Tutorial

ER Modelling & Design

COMP3278B

Introduction to Database Management Systems

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Question 1

ER Model

Question 1a (2min)

- "A person can own a number of cars, but each car must be owned by exactly one person."

Can you draw an ER-diagram to model the data of this application?

Question 1a

- "A person can own a number of cars, but each car must be owned by exactly one person."

Step 1. Identify the entity & entity sets.

Car	Person

Question 1a

"A person can own a number of cars, but each car must be owned by exactly one person."

A. X: ═══   and Y: ═══
B. X: ──   and Y: →
C. X: ←   and Y: ═══
D. X: ═══   and Y: →

Step 2.1. Identify the relationships and relationship sets.

Car	owns	Person

Question 1a

- "A person can own a number of cars, but <u>each car must be owned by exactly one person</u>."

  A. X: ══ and Y: ══
  B. X: ── and Y: →
  C. X: ← and Y: ══
  D. X: ══ and Y: →

Step 2.2. Identify the cardinality of the relationship.

Cardinality

Question: Each car is owned by one person or can be owned by many people?

Car

owns

Person

?

Question 1a

"A person can own a number of cars, but each car must be owned by exactly one person."

A. X: ═══ and Y: ═══
B. X: ─── and Y: →
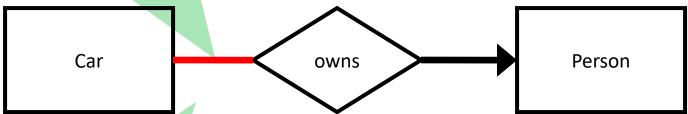C. X: ← and Y: ═══
D. X: ═══ and Y: →

Step 2.2. Identify the cardinality of the relationship.

Cardinality

Question: Each person can own one car or can own many cars?

Question: Each car is owned by one person or can be owned by many people?

Car — owns → Person
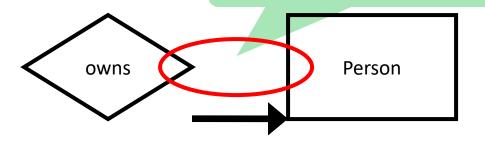
Answer: Each car owned by exactly one person (but not many people).

←

or

?

Question 1a

● "A person can own a number of cars, but each car must be owned by exactly one person."

A. X: ═══   and   Y: ═══
B. X: ───   and   Y: →
C. X: ←   and   Y: ═══
D. X: ═══   and   Y: →

Step 2.2. Identify the cardinality of the relationship.

Cardinality

Question: Each person can own one car or can own many cars?

| Car | —— | owns | → | Person |
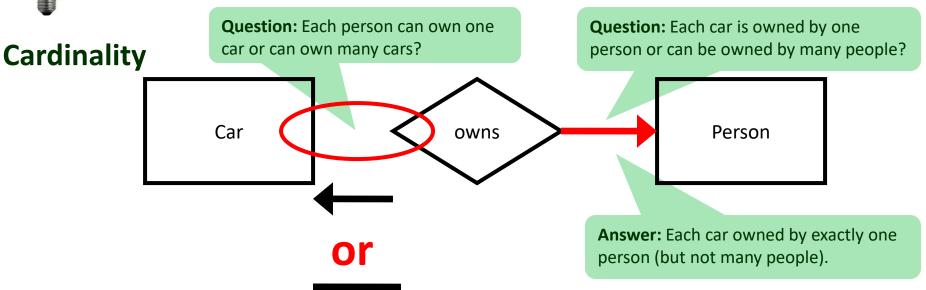
Answer: Each person can own a number of car (not just one)

Question 1a

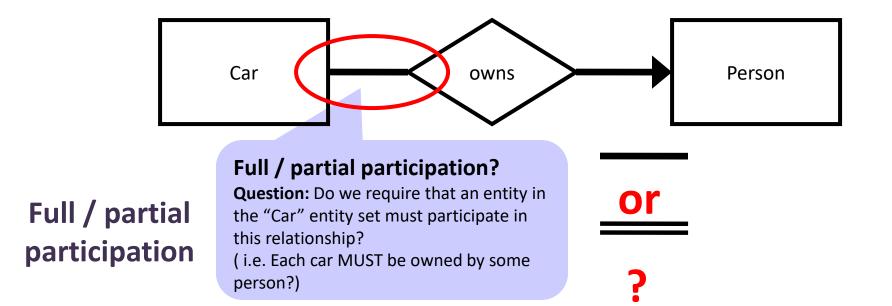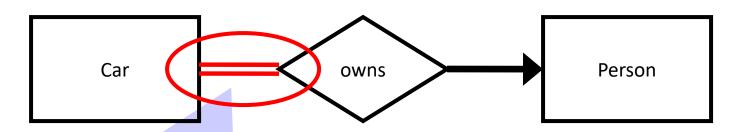● "A person can own a number of cars, but <u>each car must be owned by exactly one person.</u>"

A. X: ═══   and Y: ═══
B. X: ──   and Y: →
C. X: ←   and Y: ═══
D. X: ═══   and Y: →

Step 2.3. Identify total/partial participation of the relationship.

```
┌──────────┐        ◇─────────┐          ┌──────────┐
│   Car    │───────( owns )──────────▶  │  Person  │
└──────────┘        └─────────◇          └──────────┘
```

Full / partial participation?
Question: Do we require that an entity in the "Car" entity set must participate in this relationship?
(i.e. Each car MUST be owned by some person?)

Full / partial participation

═══
or
═══

?

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Question 1a

● "A person can own a number of cars, but <u>each car must be owned by exactly one person.</u>"

A. X: ═══ and Y: ═══
B. X: ─── and Y: →
C. X: ← and Y: ═══
D. X: ═══ and Y: →

Step 2.3. Identify total/partial participation of the relationship.

Car ═══ owns → Person

Full / partial participation

Full participation !
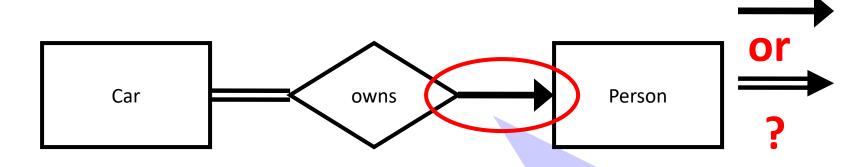**Answer:** An entity in the "Car" entity set must participate in this relationship.
(i.e. Each car MUST be owned by exactly one owner.)

