[1DV503] Database Technology and Modeling

Firas Moussa
School of Computer Science, Physics
and Mathematics, Linnaeus University, Sweden
fm222us@student.lnu.se

Task 1. The Hospital database (25 points)

1.1 Identify all entities and their attributes from the description of database requirements using the following Table template:

Entity	**Attribute**	**Attribute Type**	**Key Attribute**	**The value type of attribute (type, NULL/NOT NULL, unique)**
DEPARTMENT	Name	Simple	false	String, not null
	Department_ID	Simple	true	Int, not null, unique
	Head_Physician_ID	Simple	false	int, not null
PHYSICIAN	Physician_ID	Simple	True	Int, not null, unique
	Name	Composite	false	String, not null
	Phone_number	Simple	false	String, not null
	Address	simple	False	String, not null
APPOINTMENT	Appointment_ID	Simple	True	Int, not null, unique
	Examination_Date	Simple	False	Date, not null, unique
PATIENT	Patient_ID	Simple	True	Int, not null, unique
	Name	Composite	False	String, not null

	Address	Simple	False	String, not null
	Phone	Simple	False	String, not null
	Insuranse_Code	Simple	True	String, not null, unique
TEST	Test_ID	Simple	True	Int, not null, unique
	Test_Date	Simple	False	Date, not null
	Test_Type	Simple	False	String, not null
	Test_Results	Simple	false	String, not null
ROOM	Room_Number	Simple	True	Int, not null, unique
	Room_Type	Simple	false	String, not null
	Availability	Simple	false	String, not null
NURSE	Nurse_ID	Simple	True	Int, not null, unique
	Nurse_Name	Composite	False	String, not null
	Phone_Number	Simple	False	String, not null
	Specialization	Multivalued	False	String, not null
MEDICATION	Medication_ID	Simple	True	Int, not null, unique
	ATC_Code	Simple	True	String, not null, unique
	Medication_Name	Simple	False	String, not null
	Medication_Type	Simple	False	String, not null
	Description	Simple	False	String, not null
PROCEDURE	Procedure_Code	Simple	True	Int, not null, unique

