Assignment 1. Conceptual Data Modelling and Database Design

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Description
In this assignment, you will design two Entity-Relationship (ER) models and analyze two ER examples in order to see your understanding of the concepts introduced in Lecture 2.

Submission
Your submission should include solutions to all tasks presented in this assignment using the assignment template provided in Moodle. Submit a report in PDF format on Moodle. The ER diagrams should not be drawn by hand. If the diagrams are too big to fit into a PDF file, please submit the diagrams as images.

Recommended Online Diagram Editor: https://app.diagrams.net/
Learning Material: Lecture 2

Task 1. The Hospital database (25 points)

Considering the following requirements and constraints:

A. The hospital is organized into departments (DEPARTMENT), and each department has a unique identifier, a name, and a particular member (physician) who is the head of the department.
B. The department consists of a number of physicians (PHYSICIAN), patients (PATIENT), and nurses (NURSE). The physician has an identifier (unique), name, phone number, and address. The physician makes an appointment (APPOINTMENT) to examine a patient. After the examination of the patient, the physician can appoint a treatment (PROCEDURE) with date and notes, and prescribe medication (MEDICATION) with prescription duration (start and end date).
C. The patient has an id (unique), name (first name and last name), address, phone, and insurance code.
D. The patient can take a test (TEST) at the hospital with a recorded id, date, type (e.g., COVID test, allergy test, etc.), and test result.
E. The appointment has information about the appointment, patient, nurse, and physician who made the appointment, with a start date and end date (when the appointment is finished), as well as the examination room (ROOM). The room has a unique number, type, and availability status (Available/Busy).
F. The nurse has an id (unique), name, phone number, and specialization (e.g., pediatric nurse, oncology nurse). The nurse can be on call to a specific examination room with a tracked start and end time of the call.
G. Medication has id(unique), atc code, name, type (e.g., pills, drops, cream), and description.
H. The procedure prescribed to the patient has a code(unique), name, and cost.

1.1 Identify all entities and their attributes from the description of database requirements using the following Table template: (5 points***)***

Entity	Attribute	Attribute Type	Key Attribute	Value type of attributes (type, NULL/NOT NULL, Unique)
Entity 1	Attribute 1	Simple	true	Unique, String, not null
	Attribute 2	Composite	false	Integer, not null
	Attribute 3	Multivalued	false	String, null
…	…	….	…	….

1.2 Identifying the relationship between entities defined in Task 1.1 using the following table template (10 points***):***

Entity A	Relationship name	Entity B	Cardinality Ration (1:1,1:N,N:1,M:N)	Attribute of Relationship	Justify your decision
Entity 1	PRESCRIBES	Entity 2	1:1	None	
..	…	…	…	…	

1.3 Design an ER schema for the hospital database based on information provided in task 1, and entities defined in 1.1 with relationships defined in 1.2. (10 points***)***
The ER schema should contain entities with their corresponding attributes, key attributes of each entity, only ***binary*** relationships, their corresponding cardinality ratio, and participation constraints (total/partial).

Task 2 Conference Review Database (25 points)

Considering a conference review database in which researchers submit their research papers for consideration. Reviews by reviewers are recorded for use in the paper selection process. The database system caters primarily to reviewers who record answers to evaluation questions for each paper they review and make recommendations regarding whether to accept or reject the paper. The data requirements are summarized as follows:

A. Authors (AUTHOR) of papers are uniquely identified by email, name (first and last name), affiliation, and country. The affiliation is in which Institution (or University) the research was conducted and consists of department name, university name, and country, for example: “Computer Science Department, Linnaeus University, Sweden”.
B. Each paper (PAPER) is assigned a unique identifier by the system and is described by a title, abstract, keywords, year, and the name of the electronic file containing the paper (e.g., paper145.pdf).
C. A paper may have multiple authors, but one of the authors is designed as a corresponding author (or contact author). The corresponding author is the main/lead author of the paper.
D. Reviewers (REVIEWER) of papers are uniquely identified by email address. Each reviewer’s first and last name, phone number, affiliation, and topics of interest are also recorded (e.g., Data Mining, eHealth, Information Visualization, Statistics, Image Processing, Neural Language Recognition, etc.)
E. Each paper is assigned between two and four reviewers. A reviewer rates each paper assigned to him or her on a scale of 1 to 10 in four categories: technical merit, readability, originality, and relevance to the conference.
F. Each review contains two types of written comments: one to be seen by reviewers only and the other feedback to the authors of the paper.
G. Reviewers can review 0 or more papers. An author can write 0 or more papers.