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Question 1a

- "A person can own a number of cars, but each car must be owned by exactly one person."

A. X: ═══ and Y: ═══
B. X: ─── and Y: →
C. X: ← and Y: ═══
D. X: ═══ and Y: →

Step 2.3. Identify total/partial participation of the relationship.
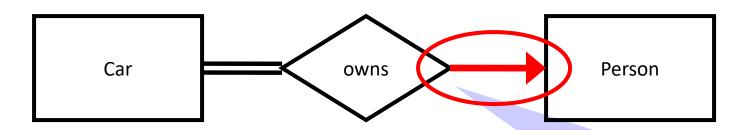

or

?

Full / partial participation

Full / Partial participation?
Question: An entity in the "Person" entity set must participate in this relationship? (i.e. Each person must own a car?)

Question 1a

"A person can own a number of cars, but each car must be owned by exactly one person."

```
A.  X: ══           and  Y: ══
B.  X: ──           and  Y: →
C.  X: ←            and  Y: ══
D.  X: ══           and  Y: →
```

Step 2.3. Identify total/partial participation of the relationship.

Car ══════ ⟨ owns ⟩ → Person

Full / partial participation

Partial participation !
Answer: An entity in the "Person" entity set **may/may not** participate in this relationship.
(i.e. Not all people own a car.)
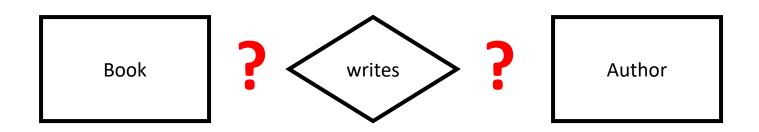
Question 1b (2min)

- "A book is written by one or more authors. In our database, we only keep the information of authors who have written some books in our database."
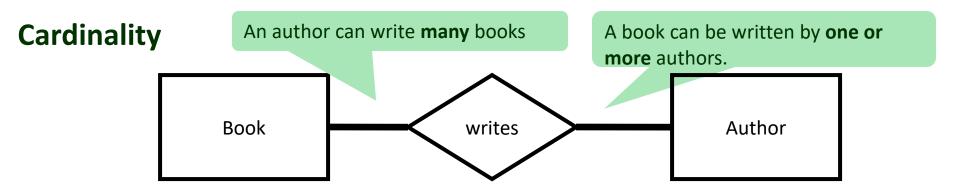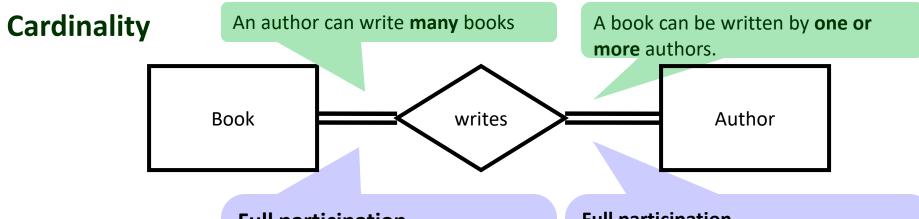
Book **?** writes **?** Author

Question 1b

- "A book is written by one or more authors. In our database, we only keep the information of authors who have written some books in our database."

Cardinality

An author can write **many** books

A book can be written by **one or more** authors.

Book — writes — Author

Question 1b

🔵 "A book is written by one or more authors. In our database, we only keep the information of authors who have written some books in our database."

Cardinality

An author can write **many** books

A book can be written by **one or more** authors.

| Book | writes | Author |

Full / partial participation
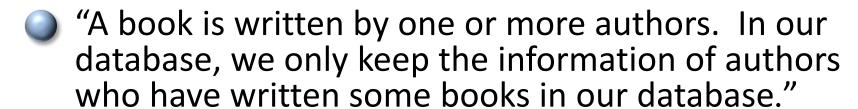
Full participation
An entity in the "Book" entity set must participate in this relationship.
(i.e. Each book **is written by** one or more authors.)
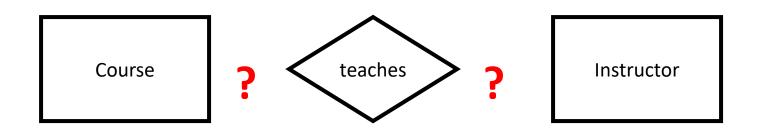
Full participation
An entity in the "Author" entity set must participate in this relationship.
(i.e. We only keep the info. of those authors who have written some books.)

Question 1c (2min)

- "Each course must be taught by an instructor. An instructor must teach at least one course."

| Course | ? | teaches | ? | Instructor |

Question 1c

"Each course must be taught by an instructor. An instructor must teach at least one course."

Cardinality

Each instructor can teach **many** courses.

Each course must be taught by **one** instructor.

Course — teaches → Instructor

Question 1c

- "Each course must be taught by an instructor. An instructor must teach at least one course."
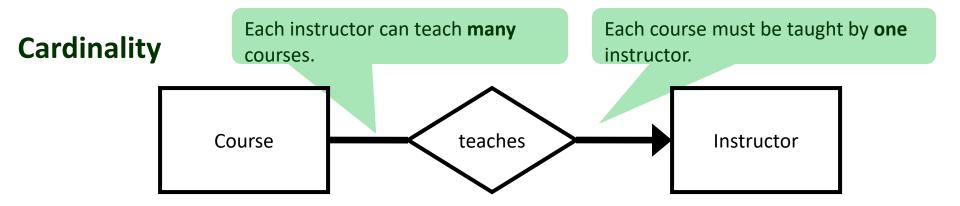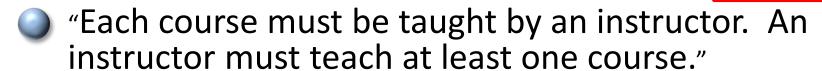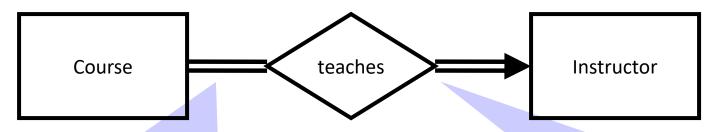
Cardinality

Full / partial participation

Full participation
An entity in the "Course" entity set must participate in this relationship.
(i.e. Each course **must be** taught by an instructor.)