	Procedure_Name	Simple	False	String, not null
	Cost	Simple	False	Int, not null

1.2 Identifying the relationship between entity sets using the following table template:

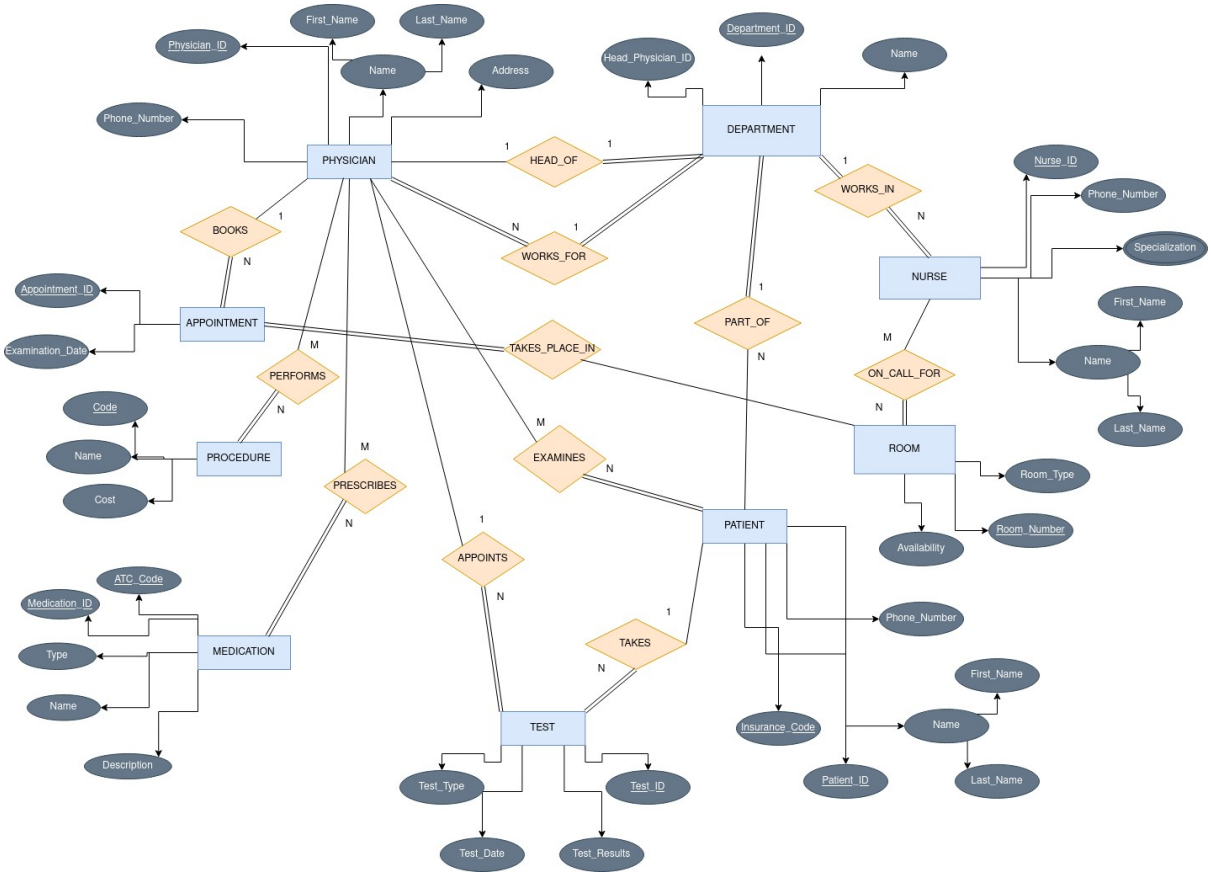
Entity A	**Relationship name**	**Entity B**	**Cardinality Ration (1:1,1:N, N:1,M:N)**	**Attribute of Relationship Types**	**Justify your decision**
DEPARTMENT	HEADS	PHYSICIAN	1:1	Head_Physician_ID	A department has one head physician, and a physician heads only one department.
PHYSICIAN	WORKS_FOR	DEPARTMENT	N:1	Physician_ID, Department_ID	A physician can work for only one department, a department can consist of multiple physicians.
NURSE	WORKS_IN	DEPARTMENT	N:1	Nurse_ID, Department_ID	A nurse can work for only one department, a department can consist of multiple nurses.
PATIENT	PART_OF	DEPARTMENT	N:1	Patient_ID, Department_ID	A patient can be a part of only one department, a department can consist of many patients.
PHYSICIAN	BOOKS	APPOINTMENT	1:N	Patient_ID, Appointment_	A physician makes multiple

				ID	appointments, but an appointment is made by one physician.
PHYSICIAN	PERFORMS	PROCEDURE	M:N	Procedure_Code, Appointment_ID	A physician can perform multiple procedures, a procedure can be performed by many physicians on different patients.
PHYSICIAN	EXAMINES	PATIENT	M:N	Patient_ID, Procedure_Code.	A physician can examine multiple patients, but a patient is examined by only one physician during an appointment.
PHYSICIAN	PRESCRIBES	MEDICATION	M:N	Patient_ID, Medication_ID, ATC_Code.	A physician can prescribe multiple medications, medication can be prescribed by many physicians.
APPOINTMENT	TAKES_PLACE_IN	ROOM	1:1	Room_Number, Apointment_ID	An appointment takes place in one room, and a room is associated with only one appointment.
NURSE	ON_CALL_FOR	ROOM	M:N	Nurse_ID, Room_Numbe	A nurse can be on call for

				r	multiple rooms, and a room can have multiple nurses on call.
PATIENT	TAKES	TEST	1:N	Test_ID	A patient can take multiple tests, and each test is associated with only one patient.

1.3 Design an ER schema for hospital database based on information provided in task 1, and entities defined in 1.2 with relationships defined in 1.3.

The ER schema should contain entities with their corresponding attributes, key attributes of each entity, relationship types, and their corresponding cardinality ratio.



