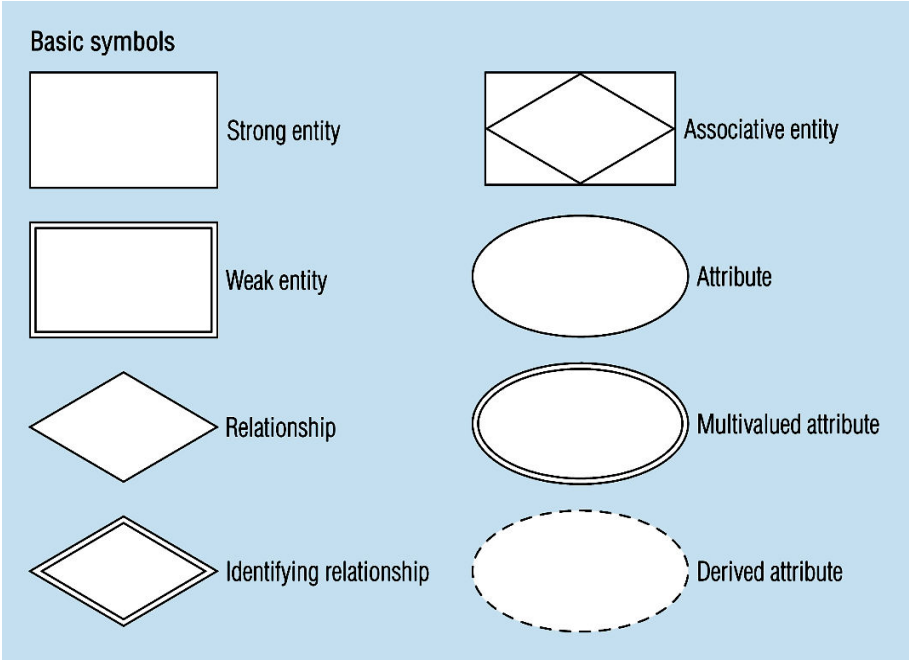


Initialisation

Strong Entities	Customer
Weak Entities	Loan
Strong Attributes	customer_id
Partial Key	loan_name



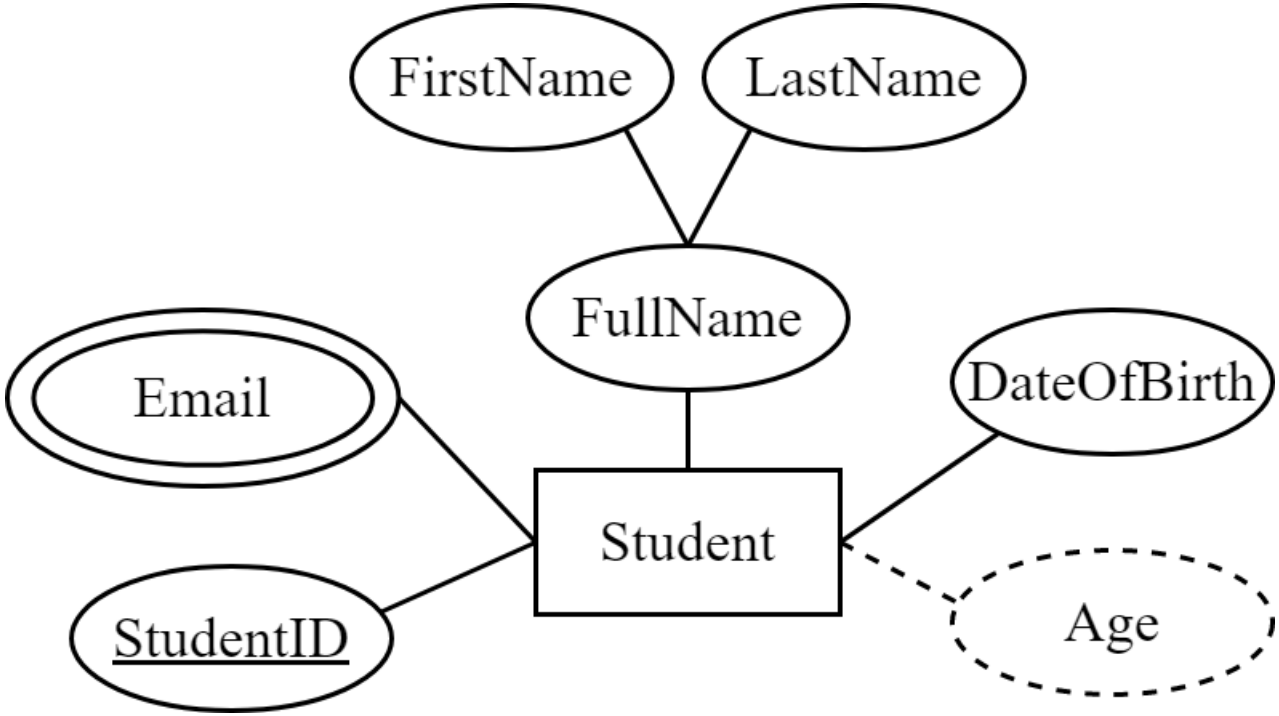
ER Notation


Basic symbols
Strong entity
Associative entity
Weak entity
Attribute
Relationship
Multivalued attribute
Identifying relationship
Derived attribute

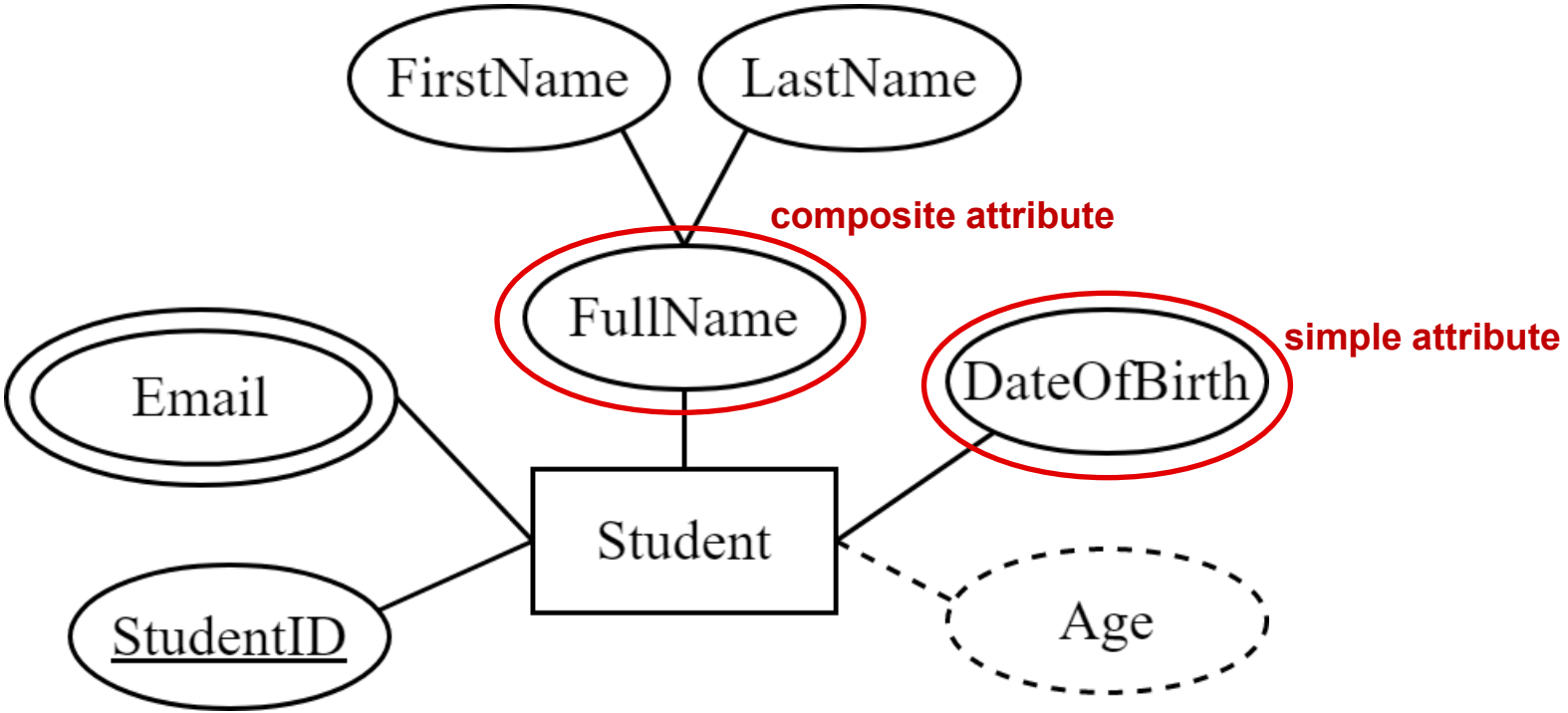
Attributes

- It describes the **characteristics** of an entity
- Ex: Student: Name, Phone, Grade,...