Full participation
An entity in the "Instructor" entity set must participate in the relationship.
(i.e. Each instructor **must teach** at least one course.)

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Question 4

Weak
Entity Set

Question 4 (3min)

- You are required to record course name and course code for the courses. A course may hold some tutorials. For each tutorial, we need to store the tutorial number (e.g., tutorial 1 of course CSIS0278B), the date and venue.

Step 1.1. Identify the entity & entity sets.

Course		Tutorial

Question 4

- You are required to record course name and course code for the courses. A course may hold some tutorials. For each tutorial, we need to store the tutorial number (e.g., tutorial 1 of course CSIS0278B), the date and venue.
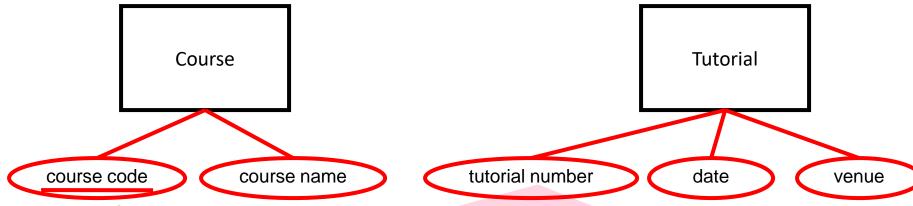
Step 1.2. Identify the attributes / primary key of the entity sets.


```
Course: course code, course name
Tutorial: tutorial number, date, venue
```

course_code uniquely identify each entity in the "Course" entity set. We use it as the primary key!

tutorial_number **CANNOT** uniquely identify each entity in the "Tutorial" entity set!
E.g. "tutorial 1" of the C0278A course, "tutorial 1" of the C1119 course…etc. It is only a **discriminator** (partial key)!

Question 4

- You are required to record course name and course code for the courses. A course may hold some tutorials. For each tutorial, we need to store the tutorial number (e.g., tutorial 1 of course CSIS0278B), the date and venue.

Step 1.3. Identify weak entity set (if any).

Weak entity set !

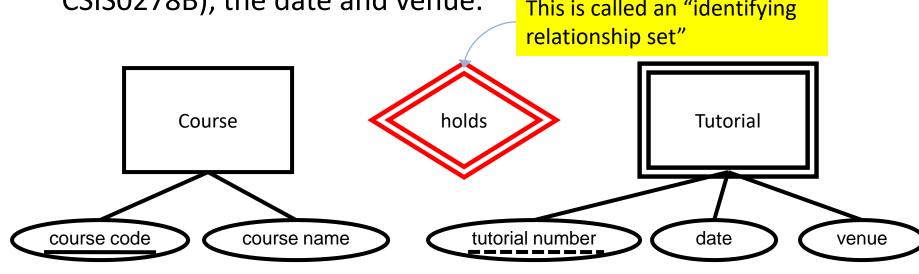Discriminator (partial key)

Course

course code   course name

tutorial number   Tutorial   date   venue

tutorial_number **CANNOT** uniquely identify each entity in the "Tutorial" entity set!
E.g. "tutorial 1" of the C0278A course, "tutorial 1" of the C1119 course…etc. It is only a **discriminator** (partial key)!

Question 4

- You are required to record course name and course code for the courses. A course may hold some tutorials. For each tutorial, we need to store the tutorial number (e.g., tutorial 1 of course CSIS0278B), the date and venue.

This is called an "identifying relationship set"

Course   holds   Tutorial

course code   course name   tutorial number   date   venue

💡 **Step 2.1. Identify the relationships and relationship sets.**

Question 4

- You are required to record course name and course code for the courses. A course may hold some tutorials. For each tutorial, we need to store the tutorial number (e.g., tutorial 1 of course CSIS0278B), the date and venue.
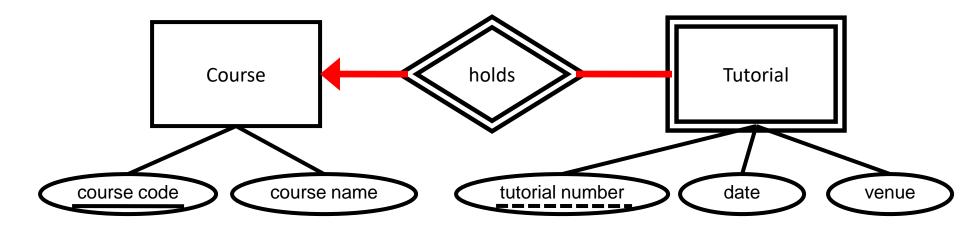

💡 **Step 2.2. Identify the cardinality of the relationship.**
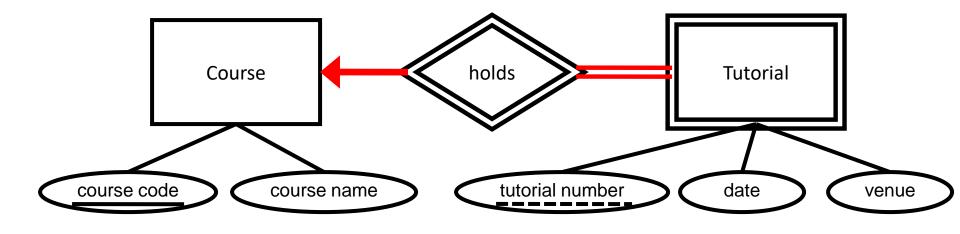
Question 4

- You are required to record course name and course code for the courses. A course may hold some tutorials. For each tutorial, we need to store the tutorial number (e.g., tutorial 1 of course CSIS0278B), the date and venue.

Step 2.3. Identify total/partial participation of the relationship.

Past paper Questions

Question 5 (5min)

- You are asked to design a database for a small IT company. Each employee of the company has at least one of the special IT skills that the company needs. The description of the special IT skills that the company needs will be stored in the database. The name and start date of employment will be recorded for each employee. The database would also keep track on the jobs information. Employee would be assigned to work on one or more jobs. The job description and time estimation for the job duration would also be recorded.

Step 1.1. Identify the entity & entity sets.