Task 2 Conference Review Database (25 points)

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

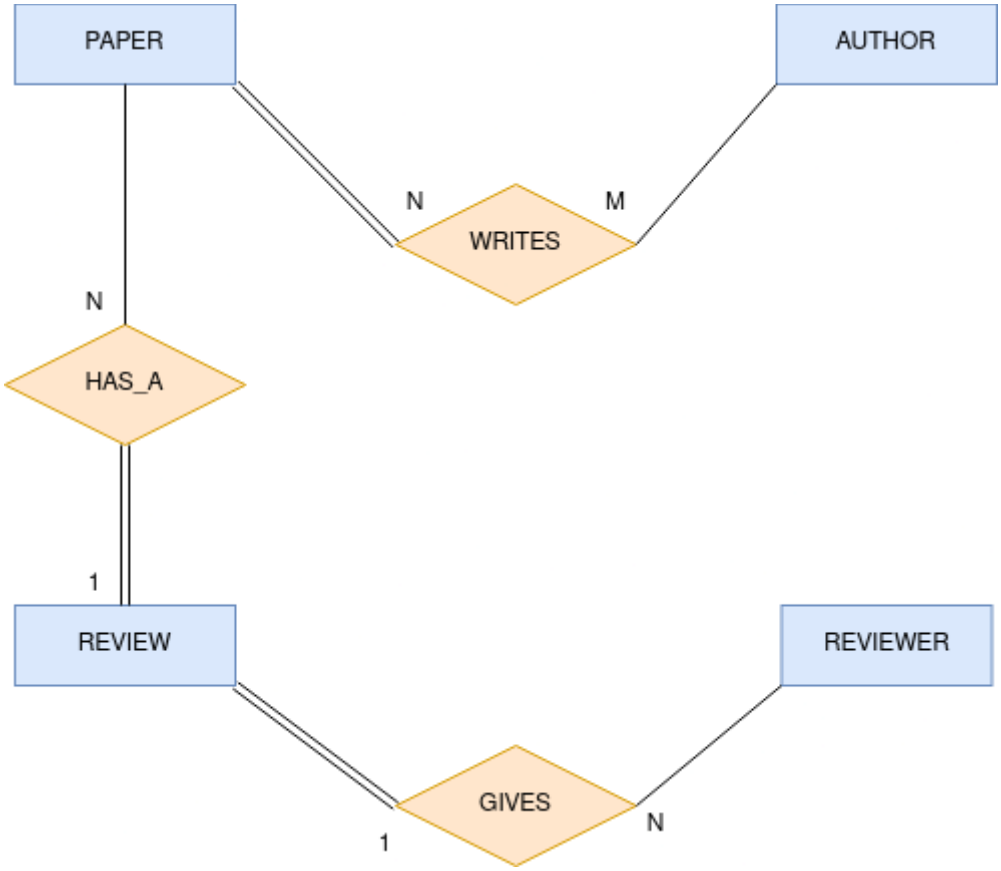
Entity	Attribute	Attribute Type	Key Attribute	Value type of attribute (type, min, max, unique, NULL/NOT NULL)
AUTHOR	Email	Simple	TRUE	String, not null, unique
	Name	Composite	False	String, not null
	Affiliation	Multi-Valued	False	String, not null
	Country	Simple	False	String, not null
PAPER	ID	Simple	True	Int, not null, unique
	Title	Simple	False	String, not null
	Abstract	Simple	False	String, not null
	Keywords	Multi-Valued	False	String, not null
	Year	Simple	False	Int, not null
	File_Name	Simple	False	String, not null
	Main_Author	Simple	False	String, not null
	Reviewers	Multi-Valued	False	Strings, not null, min(2)-max(4)
REVIEWER	Email	Simple	True	String, not null, unique
	Name	Composite	False	String, not null
	Phone_Number	Simple	False	String, not null
	Affiliation	Multi-Valued	False	String, not null
	Topics_Of_Interest	Multi-Valued	False	String, not null
REVIEW	Review_ID	Simple	True	Int, not null, unique

	Paper_ID	Simple	True(FK)	Int, not null, unique
	Technical_Merit	Simple	False	Int, not null, min(1)-max(10)
	Readability	Simple	False	Int, not null, min(1)-max(10)
	Originality	Simple	False	Int, not null, min(1)-max(10)
	Relevance	Simple	False	Int, not null, min(1)-max(10)
	Commments_For_Reviewers	Simple	False	String, not null
	Comments_For_Authors	Simple	False	String,not null

2.2 Identifying the relationship between entity sets using the following table template:

Entity A	Relationship name	Entity B	Cardinality Ration (1:1,1:N,N:1,M:N)	Attribute of Relationship Types	Justify your answer
REVIEWER	GIVES	REVIEW	N:1	Review_ID, Email	A reviewer can give many reviews, but each review can only be assigned to one reviewer.
AUTHOR	WRITES	PAPER	M:N	Email, Paper_ID	Many authors can write a paper, and a Paper may have multiple authors.
PAPER	HAS_A	REVIEW	N:1	Review_ID	A paper can have many (2-4) reviews. But a review can only be assigned to one paper.