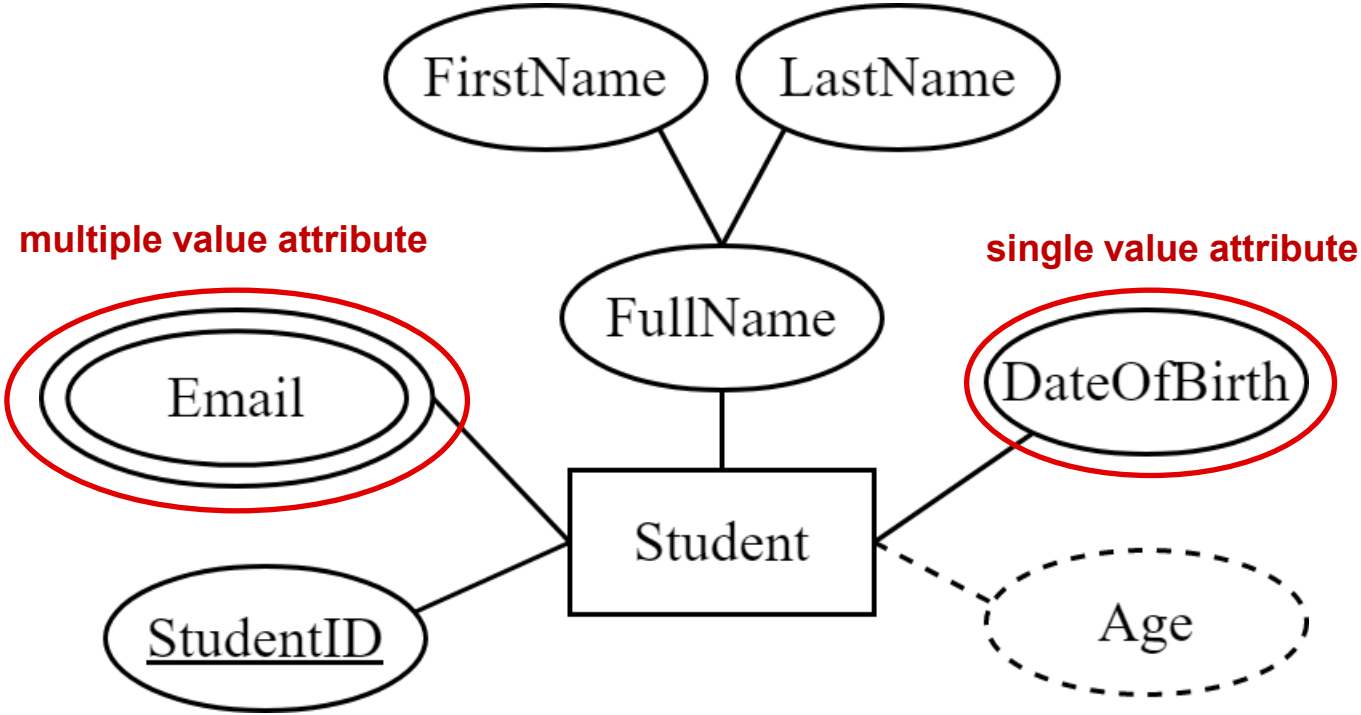
Attributes


FirstName
LastName
FullName
Email
DateOfBirth
Student
StudentID
Age

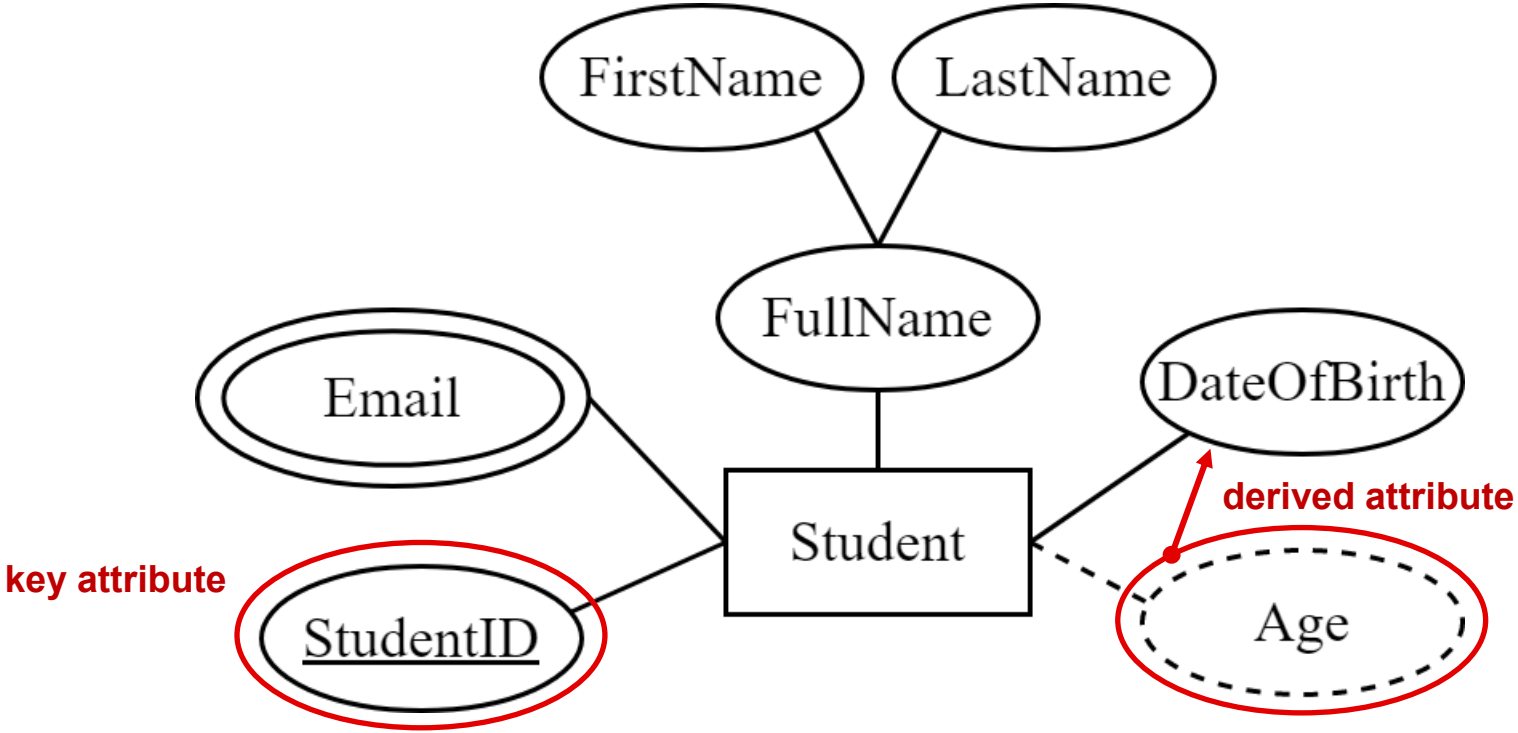
Attributes


FirstName
LastName
composite attribute
FullName
Email
DateOfBirth
simple attribute
Student
StudentID
Age

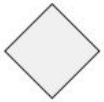
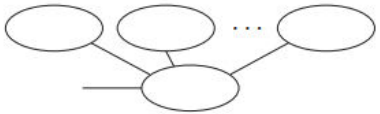
Attributes


FirstName
LastName
multiple value attribute
single value attribute
FullName
Email
DateOfBirth
Student
StudentID
Age

Attributes


FirstName
LastName
FullName
Email
DateOfBirth
derived attribute
Student
key attribute
StudentID
Age

Attributes

Symbol	Meaning
	Entity
	Weak Entity
	Relationship
	Indentifying Relationship
	Attribute
	Key Attribute
	Multivalued Attribute
	Composite Attribute
	Derived Attribute

Practice

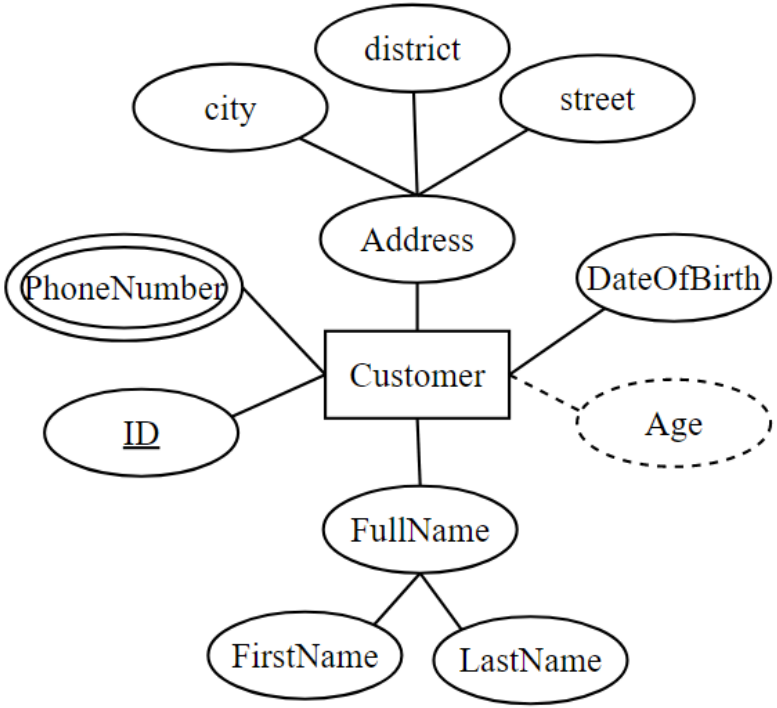
Requirement: Define the Customer entity with the following attributes:

- Address (City, District, Street)
- Multiple Phone Numbers
- Full Name (First Name, Last Name)
- Date of Birth
- Age

Practice

The Customer entity:

- Address (City, District, Street)
- Multiple Phone Numbers
- Full Name (First Name, Last Name)
- Date of Birth
- Age

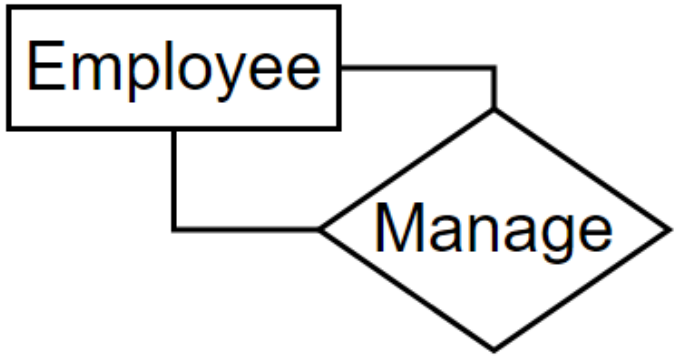


Relationship

- Describe the number of entities involved in the system and explain their relationships

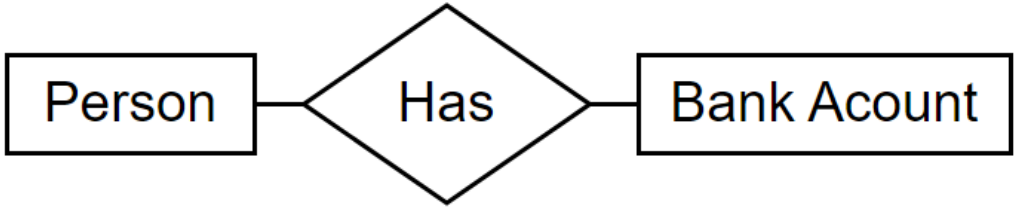
Unary/ Recursive Relationship

- There **only one entity** participating in the relationship



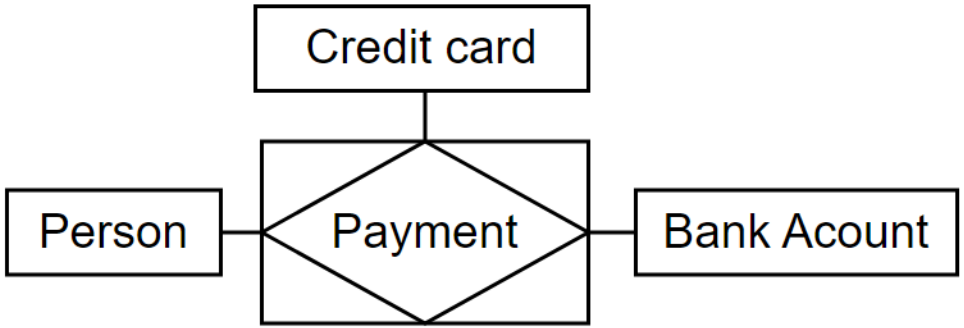
Binary Relationship

- There **2 different entities** participating in the relationship



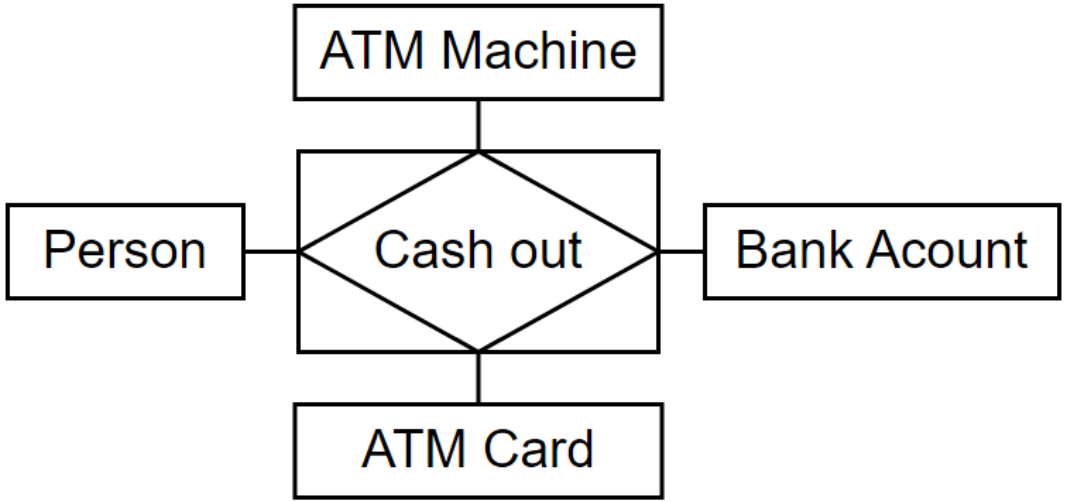
Ternary Relationship

- There 3 **different entities** participating in the relationship



N-nary Relationship

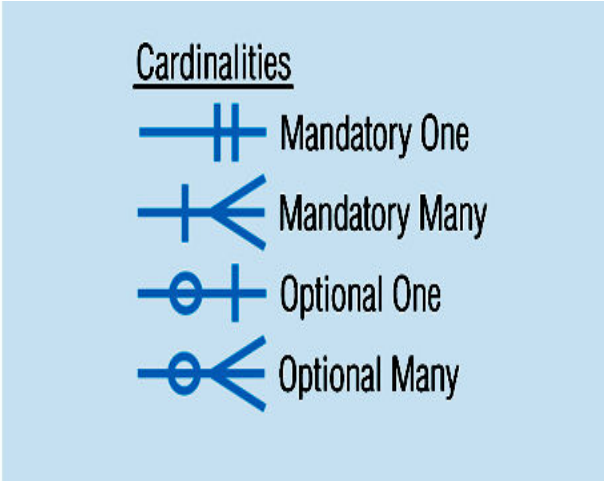
- There N **different entities** participating in the relationship



Cardinality

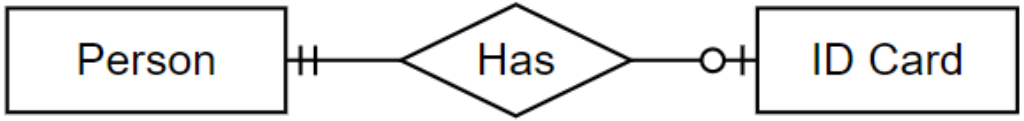
Cardinality describes a relationship between two entities, representing the minimum and maximum number of occurrences of one entity that can be associated with an occurrence of a related entity

- one to one
- many to one
- one to many
- many to many

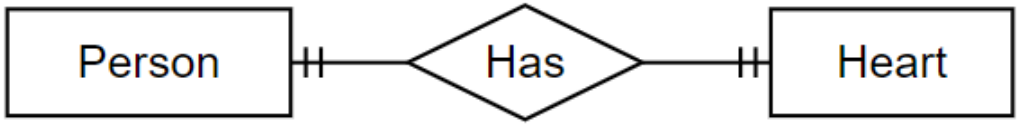


One to One

- Person has one ID Card

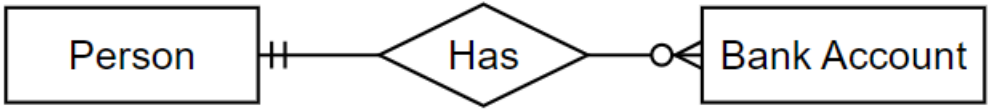


- Person has one Heart

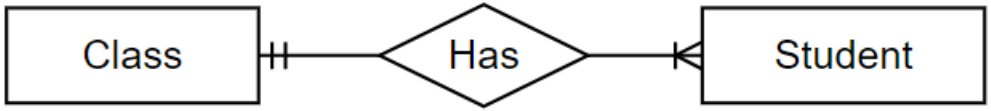


Many-to-One or One-to-Many

- **Person** has 0 or many **BankAccount, a BankAccount** belongs to one **Person**

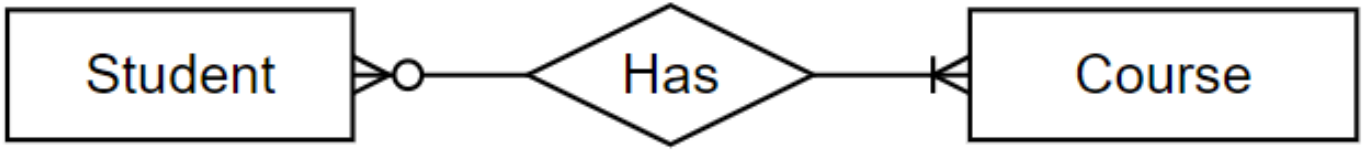


- **Class** has 1 or many **Students**, **Student** must be in one **Class**



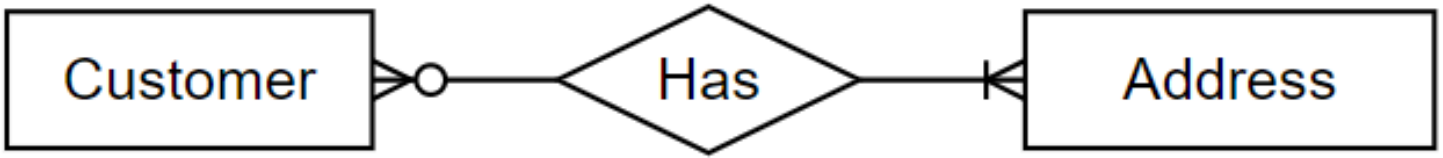
Many-to-Many

- **Student** must study 1 or many **Courses, Course** can learn by 0 or many **Students**