Employee

IT Skill

Job

Question 5

You are asked to design a database for a small IT company. Each employee of the company has at least one of the special IT skills that the company needs. The description of the special IT skills that the company needs will be stored in the database. The name and start date of employment will be recorded for each employee. The database would also keep track on the jobs information. Employee would be assigned to work on one or more jobs. The job description and time estimation for the job duration would also be recorded.

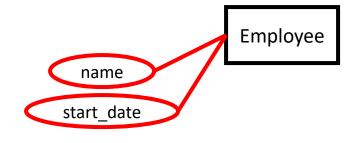## Step 1.2. Identify the attributes / primary key of the entity sets.
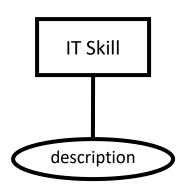
Employee

IT Skill

description

Job

Question 5

You are asked to design a database for a small IT company. Each employee of the company has at least one of the special IT skills that the company needs. The description of the special IT skills that the company needs will be stored in the database. The name and start date of employment will be recorded for each employee. The database would also keep track on the jobs information. Employee would be assigned to work on one or more jobs. The job description and time estimation for the job duration would also be recorded.

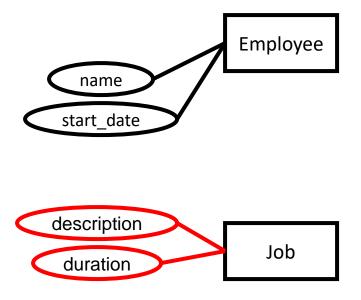**Step 1.2. Identify the attributes / primary key of the entity sets.**

Question 5

You are asked to design a database for a small IT company. Each employee of the company has at least one of the special IT skills that the company needs. The description of the special IT skills that the company needs will be stored in the database. The name and start date of employment will be recorded for each employee. The database would also keep track on the jobs information. Employee would be assigned to work on one or more jobs. The job description and time estimation for the job duration would also be recorded.

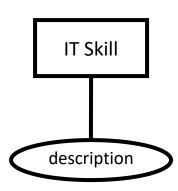## Step 1.2. Identify the attributes / primary key of the entity sets.

Question 5

You are asked to design a database for a small IT company. Each employee of the company has at least one of the special IT skills that the company needs. The description of the special IT skills that the company needs will be stored in the database. The name and start date of employment will be recorded for each employee. The database would also keep track on the jobs information. Employee would be assigned to work on one or more jobs. The job description and time estimation for the job duration would also be recorded.

Step 1.2. Identify the attributes / primary key of the entity sets.
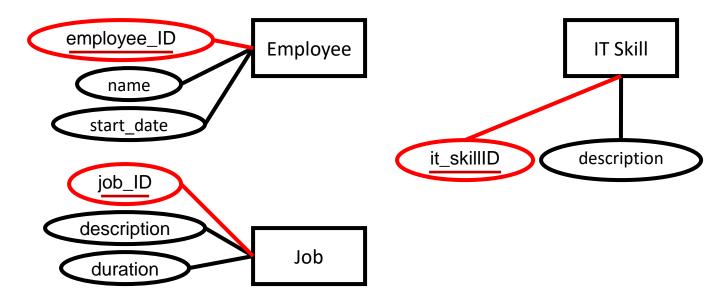
Question 5

You are asked to design a database for a small IT company. Each employee of the company has at least one of the special IT skills that the company needs. The description of the special IT skills that the company needs will be stored in the database. The name and start date of employment will be recorded for each employee. The database would also keep track on the jobs information. Employee would be assigned to work on one or more jobs. The job description and time estimation for the job duration would also be recorded.
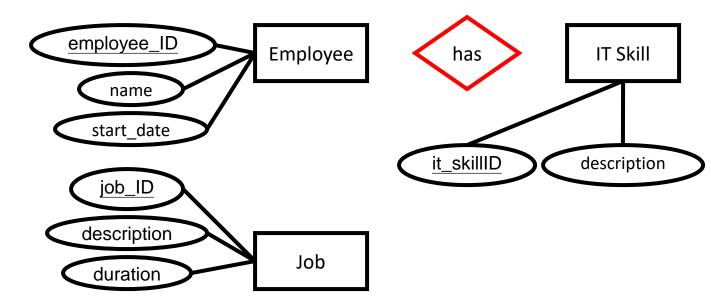
Step 2.1. Identify the relationships and relationship sets.

Question 5

You are asked to design a database for a small IT company. Each employee of the company has at least one of the special IT skills that the company needs. The description of the special IT skills that the company needs will be stored in the database. The name and start date of employment will be recorded for each employee. The database would also keep track on the jobs information. Employee would be assigned to work on one or more jobs. The job description and time estimation for the job duration would also be recorded.
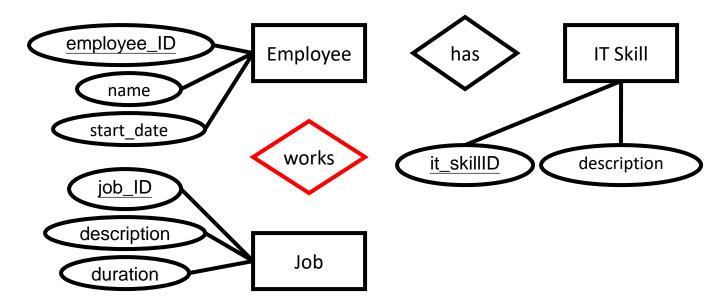
Step 2.1. Identify the relationships and relationship sets.

Question 5

You are asked to design a database for a small IT company. <u>Each employee of the company has at least one of the special IT skills that the company needs.</u> The description of the special IT skills that the company needs will be stored in the database. The name and start date of employment will be recorded for each employee. The database would also keep track on the jobs information. Employee would be assigned to work on one or more jobs. The job description and time estimation for the job duration would also be recorded.
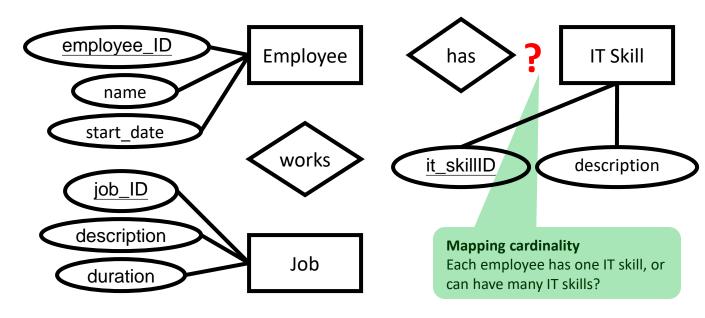
Step 2.2. Identify the cardinality of the relationship.

employee_ID — name — start_date — Employee — has — **?** — IT Skill

it_skillID — description

works

job_ID — description — duration — Job

Mapping cardinality
Each employee has one IT skill, or can have many IT skills?