2.3 Design an ER schema for review database based on information provided in task 2, and entities defined in 2.1 with relationships defined in 2.2. 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:

1. List a strong (nonweak) entities in the ER diagram

Answer:

BANK, LOAN, CUSTOMER, ACCOUNT

2. Is there a weak entity? If so, give its name, partial key, and identifying relationship (owner entity)

Answer:

BANK_BRANCH, Branch_no(PK), BANK (owner).

3. What constraints do the partial key and the identifying relationship (owner) of the weak entity have in this diagram

Answer:

It is useless without the key of the identifying relationship (BANK entity). To find a specific Bank_Branch we would need to specify the Bank Code first. I.E Bank_Branch cannot exist without an associated bank.

4. List the names of all relation (entity) and specify the (min, max) constraint using the total/partial participation of an entity in a relationship (on both sides of the relation: left and right). Justify your answer.

Answer:

Entity name	Relationship name	(min,max)	Justify your answer
Bank	Has_Branches	(1,N)	Since this entity has a total participation in the relationship the minimum value is 1. The entity needs to exist in the relationship. But a bank can have many branches connected to it hence the max would be N.
Bank_Branch	Has_Branches	(1,1)	Similarly the bank_branch needs to exist in the relationship since a bank cannot exist without a bank_branch. But each branch can only be associated with a maximum of 1 bank, hence (1,1).
Bank_Branch	Has_Accounts	(0,N)	A bank branch has partial participation in this relationship, meaning that it does not need to have any accounts, but it can also have many accounts, hence (0,N)
Account	Has_Accounts	(1,1)	An account has total participation, meaning that it needs to exist in the relationship and can only be associated with 1 bank_branch.
Bank_Branhc	Loans	(0,N)	A bank branch has partial participation and it does not need to have any loans, but it can have many loans also.
Loan	Loans	(1,1)	The loan needs to be connected to only one bank_branch.
Loan	L_C	(1,N)	The loan can be connected to 1 or many customers.
Customer	L_C	(0,M)	The customer can have 0 or many loans.
Account	A_C	(1,N)	The account can have 1 or many customers, for example a shared family account.
Customer	A_C	(0,M)	A customer can have 0 accounts or many accounts.

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.

N	Statement	True/ False/ Maybe	Justify your answer
1	Every pilot has been a passenger in some flight.	False	The pilot has a partial participation for all relationships, meaning that they could have been on (0,N) flights.
2	Every flight has at least one deadheading pilot.	False	The flight can have (0,1) deadheading pilots.
3	Every flight has at least 2 pilots.	True	The flight has a total participation in the flies relationship showing it can have (2,N) pilots.
4	Every pilot has flown at least 2 times.	False	The pilot has a partial participation, meaning they could have flown (0,N) flights.
5	There are tickets that do not belong to any flight	False	The tickets have a totatl participation in the Belong to relationship, they need to belong to (1,1) flight.
6	Some airline does not have flights	False	The airline and the flight have both a total participation in the Belong to relationship.
7	Some flight does not have assigned aircraft	False	A flight has toatl participation in the Assigned relationship and cannot exist without an aircraft (1,1).
8	Each flight has a departure and arrival airport assigned	True	A flight has total participation in the Departure and Arrival relationships meaning they have a (1,1) min, max constraint. They need to have at least and maximum of 1 airport for arrival and departure.

9	A passenger can be a pilot	True	A pilot can be a passanger since these entities are connected in the is a relationship.
10	Passengers can buy one ticket for the flight	False	A passenger can buy many tickets but each ticket is only assigned to one passenger.
11	There are tickets that do not have a class type (Economy, Business, etc.)	True	The ticket has partial participation in the has – class relationship, meaning it can have (0,N) classes.
12	There are some tickets without payment	False	The ticket has total participation in the receives rleation meaning that it needs to have one payment and one payment only (1,1).
13	There are some flights without tickets	False	The ticket and the flight both have total participation meaning there cannot be a flight without a ticket and there cannot be a ticket without a flight.
14	There are some aircraft that are not assigned to a flight	True	Since the aircraft has a partial relationship, it can have (0,N) flights assigned.
15	Some airlines do not have any flights.	False	The airline and the flight have both a total participation in the Belong to relationship.