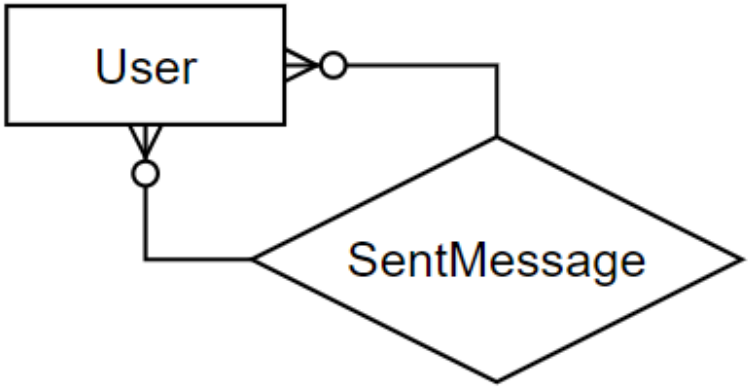
Practice 1

Ex1: Customer can have one or many Addresses, one Address can belong to zero or many customers



Practice 2

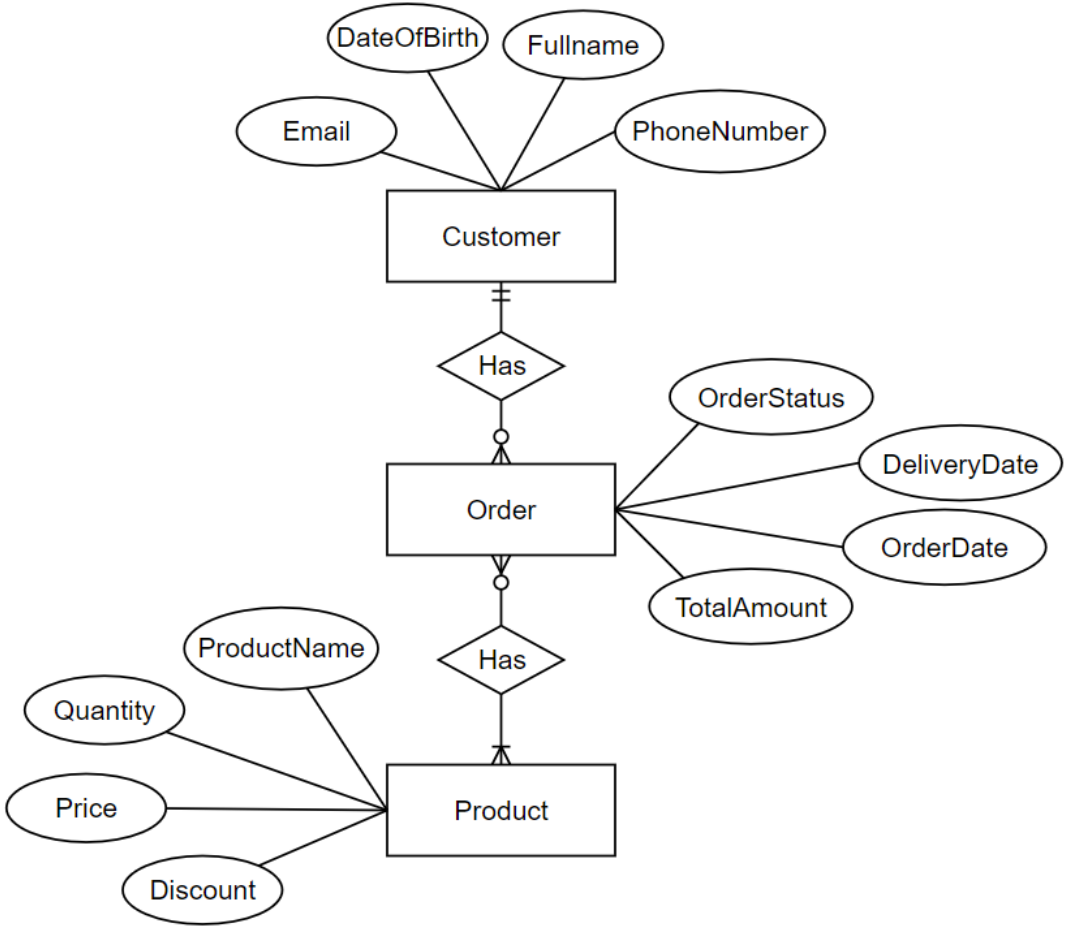
Ex2: Users can send zero or many messages to other Users. Users can receive zero or many messages from other Users



Shopee ER Model to database chema

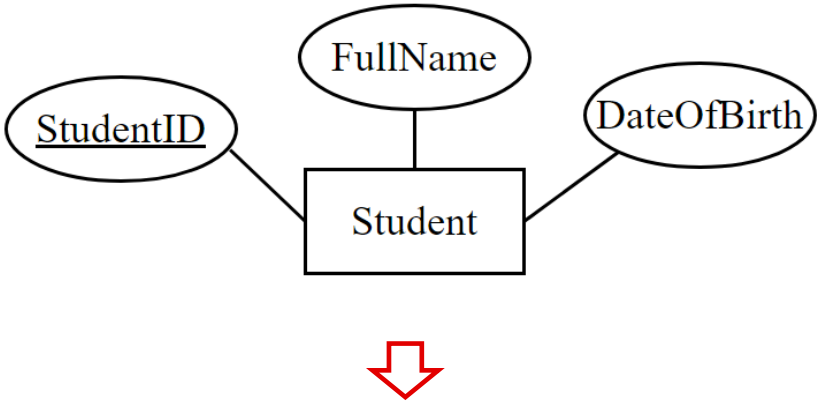
Design Shopee ER Model

- **Customers** have information such as name, address, phone number, email, date of birth, etc.
- Customers can have multiple **orders**.
- Each **order** consists of attributes like total amount, delivery address, and delivery date.
- Orders can contain multiple products, each with attributes including product name, quantity, price, and discount.
- Products can belong to multiple orders.


DateOfBirth
Fullname
Email
PhoneNumber
Customer
Has
OrderStatus
DeliveryDate
Order
OrderDate
TotalAmount
Has
ProductName
Quantity
Price
Product
Discount

Convert ER Model to database schema?

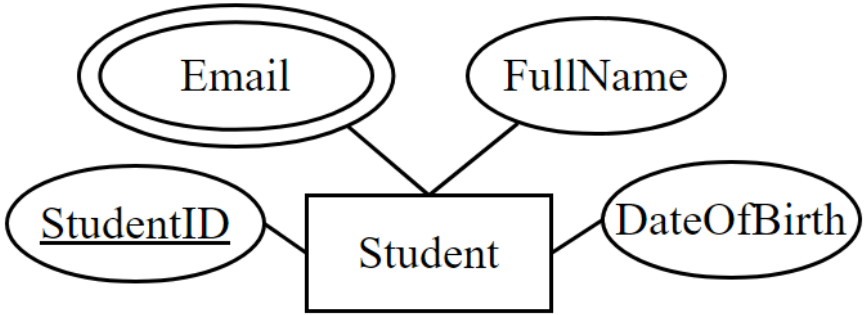
Simple attribute entity



StudentID	FullName	DateOfBirth
1	Snoop Dog	2/19/2000
2	The Rock	2/16/1999

Student(**StudentID**, FullName, DateOfBirth)

Multiple value attribute



Student(**StudentID**, FullName, DateOfBirth)

StudentEmail(**StudentID**, **Email**)

Multiple value attribute

Student(**StudentID**, FullName, DateOfBirth)

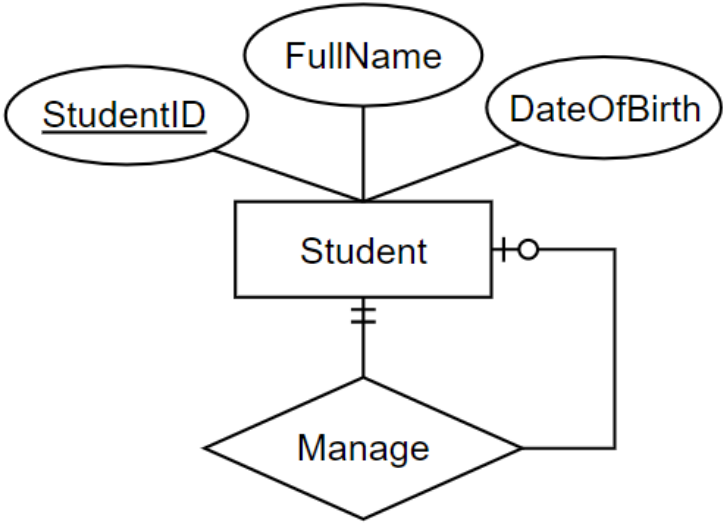
StudentEmail(**StudentID**, **Email**)

