

Practical 4

ER Model

Learning objectives

For a given scenario,

1. Identify meaningful entities, attributes and keys of the entities.
2. Identify meaningful relationships among entities.
3. Create suitable description for entities, attributes, relationships and constraints among entities.
4. Draw an ER diagram using Chen's notation (on paper).
5. Draw an ER diagram using IE notation (on paper).

Setting-up

- This practical will not use MySQL and you will draw diagrams in paper.
- Save your description files and diagrams (as photos of the diagrams drawn on paper or digitally created diagrams) of this practical in DBS/Prac04 directory. If Prac04 directory is not there, create a one.
- The exercises in this practical require you to design a database that matches the requirements given using ER modelling.

1. Creating ER diagrams - A simple airport scenario

Design a database using an ER model for an airport services company that handles passengers departing from an airport, given the following information:

- The database will include information about passengers (ticket number, name, phone number), flights (flight number, departure date, departure time), seats on the flights (class, seat number), and departure gates (gate number, intercom number).
- Each passenger taking a flight is identified by a unique ticket number, each seat on a flight by a unique seat number (but a given seat number can be present on many flights), and each gate by a unique gate number. Each flight has a flight number which is unique for the route travelled, but there can be a number of instances of this flight on any given day.
- The number of bags and the check in time are to be recorded for each passenger who has checked in for a flight.
- Each passenger taking a flight is assigned at most one seat on the flight and a seat can be assigned to at most one passenger. A particular flight on a given date departs from exactly one gate while several flights may depart from a gate on any given day.

To construct the ER model, please follow the steps below:

You may do step1 to step 3 in a computer file or on a paper.

Step 4 to step 5 are to be done on paper.

1. Identify the entity sets, their keys and attributes; record this information in a tabular form (similar to the table below).

Entity Sets	Keys	Other Attributes

2. Identify the relationship sets, their participating entity sets and attributes if any in a tabular form (similar to the table below).

Relationship sets	Between which entity Sets	Attributes of relationship set

3. Identify the cardinality and participation constraints (e.g., one-many, many-many, etc., exactly one, one or more etc.); record this information in tabular form (similar to the tables below).

Make note of any assumptions you made, if sufficient information is not provided.

Relationship sets	Cardinality Constraints	Participation/other constraints

4. Draw the ER diagram using the Chen's notation as discussed in the Lecture 3.
5. Convert the ER diagram to IE notation as discussed in the Lecture 3.

Discuss your diagrams with the others/ tutor and check them to ensure their correctness.

2. Creating ER diagrams – Car racing competition

(This question is a revised scenario from the 2015 mid-semester test.)

The company 'Formula 30' is looking to start a new car racing competition. They hire you to design a database to track their race information. The following information is provided to you by Formula 30.

- The database will include information about drivers who are competing in races. Information such as first name, last name, web page, address, phone number and the racing licence number of each driver needs to be stored.
- Races would be held in different countries and each race has a name. Drivers play in teams and team name, sponsor, contact name, contact address, contact phone are to be recorded. Each car is identified by a unique number that must be clearly displayed on various positions on the car. Make of the car is also important. Races and teams have unique codes, specifically designed to identify them.
- Each team must have a contact person, who may be a driver but could be someone else associated with the team; each such contact must have their unique name, address and phone number recorded.

Use the same steps used in the Airport scenario to design the database with an ER diagram.

3. Creating ER diagrams – Patients database

A database of patients at a doctors' surgery is to be designed to record the following information:

- Each patient, with a patient identification number, first name, surname and date of birth;
- Each doctor with registration number, surname, first name, specialisation and graduation date;
- At every consultation a doctor meets with a patient at a given time and date. At the consultation the doctor may diagnose a patient to have one or more illnesses, and prescribe one or more medicines to the patient;
- For each medicine, the identification code, the name and cost;
- For each illness, an identifying code, a name and a description.
- A patient may have a number of consultations, but the patient can have only one consultation at any time.

Use the same steps used in the Airport scenario to design the database with an ER diagram. Make

You may do the following additional tasks to practice more on ER modelling.