Question 5

You are asked to design a database for a small IT company. <u>Each employee of the company has at least one of the special IT skills that the company needs.</u> The description of the special IT skills that the company needs will be stored in the database. The name and start date of employment will be recorded for each employee. The database would also keep track on the jobs information. Employee would be assigned to work on one or more jobs. The job description and time estimation for the job duration would also be recorded.
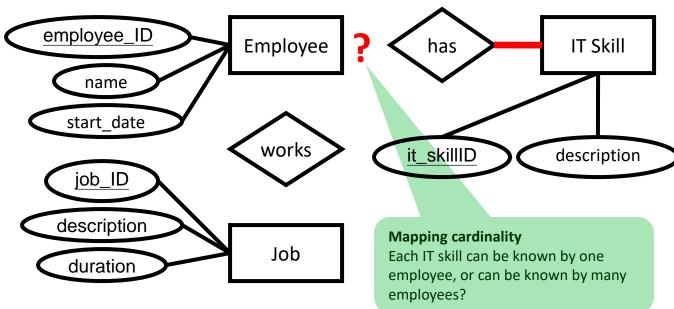
Step 2.2. Identify the cardinality of the relationship.

Mapping cardinality
Each IT skill can be known by one employee, or can be known by many employees?

Question 5

You are asked to design a database for a small IT company. <u>Each employee of the company has at least one of the special IT skills that the company needs.</u> The description of the special IT skills that the company needs will be stored in the database. The name and start date of employment will be recorded for each employee. The database would also keep track on the jobs information. Employee would be assigned to work on one or more jobs. The job description and time estimation for the job duration would also be recorded.
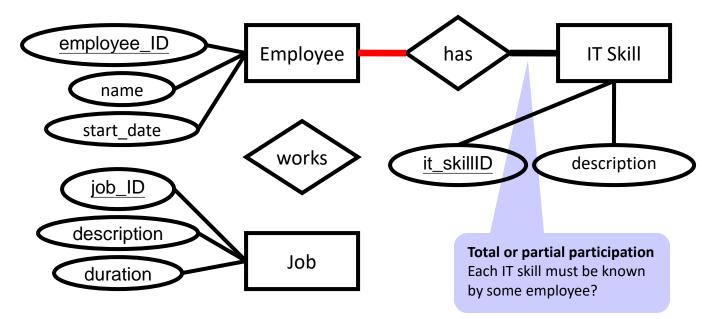
Step 2.3. Identify total/partial participation of the relationship.

Total or partial participation
Each IT skill must be known by some employee?

Question 5

You are asked to design a database for a small IT company. <u>Each employee of the company has at least one of the special IT skills that the company needs.</u> The description of the special IT skills that the company needs will be stored in the database. The name and start date of employment will be recorded for each employee. The database would also keep track on the jobs information. Employee would be assigned to work on one or more jobs. The job description and time estimation for the job duration would also be recorded.
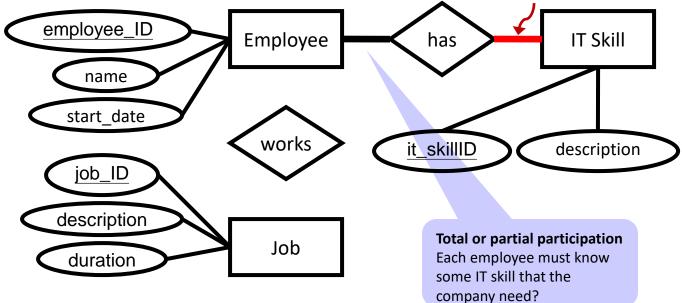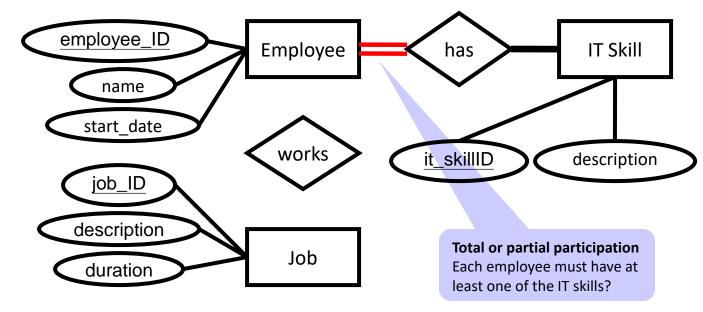
*Note: It is not clear whether it is full/partial participation here. Please **state your assumption**.
E.g., **We assume partial participation**, which means that NOT every IT skill that the company need is known by employee.

Total or partial participation
Each employee must know some IT skill that the company need?

Question 5

You are asked to design a database for a small IT company. <u>Each employee of the company has at least one of the special IT skills that the company needs.</u> The description of the special IT skills that the company needs will be stored in the database. The name and start date of employment will be recorded for each employee. The database would also keep track on the jobs information. Employee would be assigned to work on one or more jobs. The job description and time estimation for the job duration would also be recorded.

Total or partial participation
Each employee must have at least one of the IT skills?
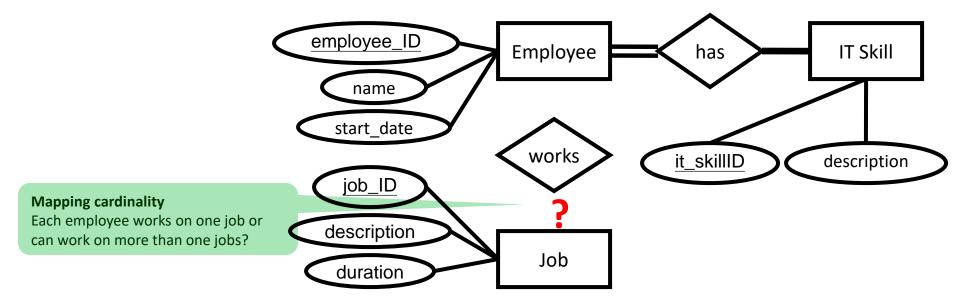
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You are asked to design a database for a small IT company. Each employee of the company has at least one of the special IT skills that the company needs. The description of the special IT skills that the company needs will be stored in the database. The name and start date of employment will be recorded for each employee. The database would also keep track on the jobs information. Employee would be assigned to work on one or more jobs. The job description and time estimation for the job duration would also be recorded.