StudentID	FullName	DateOfBirth
1	Snoop Dog	2/19/2000
2	The Rock	2/16/1999

StudentID	Email
1	snoop@high.com
1	snoop@low.com
2	power@man.com
2	supper@man.com

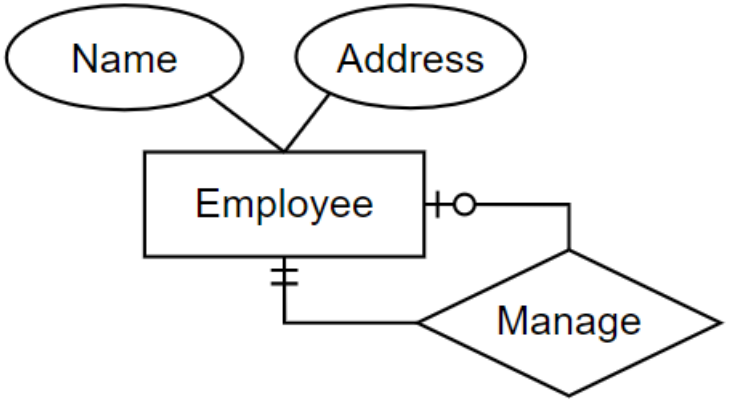
3	test@man.com

Unary one to one (optional)



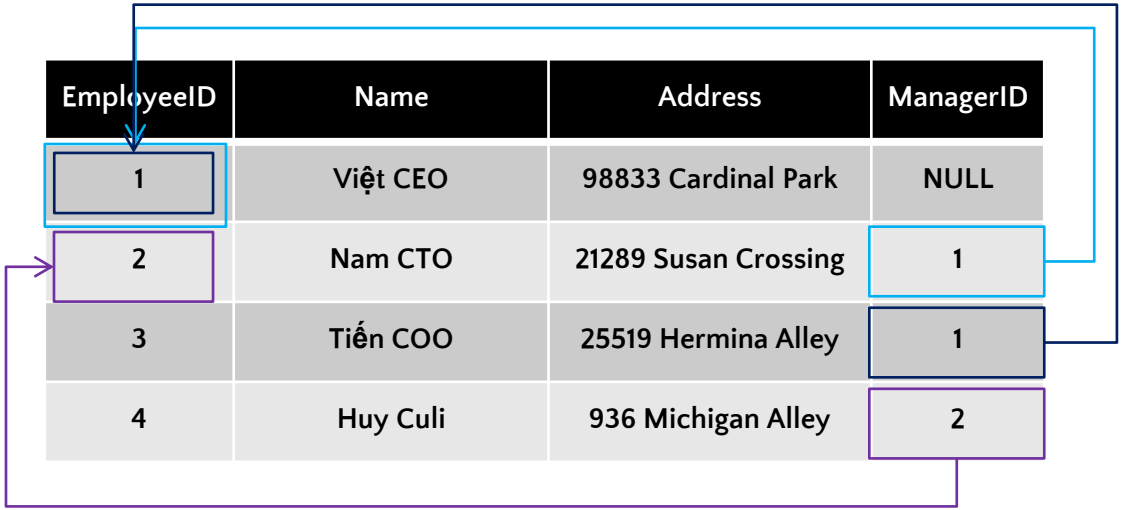
Student(**StudentID**, FullName, DateOfBirth, **ManageID**)

Unary one to many



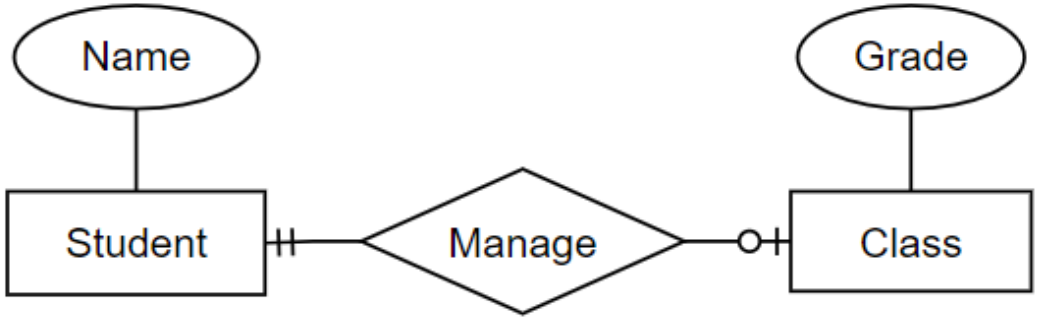
Employee(**EmployeeID,** Name, Address, **ManagerID**)

Employee(**EmployeeID,** Name, Address, **ManagerID**)



EmployeeID	Name	Address	ManagerID
1	Việt CEO	98833 Cardinal Park	NULL
2	Nam CTO	21289 Susan Crossing	1
3	Tiến COO	25519 Hermina Alley	1
4	Huy Culi	936 Michigan Alley	2

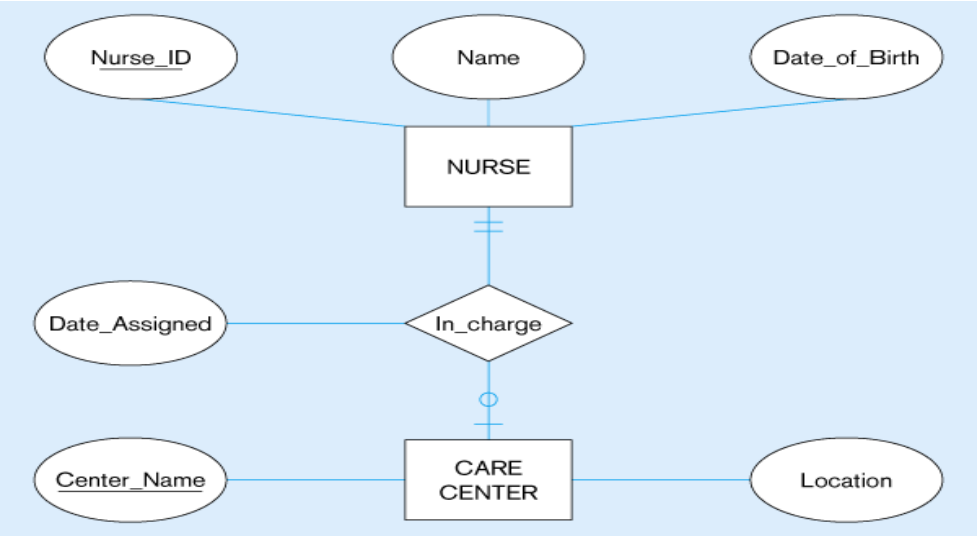
Binary one to one (optional)

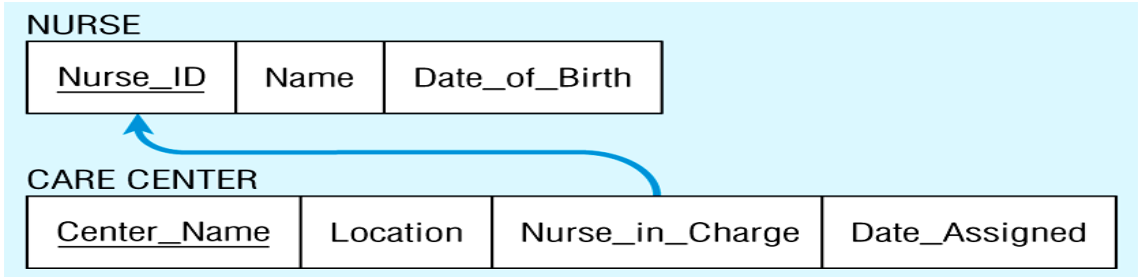


Student (**StudentID**, Name)

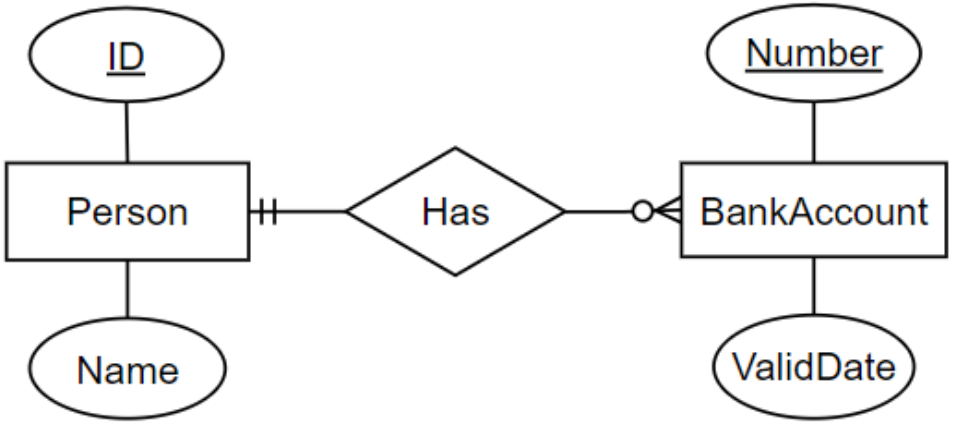
Class (**ClassID**, **ManagerID**, Grade)

