Database Management Systems Assignment 2

Submission

Your solution should be submitted in a single file in pdf format, named USER-NAME_hw2.pdf, through Moodle.

Submission is individual. In the submitted PDF file, please include the username and ID. In questions where it is not clear from the context, show the steps that lead to your answer.

1 ER Diagram - 50 points

In this question, you will design a database by creating an ER diagram and converting it to a schema. You may add attributes when necessary, but try to keep your design simple and faithful to the scenario.

- Design an ER schema diagram for this database using as much of the E/R model taught in class as appropriate.

- **If you make an assumption that is not stated in the scenario, explicitly state it.**

- Map the schema that you designed above to relations. For each relation, indicate all attributes, keys, and foreign keys, if there are any between the tables.

Design a database schema for a hospital chain. Each Hospital is uniquely identified by its name and includes details such as address, contact information, departments, and rooms. Each Department has a name and includes a specialization, a description and staff (doctors and nurses).

Each Person in the hospital system has a unique ID and basic details: name, address, phone number, and birth date. Patients also have a medical history and can be treated in multiple hospitals. Doctors and Nurses include the same base data, have some specialization and are exclusively tied to one hospital.

The database also maintains data about rooms in each department, storing information including room number and floor.

Additionally, patients may come to the hospital for appointments, each having a unique ID and details like date & time, patient, doctor and department. Patients receive a bill for each appointment, listing procedures and medications.

Medications have a unique name, generic name, description, price, insurance coverage and interactions with other medications. Procedures, performed by doctors on patients within a department, have a unique name, description, duration, price and insurance coverage.

2 Views and Query containment - 20 points

You are given the following schema, describing a bank:
customer(<u>id</u>, name, credit_rating)
account(<u>id</u>, currency, owner, balance)
current_account(<u>id</u>, savings, overdraft_fee)
savings_account(<u>id</u>, currency_id, commission)
currency(<u>id</u>, name, symbol, exchange_rate)

The following foreign keys are defined:
account(currency) → currency(id)
account(owner) → customer(id)
current_account(id) → account(id)
current_account(savings) → savings_account(id)
savings_account(id) → account(id)
savings_account(currency_id) → currency(id)

The **customer** and **account** tables store information about the bank's customers and accounts. There are two specific account types with additional details:

- **current_account**: Tracks current accounts (*"OVER VESHAV"*) linked to a savings account for fund transfers, along with an overdraft commission.

- **savings_account**: Tracks savings accounts, including their currency and yearly commission.

The **currency** table lists the bank's currencies, including their name, symbol (e.g., $), and exchange rate to NIS.

You may assume there are no NULLs in the tables.

You are given the view:

```sql
CREATE VIEW myview AS
SELECT a.id, a.currency, a.balance
FROM acount a, customer c
WHERE a.owner = c.id
```

For each of the following queries, choose one of these options and explain your answer:

(A) The query and myview return the same output for every database.

(B) The tuples returned by the query are also returned by myview, but myview might return additional tuples or duplicates of tuples from the query.

(C) The tuples returned by myview are also returned by the query, but the query might return additional tuples or duplicates of tuples from myview.

(D) None of the above.

Query 1

```sql
SELECT sa.id, cu.id, a.balance
FROM acount a, savings_account sa, currency cu
WHERE a.id = sa.id
AND cu.id = a.currency
```

Query 2

```sql
SELECT DISTINCT sa.id, a.currency, a.balance
FROM account a, savings_account sa
WHERE a.currency = sa.currency_id
```

Query 3

```sql
SELECT a.id, a.currency, MAX(a.balance)
FROM account a, customer c
WHERE a.owner = c.id
GROUP BY c.id, a.id, a.currency
```

Query 4

```sql
SELECT ca.id, a.currency, a.balance
FROM account a, current_account ca
WHERE a.id = ca.id
AND EXISTS (
    SELECT *
    FROM savings_account sa
    WHERE sa.id = ca.savings)
)
```

3 Normalization & BCNF - 30 points

Let $R(A, B, C, D, E, F)$ be a table with the following functional dependencies:

$$A, B \rightarrow C$$
$$D \rightarrow E, F$$
$$C \rightarrow B$$
$$C \rightarrow E$$

(a) Find all minimal keys

(b) Decompose R to BCNF. Detail the stages of the decomposition and for each stage indicate what is the functional dependency violating BCNF, the intermediate tables and their minimal keys.

(c) Are there any non-trivial dependencies in the original table that are not preserved after your decomposition? If your answer is no, explain why. If your answer is yes, list them and explain, providing an example of records that, if added to the relations after decomposition, would cause dependency violations in the reconstruction of R.