Step 2.2. Identify the cardinality of the relationship.

Mapping cardinality
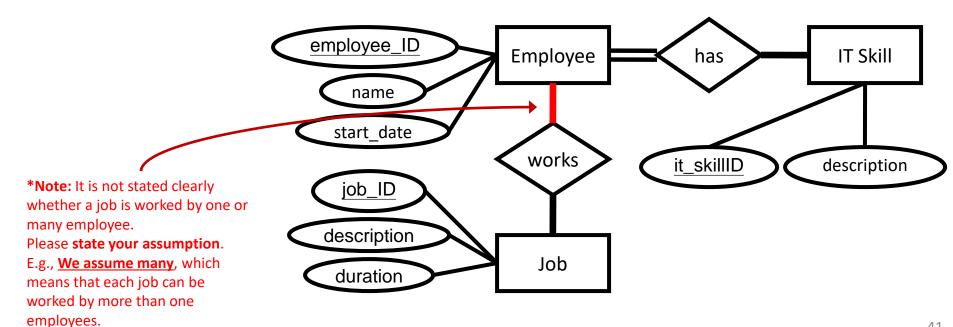Each employee works on one job or can work on more than one jobs?

Question 5

You are asked to design a database for a small IT company. Each employee of the company has at least one of the special IT skills that the company needs. The description of the special IT skills that the company needs will be stored in the database. The name and start date of employment will be recorded for each employee. The database would also keep track on the jobs information. Employee would be assigned to work on one or more jobs. The job description and time estimation for the job duration would also be recorded.

Mapping cardinality
Each job can be "worked by" one employee or can be "worked by" many employees?

Question 5

You are asked to design a database for a small IT company. Each employee of the company has at least one of the special IT skills that the company needs. The description of the special IT skills that the company needs will be stored in the database. The name and start date of employment will be recorded for each employee. The database would also keep track on the jobs information. Employee would be assigned to work on one or more jobs. The job description and time estimation for the job duration would also be recorded.

*Note: It is not stated clearly whether a job is worked by one or many employee.
Please **state your assumption**.
E.g., **We assume many**, which means that each job can be worked by more than one employees.
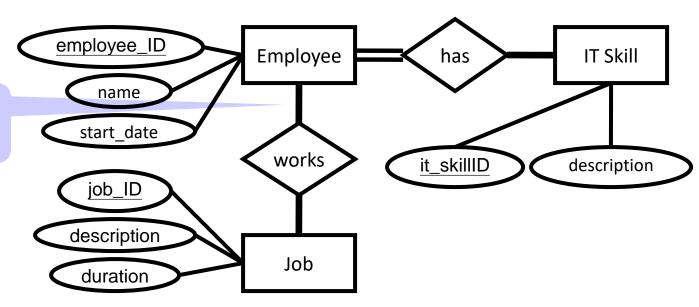
Question 5

You are asked to design a database for a small IT company. Each employee of the company has at least one of the special IT skills that the company needs. The description of the special IT skills that the company needs will be stored in the database. The name and start date of employment will be recorded for each employee. The database would also keep track on the jobs information. Employee would be assigned to work on one or more jobs. The job description and time estimation for the job duration would also be recorded.
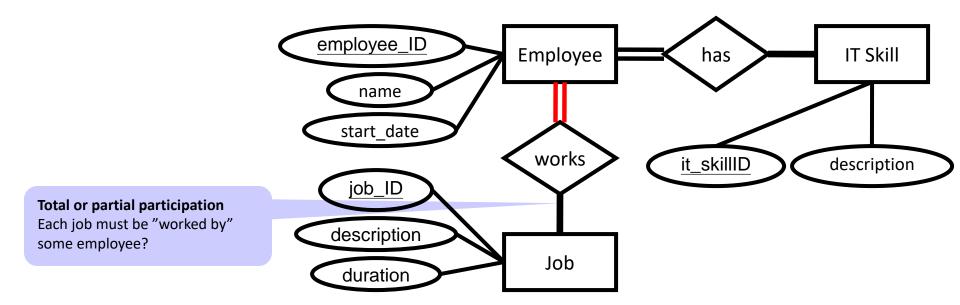
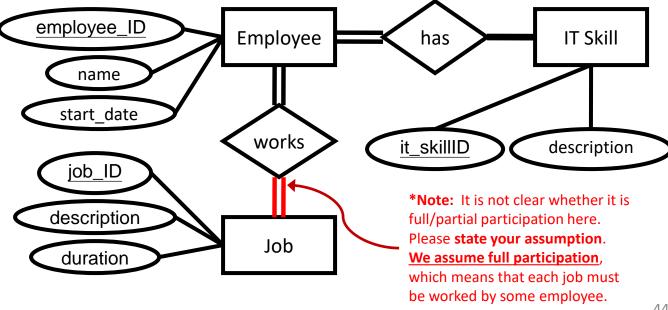**Step 2.3. Identify total/partial participation of the relationship.**

Total or partial participation
Each employee must work on some job?

Question 5

You are asked to design a database for a small IT company. Each employee of the company has at least one of the special IT skills that the company needs. The description of the special IT skills that the company needs will be stored in the database. The name and start date of employment will be recorded for each employee. The database would also keep track on the jobs information. Employee would be assigned to work on one or more jobs. The job description and time estimation for the job duration would also be recorded.

Total or partial participation
Each job must be "worked by" some employee?

Question 5

You are asked to design a database for a small IT company. Each employee of the company has at least one of the special IT skills that the company needs. The description of the special IT skills that the company needs will be stored in the database. The name and start date of employment will be recorded for each employee. The database would also keep track on the jobs information. Employee would be assigned to work on one or more jobs. The job description and time estimation for the job duration would also be recorded.