Binary one to one (optional)





Binary one to many

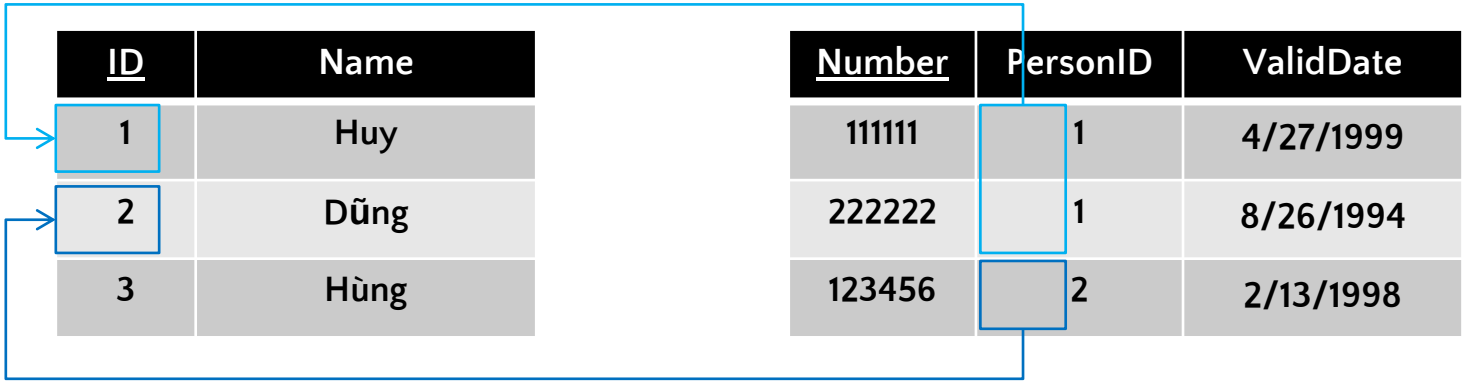


Person(**ID**, Name)

BankAccount(**Number**, PersonID, ValidDate)

Person(**ID**, Name)

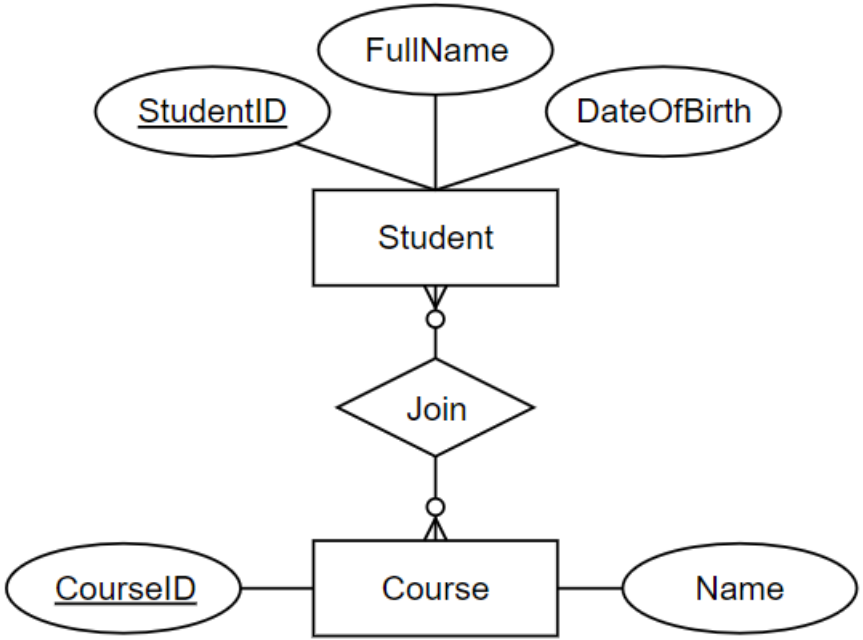
BankAccount(**Number**, PersonID, ValidDate)



ID	Name
1	Huy
2	Dũng
3	Hùng

Number	PersonID	ValidDate
111111	1	4/27/1999
222222	1	8/26/1994
123456	2	2/13/1998

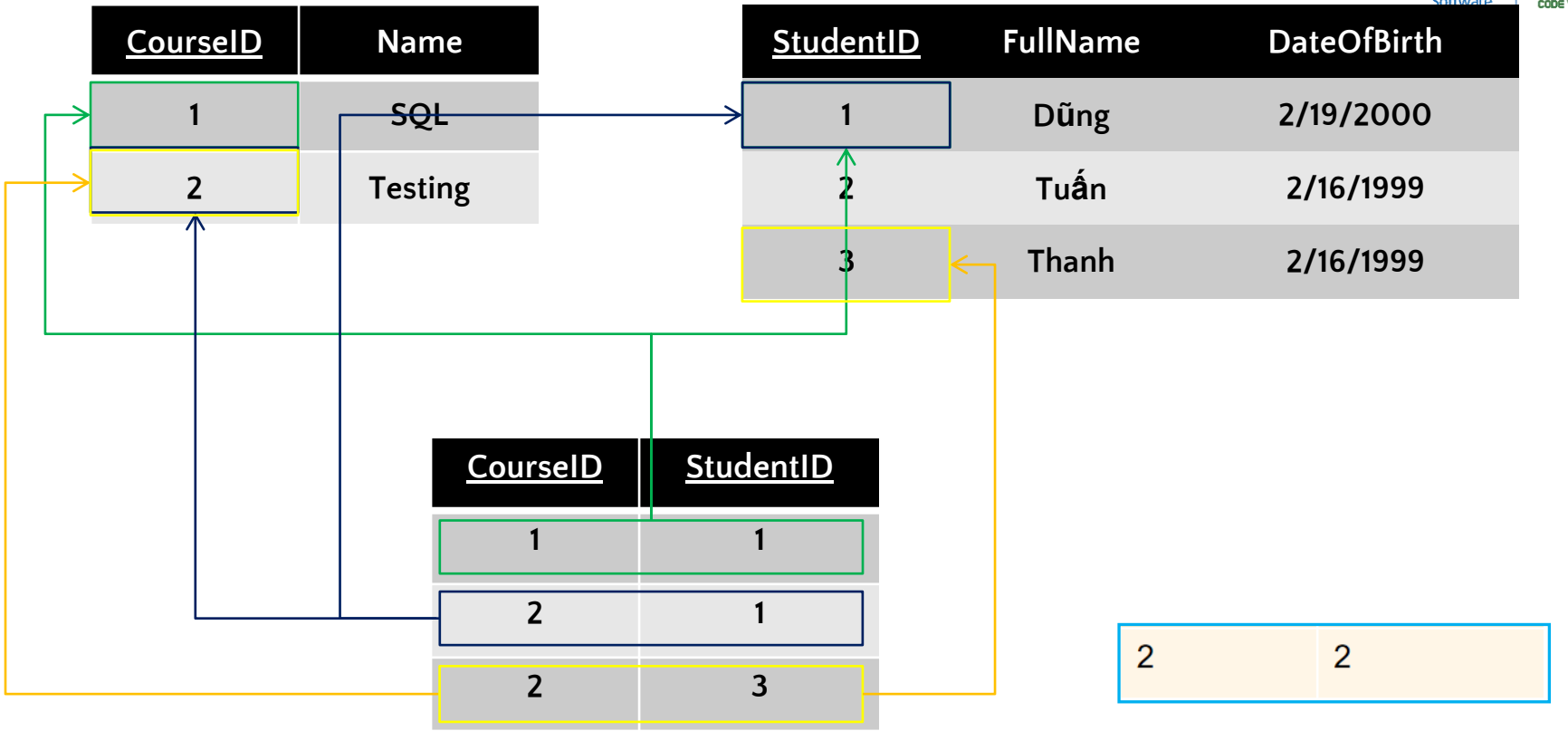
Binary many to many



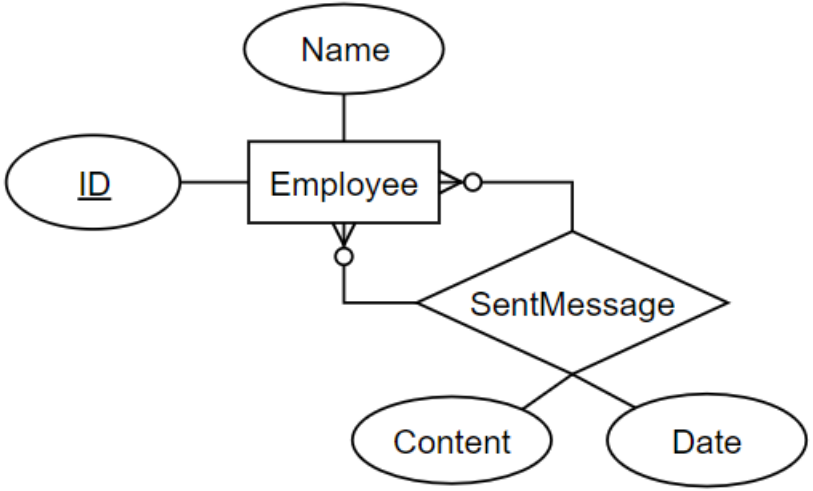
Student(**StudentID**, FullName, DateOfBirth)