2.1 Identify all entities and their attributes from the description of Conference review database requirements using the following Table template (*5 points****):***

Entity	**Attribute**	**Attribute Type**	**Key Attribute**	**Value type (e.g., data type, min, max, the default value (if applicable/any), NULL/NOT NULL, Unique)**
Entity 1	Attribute 1	Simple	true	String, not null
	Attribute 2	Simple	false	Integer, Unique, not null
	Attribute 3	Multivalued	false	
…	…	…..	…	….

2.2 Identifying the relationship between entities defined in Task 2.1 using the following table template (10 points***):***

Entity A	**Participation Entity A**	**Relationship name**	**Participation Entity B**	**Entity B**	**Cardinality Ration (1:1,1:N, N:1,M:N)**	**Attribute of Relationship**	**Justify your answer**
Entity 1	Total	Reviewing	Partial	Entity 2	1:N	Comment	

2.3 Design an ER schema for the review database based on information provided in task 2, and entities defined in 2.1 with relationships defined in 2.2. (*10 points****)***

The ER schema should contain entities with their corresponding attributes, key attributes of each entity, ***binary*** relationships, their corresponding cardinality ratio, and participation constraints (total/partial). You are free to make additional assumptions if you feel that some information is missing. Make sure to **document all assumptions** that you make. Please justify your assumptions.

Task 3. Bank database (25 points)

Consider the ER diagram shown below for part of a BANK database. Each bank can have multiple branches, and each branch can have multiple accounts and loans. Provide answers on the following statements:

A. List all strong (nonweak) entities in the ER diagram (*5 points*)
B. Is there a weak entity? If so, give its name, partial key, and identifying relationship (owner entity) (*5 points*)
C. What constraints do the partial key and the identifying relationship (owner) of the weak entity have in this diagram? (*5 points*)
D. List the names of all relation (entity) and specify the (min, max) constraint using total/partial participation of an entity in a relationship (on both sides of the relation: left and right). Justify your answer. (*10 points*)