*Note: It is not clear whether it is full/partial participation here. Please **state your assumption**. **We assume full participation**, which means that each job must be worked by some employee.

Question 6 (10min)

- **You are required to design a database to store the information of the soccer association.**

  - The **ID** of the team, **name**, **address** and **phone number** should be stored for each soccer team.

  - Each soccer player must belong to a team with a "**playerNumber**", **salary** and **description**.

  - Note that playerNumber is not unique. To identify a soccer player, the playerNumber has to be used together with the ID of the team.

  - The soccer teams can have some sponsors.

    - The **name** and the **phone number** should be recorded for each sponsor.

    - A team can have more than one sponsor, and a sponsor can support more than one team.

    - We only store the information of those sponsors who have sponsored some team.

    - The **starting sponsor date** between a particular sponsor and team should be noted.
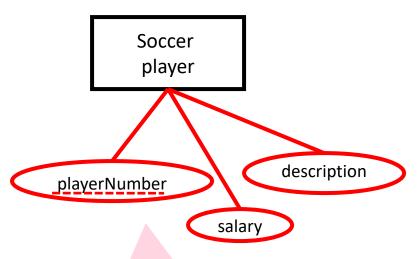
Question 6

Step 1.1. Identify the entity & entity sets.

Soccer player

Team

Sponsor

Question 6

💡 **Step 1.2. Identify the attributes / primary key of the entity sets.**
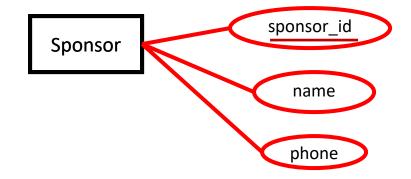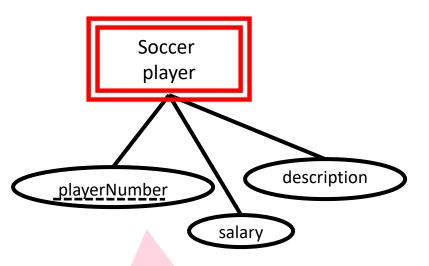

The playerNumber **cannot** uniquely identify the entities in the "Soccer player" entity set.
Here, we recognize that it is a **partial key**, and the use of **weak entity**.

Question 6

💡 **Step 1.3. Identify weak entity set (if any).**
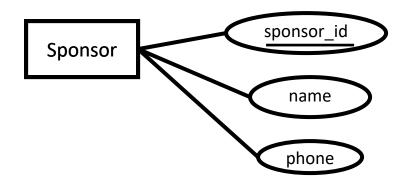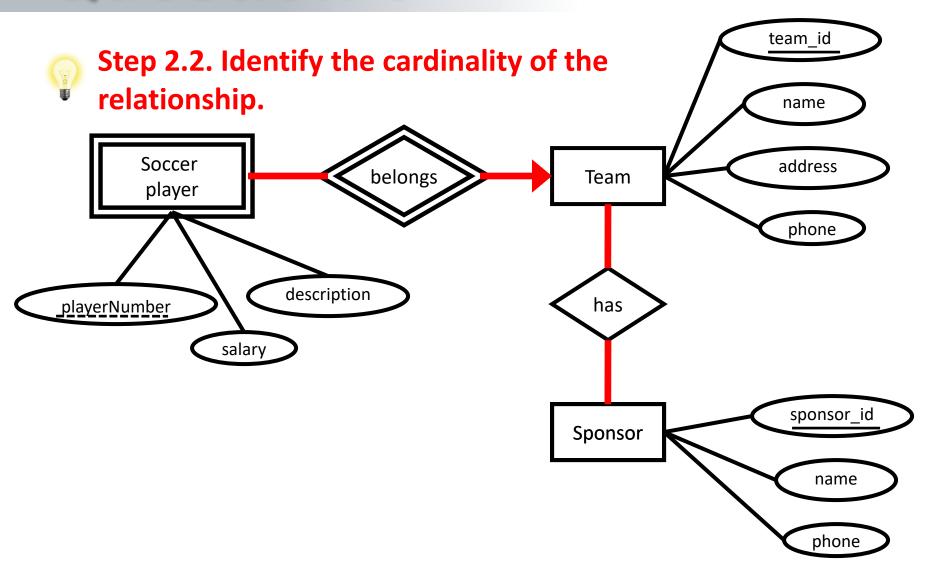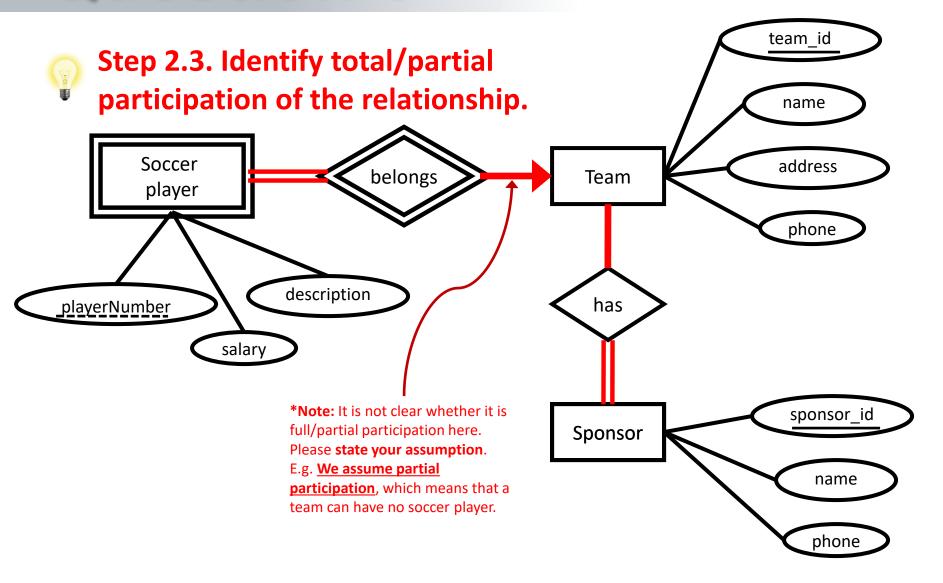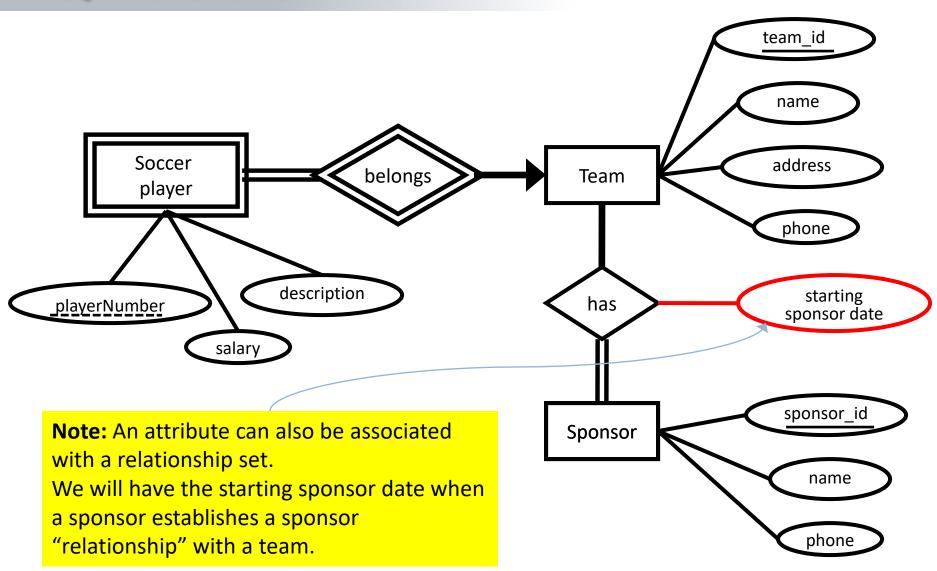