4. Additional tasks: Creating ER diagrams – residents of a city

Consider the following information to be stored about the residents of a city:

- Each resident is identified by a citizen ID, and has name, gender and date of birth.
- A resident is either born in this city or born elsewhere. For a resident born in this city, the birth registration number is to be stored; for anyone not born in this city, the place, state and country of birth are to be stored, but not the birth registration number.
- Each resident belongs to one and only one family. A family is identified by a family ID, and has a name and an address. A family has one and only one head, and may have zero or more other members.

Use the steps 1- 4 in the Airport scenario to design the database with an ER diagram.

5. Additional task: Creating ER diagrams – residents of a city

You are part of a team preparing software, for a client, Internal Ventures, who on-sell bus and train tours. You are to design and implement the database that will store much of their information.

- The database will include information about tours. Each tour has a name, a cost, a starting place and destination as well as a start and end date and time. Each bus tour also has the capacity of the bus and each train tour has the number of carriages in the train. None of this information is guaranteed to be unique.
- The database also tracks billing information of customers, including the name, address and credit card number and expiry date. None of this information is necessarily unique.
- A purchase by a customer results in a booking for a number of passengers. The name, address and telephone number of each passenger is recorded. Passengers must also provide their Medicare number and digit in case of medical emergencies. (The digit is the number before the name on the Medicare card.) The system verifies Medicare numbers and doesn't allow the same number and accompanying digit for two different passengers.

Any booking of a tour made by a customer is recorded, including the amount of discount given (if any) and the number of places required. Each booking is only associated with a single customer account, though. A customer can have many bookings at a time.

Use the steps 1- 4 in the Airport scenario to design the database with an ER diagram.

6. Additional task: using software tools to draw an ER diagram

There are many free tools/ tools with community edition available for creating ER diagrams. Following are some easy to use online tools

- diagrams.net (<https://app.diagrams.net/>) (Note:former draw.io application)
- Lucidcharts (<https://www.lucidchart.com/>)
- Visual paradigm (<https://online.visual-paradigm.com/>)
- MySQL Workbench

Use these or any other software tool to recreate at least one of your diagrams. There is no need to submit this work as part of your practical work.

7. Submitting your work

All preliminary work you have done (entity identification table, relationship identification table etc.) and the ER diagrams created are to be submitted as prac04 work.

Label each of your preliminary work and ER diagrams with the task name such as 'Task 1- ER of Patience database' and take photos of them. You may have many pages or workings.

Create a sub directory for each task under Prac04 directory and add the images related to the task to that directory.

Zip your Prac04 directory and upload it to Blackboard under 'Assessments/In Class Practical Submissions'

Note 1: Identifying entities and relationships

- Sometimes it's not obvious whether something is an entity or a relation.
- The first thing to check for is whether one of the attributes listed is itself another entity or relation. At the early design stage, we generally want to avoid having other entities as attributes. This means that if you have more than one attribute for an entity that matches another entity in the table, you have probably confused a relationship for an entity.
- One attribute from another relation possibly means that you have a weak relation. For example, if you have author as an attribute for Writes and also have an Authors relation, then Writes is probably a relationship rather than an entity. You may want to review the relevant parts of Lecture 3 and the textbook if you're not confident with this.

Note2: Extracting only relevant information from a scenario

- Some of the questions come from mid-semester tests, and as such are good practice for you. However, the questions include some information that you don't yet need. Most English-language questions also contain irrelevant information, but that is also the case in tests and exams; you need to learn what parts are relevant. When talking to a client with little or no technical background, this skill will be very important.

Check whether you have achieved learning outcomes:

I am confident that for a given scenario related to a real world situation I can,

Identify entities and attributes	✓
Identify relationships (unary, binary, ternary) and any attributes of them	
Identify the cardinality (one-one, one-many, many-many) and the participation (fully or partial participation) of relationships	
Design a suitable ER diagram using Chen's notation	
Design a suitable ER diagram using IE notation	
Make realistic assumptions when managing incomplete information in my database designs	

Please refer lecture slides, reading materials, and online resources and attempt again, if all the learning outcomes were not achieved. Ask your tutor and get help if you need any clarification.

It's always a good practise to try to finish the practical of a particular week, before attempting the next practical worksheet as your work will be building upon the previous week's tasks.