**Midterm I**

**CS425 - Database Organization**

**Instructions**

* Try to answer all the questions using what you have learned in class.

### When writing a query, write the query in a way that it would work over all possible database instances and not just for the given example instance!

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* Exam includes 4 relational algebra questions, one DDL, two SQL Queries, one update SQL, an ER Diagram and reduction.

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* I will work on my own on the exam and I will not share my answers or discuss it with anyone even after completing the exam.

Signature

Consider the following database schema and example instance storing information about medical care:

# hospital

|  |  |  |
| --- | --- | --- |
| **Hospital** | **Doctor** | **County** |
| Dupage | Bob | Dupage |
| GoodSam | Bob | Dupage |
| Northwesertn | Joan | Cook |

**patient**

|  |  |  |  |
| --- | --- | --- | --- |
| **pName** | **insurance** | **age** | **County** |
| Sam  Paul | HMO  PPO | 13  87 | Dupage  Cook |

**doctor**

**procedure**

|  |  |  |
| --- | --- | --- |
| **pName** | **Recovery time** | **Anesthesia** |
| Heart | 15 | Yes |
| Bladder | 5 | No |
| Lung | 5 | Yes |

**takeCare**

|  |  |  |  |
| --- | --- | --- | --- |
| **patient pName** | | **doctor** | **hospital** |
| Sam  Paul | Lung  Heart | Bob  Bob | Dupage  CoodSam |
|  |  |  |  |

|  |  |  |
| --- | --- | --- |
| **docName** | **insurance** | **rate** |
| Joan | HMO | 15,000 |
| Joan | PPO | 20,000 |
| Bob | HMO | 12,000 |
| Bob | PPO | 14,000 |

### Hints:

* Attributes with black background form the primary key of a relation.
* The attribute *pName* of relation *takeCare* is a foreign key to relation *procedure*.
* The attribute *patient* of relation *takeCare* is a foreign key to relations *patient* .
* The combination of attribute *doctor and hospital* of relation *takeCare* is the foreign key to relations *hospital.*

The attribute *doctor* of relation *takeCare* stores doctors. However, it is not a foreign key to relation *doctor*, because the primary key of that relation also includes insurance information.

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**Part 1 Relational Algebra**

**Question 1.1 (3 points)**

Write a relational algebra expression that returns the patient’s name and cost that had heart or lung procedure.

**Question 1.2 (2.5points)**

Write a relational algebra expression that returns the patient’s name that had the procedure performed in hospital located in a different county than their residence.

**Question 1.3 (2.5 points)**

Write a relational algebra expression that returns the patient’s age for all patients with lung disease (had a lung procedure)

**Question 1.4 (2.5 points)**

Write a relational algebra expression that returns the patient’s name and recovery time needed for each procedure they have done.

**Part 2.1 SQL DDL**

**Question 2.1 (2.5 Points)**

Write an SQL statement that creates a new table *treatment* that stores the *hospitalname,* the *procedure* and the *patientname*. Furthermore, we want to store a *hospitalFee* for each assignment. The combination of procedure, hospitalname and patientname uniquely identifies an assignment. Each assignment has a *hospitalFee* that is bigger than 0 and smaller than 1,000,000 dollars. When *hospitalname* is removed from the hospital table it gets deleted from the treatment table.

## Part 2.2 Query

## Question 2.2.1 (2 Points)

Write an SQL query that returns the county for which the average age of patients is below 35.

## Question 2.2.1 (2.5 Points)

Write an SQL query that returns the name and rate for all doctors that support HMO combined with each patient they are taking care of.

## Part 2.3 SQL Updates

## Question 2.3.2 (1.5 Points)

Increase the rate of all doctors for HMO insurances by 1,000.

**Part 3 ER diagram for food management**

Recipe information is identified by recipe name, it includes inventor and kitchen. A food item is identified by its name and has type and number of calories as attributes. A store is identified by its name and it has other attributes: address, a yearly profit and size. A section is associated with a store and has discriminator name and size.

The foodItem is sold at one or multiple stores and has a listed price in each store.

Each recipe has a list of ingredient names (food item) with an associated quantity.

**Question 3.1 Create an ER diagram for the food management relation (3.5 points)**

**Question 3.2 Create the relational schema described in the ER above (3 points )**