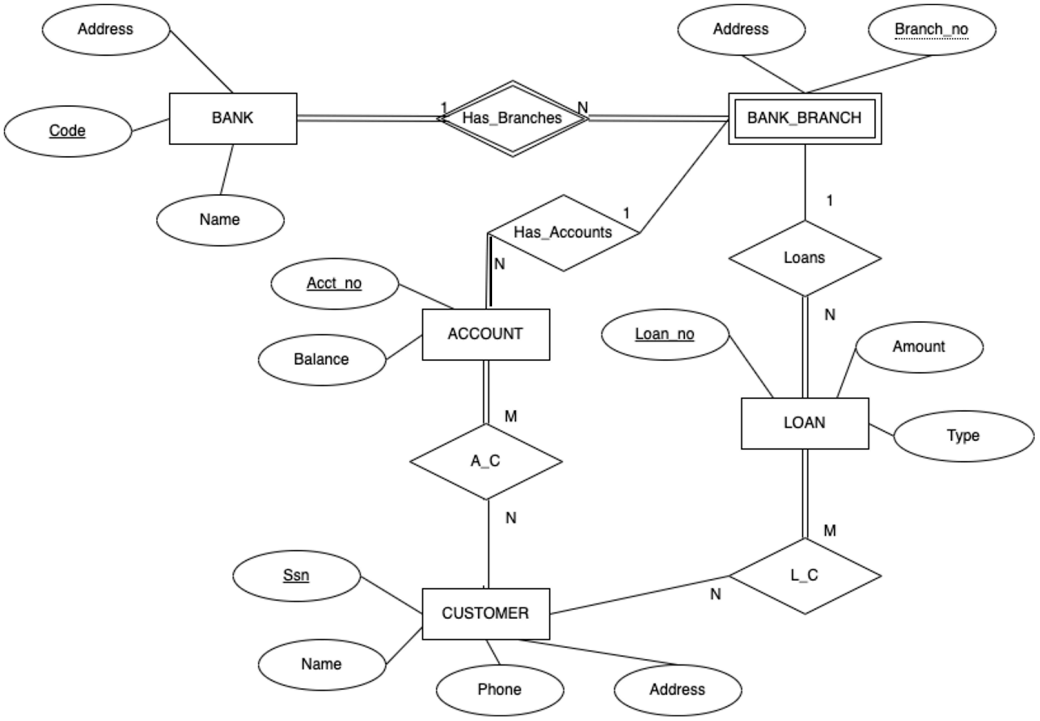

Figure 1. ER diagram for Bank database

Task 4. Airport Management database (25 points)

4.1 Given the constraints shown in the ER schema below, respond to the following statements with True, False, or Maybe.

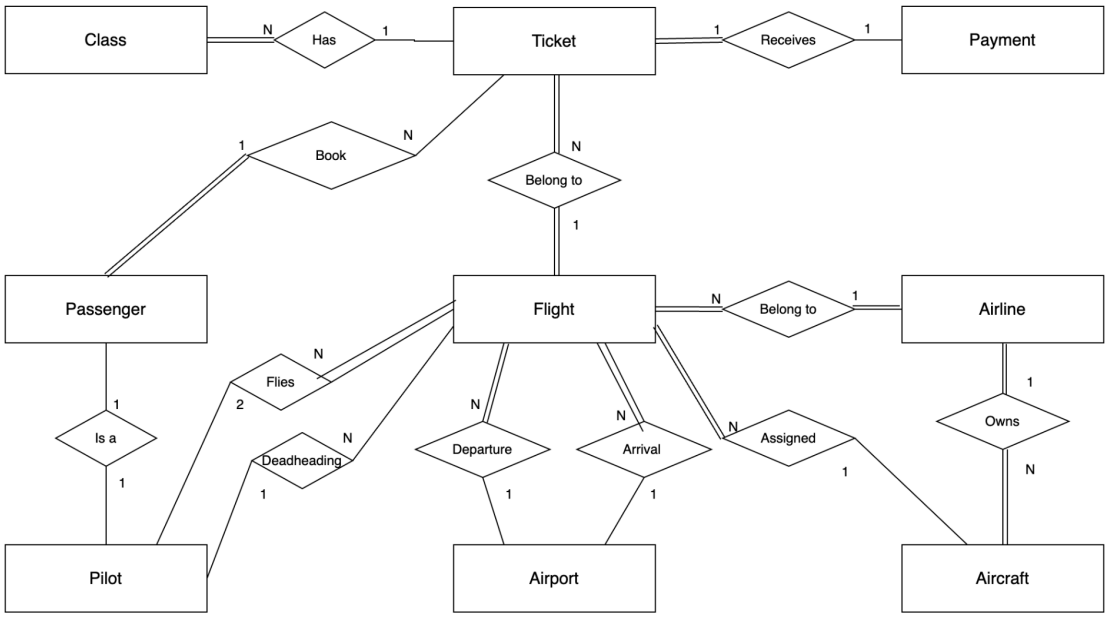

Figure 2 - Airport Management ER schema

Clarifications:

Class entity represents the ticket type, such as Economy, Business, Flex class, etc.
A daedheading relationship means when the pilot is on duty flights as a passenger to another airport for work mid-trip or to return to their domicile city after a trip.

1. Every pilot has been a passenger in some flight.
2. Every flight has at least one deadheading pilot.
3. Every flight has at least 2 pilots.
4. Every pilot has flown at least 2 times.
5. There are tickets that do not belong to any flight
6. Some airlines do not have flights
7. Some flights do not have assigned aircraft
8. Each flight has a departure and arrival airport assigned
9. A passenger can be a pilot
10. Passengers can buy one ticket for the flight
11. There are tickets that do not have a class type (Economy, Business, etc.)
12. There are some tickets without payment
13. There are some flights without tickets
14. There are some aircraft that are not assigned to a flight
15. Some airlines do not have any flights.