The playerNumber **cannot** uniquely identify the entities in the "Soccer player" entity set.
Here, we recognize that it is a **partial key**, and the use of **weak entity**.

Question 6

Step 2.1. Identify the relationships and relationship sets.

Question 6

Step 2.2. Identify the cardinality of the relationship.

Question 6

💡 **Step 2.3. Identify total/partial participation of the relationship.**

*Note: It is not clear whether it is full/partial participation here. Please **state your assumption**. E.g. **We assume partial participation**, which means that a team can have no soccer player.

Question 6

Note: An attribute can also be associated with a relationship set.
We will have the starting sponsor date when a sponsor establishes a sponsor "relationship" with a team.

Past Assignments
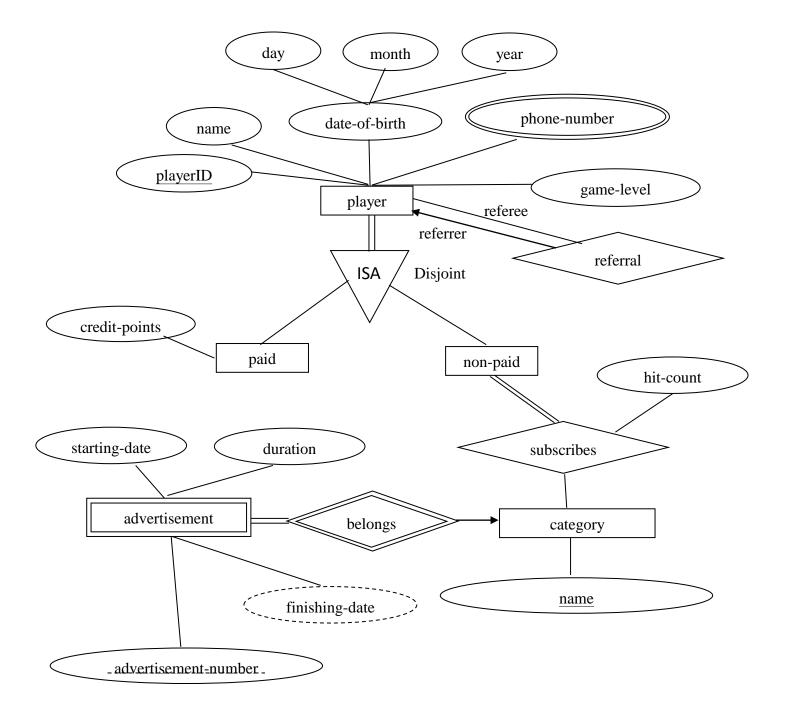
Question 7 [30min]

more on next slide

- CreativeGames, a game design company is designing a mobile app called *HK Online*. As the chief designer of *HK Online*, you are going to design a database system to maintain information for the game. The scenario is described below.

- **There is a player information system**

  - For each **player**, his/her name, phone number(s), date of birth (compose of day, month and year) are recorded.

  - Each player of HKOnline has a unique ID (called *playerID*).

  - Player must belong to either **paid players** or **non-paid players** (but not both).

  - A player can refer another player to HK Online. We will keep track of the referral information. A player can be referred by none or one player only.

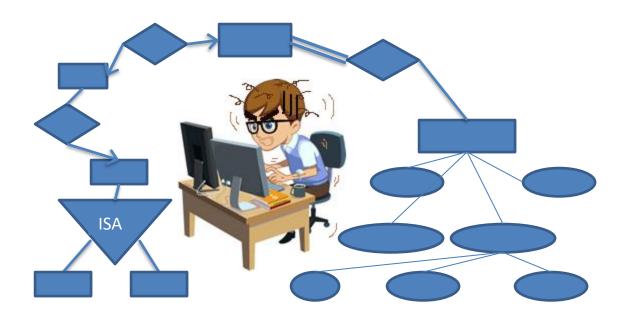 - For paid players his/her credit points will be stored.

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There is an advertisement system

- For each **advertisement**, we store the advertisement number, starting date, duration and the finishing date.

- The finishing date can be derived from the starting date and duration.

- Each **advertisement** belongs to one and only one **category**. (A category can have no advertisement)

- Each **category** consists of a name, which serves as the identifier of the category.

- There is no identifier for **advertisement** and they have an advertisement number which is unique among the **category** it belongs to, but not globally among all advertisements.

All non-paid players will subscribe to a **category** in the advertisement system. We will maintain the hit count of each non-paid player in their subscription. **End of question.**

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We wish you enjoy learning Database in this course."

Tutorial ER Diagram

END

COMP3278B

Introduction to Database Management Systems

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