StudentCourses(**StudentID**, **CourseID**)

Course(**CourseID**, Name)


CourseID
Name
1
SQL
2
Testing
StudentID
FullName
DateOfBirth
1
Dũng
2/19/2000
2
Tuấn
2/16/1999
3
Thanh
2/16/1999
CourseID
StudentID
1
1
2
1
2
3
2
2

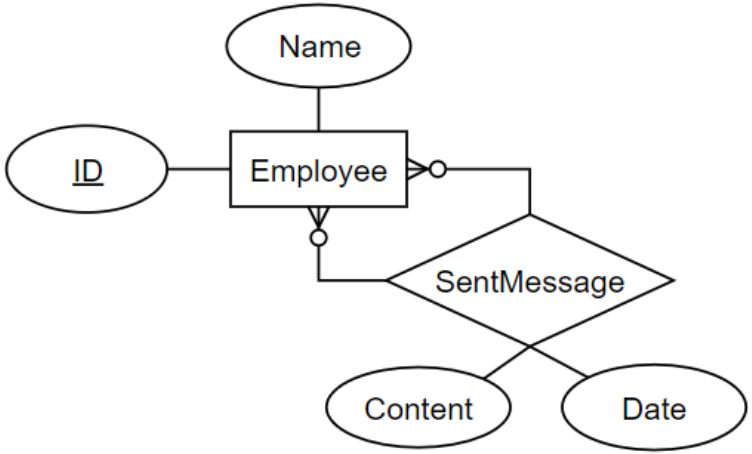
Unary many to many



Employee(**ID**, Name)

Messages(**FromEmployeeID**, **ToEmployeeID**, Content, Date)

Make you easy to see



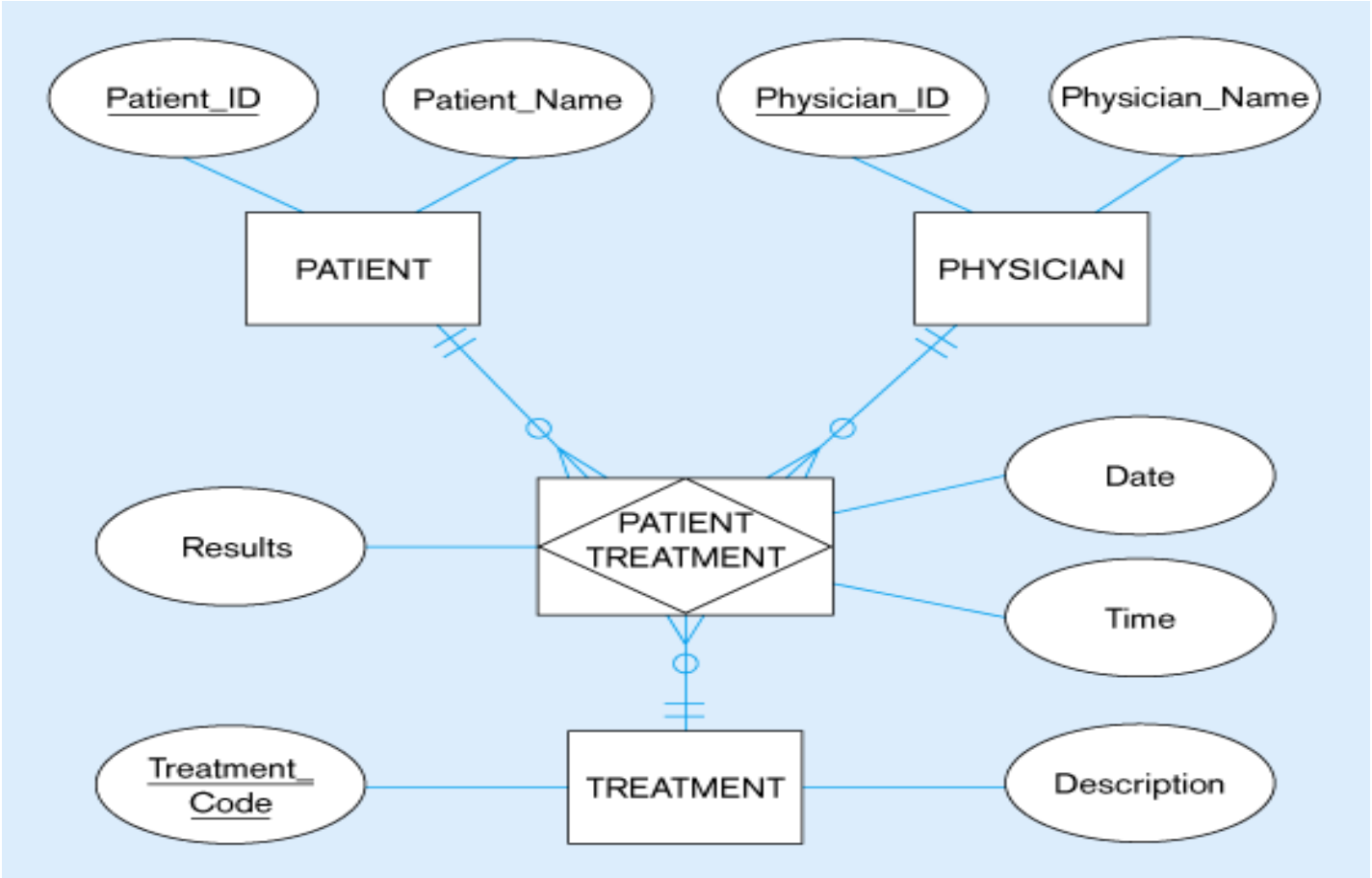
Employee(**ID**, Name)

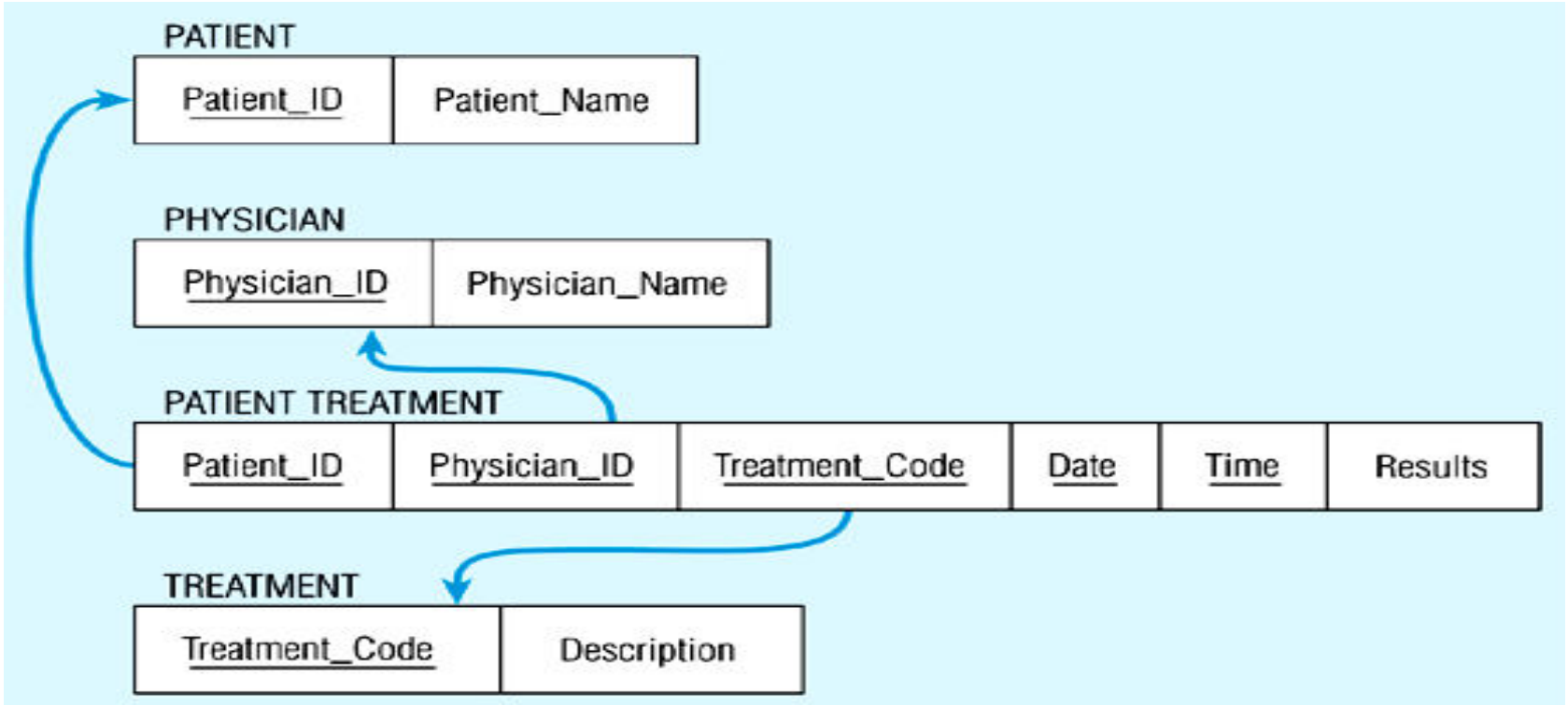
Messages(**FromEmployeeID**, **ToEmployeeID**, Content, Date)

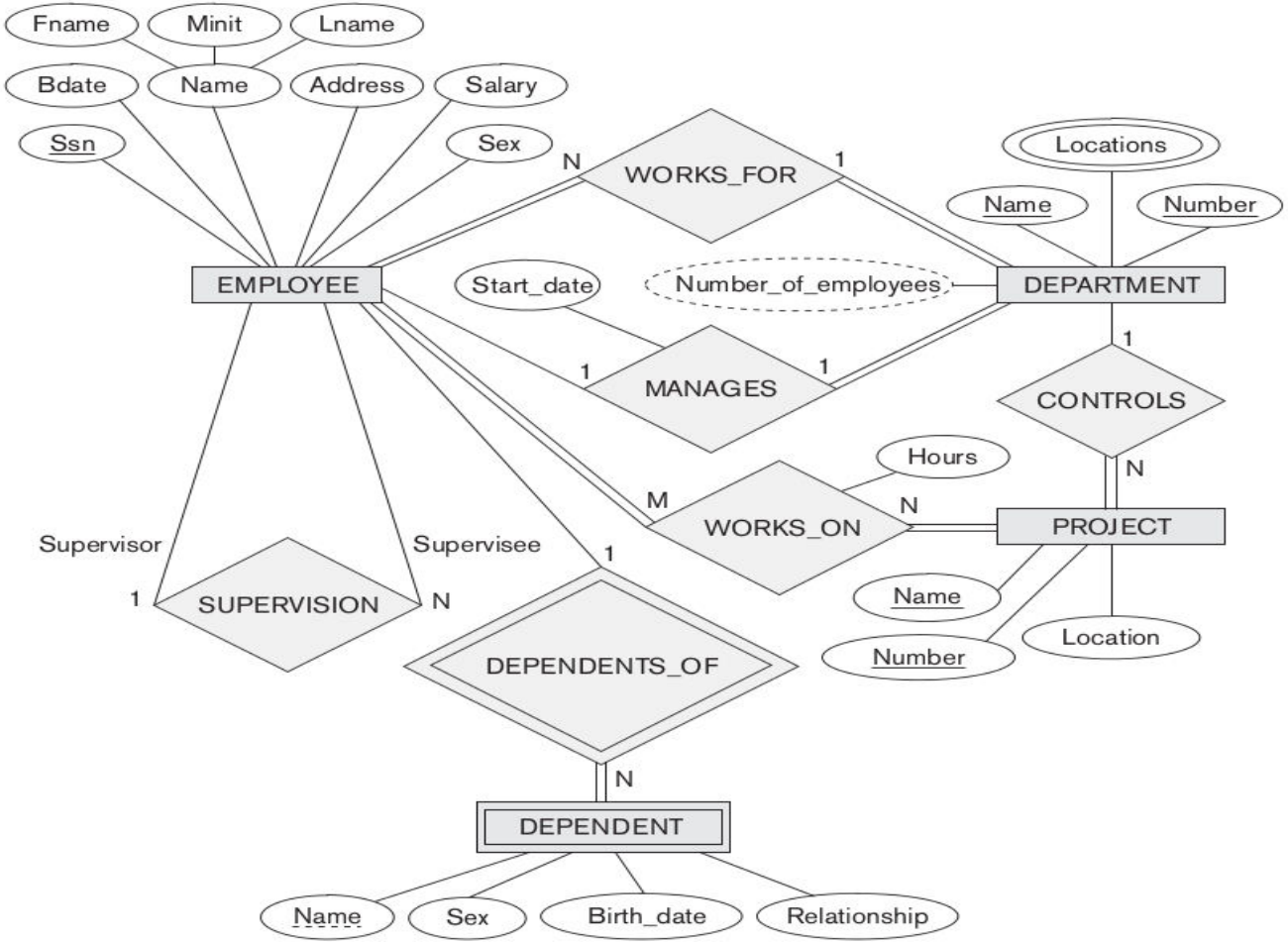
Employee(**ID**, Name)

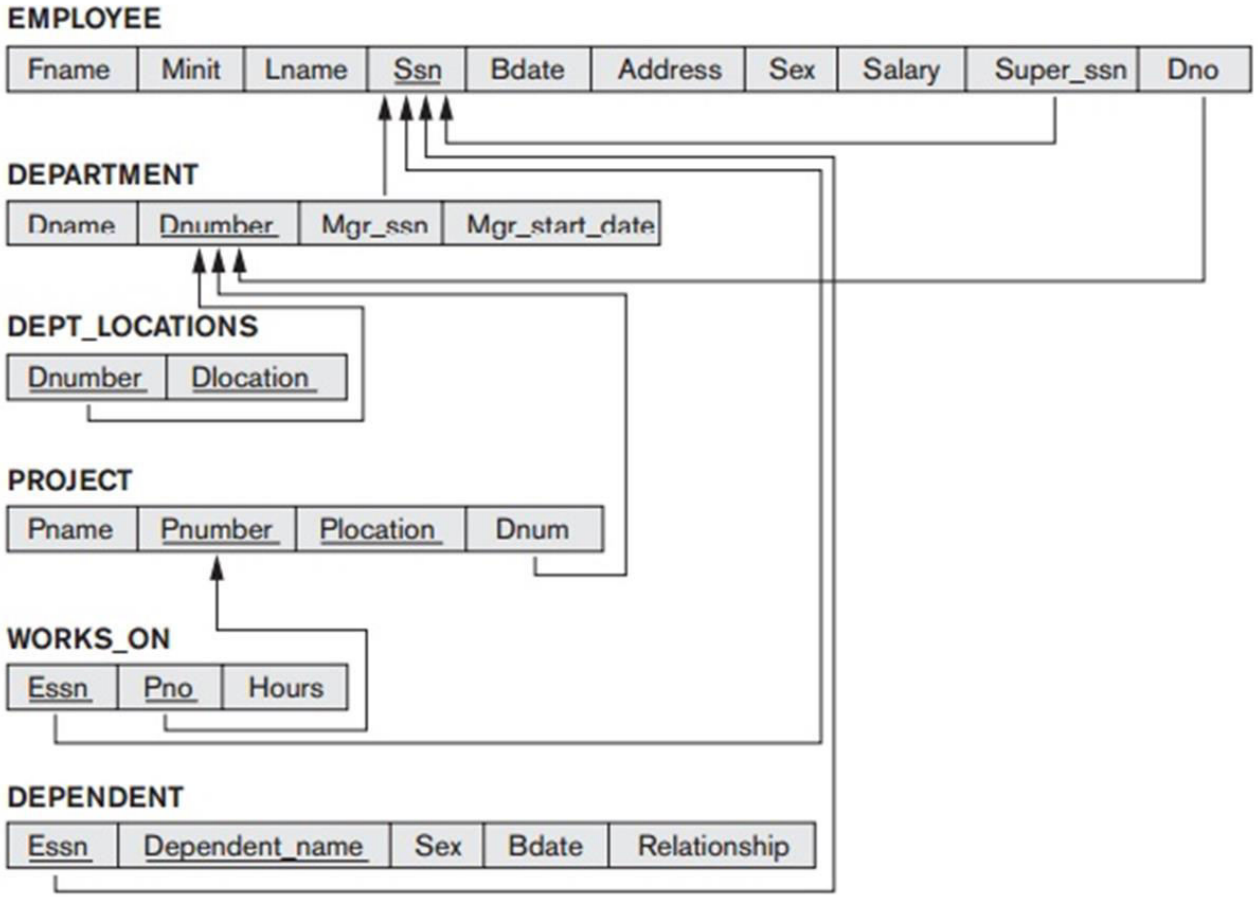
ID	Name
1	Nam
2	Dũng
3	Huy

FromEmployeeID	ToEmployeeID	Content	Date
1	2	Hi, How it's going?	2/19/2023
2	1	Oh hello, I'm good, how about you?	2/19/2023
1	2	Yeah, I'm great.	2/19/2023
2	1	Oke, bye ;>	2/19/2023


Patient_ID
Patient_Name
Physician_ID
Physician_Name
PATIENT
PHYSICIAN
Results
PATIENT TREATMENT
Date
Time
Treatment_ Code
TREATMENT
Description


PATIENT
Patient_ID
Patient_Name
PHYSICIAN
Physician_ID
Physician_Name
PATIENT TREATMENT
Patient_ID
Physician_ID
Treatment_Code
Date
Time
Results
TREATMENT
Treatment_Code
Description


Fname
Minit
Lname
Bdate
Name
Address
Salary
Ssn
Sex
N
WORKS_FOR
1
Locations
Name
Number
EMPLOYEE
Start_date
Number_of_employees
DEPARTMENT
1
MANAGES
1
1
CONTROLS
Hours
N
M
WORKS_ON
N
PROJECT
Supervisor
Supervisee
1
1
SUPERVISION
N
Name
Location
Number
DEPENDENTS_OF
N
DEPENDENT
Name
Sex
Birth_date
Relationship


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

Thank you!

*Any **questions** ?*