

Database Management Systems

(COP 5725)

Spring 2020

Instructor: Dr. Markus Schneider

TA: Kyuseo Park

Homework 2

Name:	
UFID:	
Email Address:	

Pledge (Must be signed according to UF Honor Code)

On my honor, I have neither given nor received unauthorized aid in doing this assignment.

Signature

For scoring use only:

	Maximum	Received
Exercise 1	25	
Exercise 2	25	
Exercise 3	22	
Exercise 4	28	
Total	100	

Exercise 1 (Relational Algebra) [25 points]

Consider the following relations. The primary keys are underlined. All attributes are of type string if not indicated otherwise.

- Student (s_ID, s_name, s_degree: integer, advisorID, d_ID)
- Lecture (l_ID, l_name, l_degree: integer, p_ID, d_ID)
- Register (s_ID, l_ID, score: integer, Semester)
- Professor (p_ID, p_name, d_ID)
- Department (d_ID, d_name, address)

1. [5 points] Find the names of professors who have taught in every semester.
2. [5 points] List the names of lectures that the CISE department offers but that are taught by a professor whose department is not CISE.
3. [5 points] Find the names of students who got the highest score in the lecture 'Databases'.
4. [5 points] Find the names of students who have registered every lecture of the CISE department.
5. [5 points] Find the names of students who got more than 90 in the 'DB' lecture and less than 70 in the 'Algorithm' lecture.

Exercise 2 (Relational Algebra) [25 points]

Consider the following relations for an online Cinema Booking system. The primary keys are underlined. All attributes are of type string if not indicated otherwise.

- Theaters(tID, name, location)
- Auditoriums(tID, aID, movie title, price: integer, number of seats: integer)
- Book(tID, aID, cID, seat number, date)
- Customers(cID, name, address)

A theater usually has several auditoriums. Assume that only the movies that are currently played on auditoriums of theaters are stored.

1. [4 points] Find the names of customers who have watched movies at every theater in Gainesville.
2. [3 points] Find the names of customers who never booked.
3. [6 points] Find the names of customers who booked the movie titled 'Parasite' more than once.
4. [4 points] Find the name of the theater that has the biggest (in terms of the number of seats) auditorium.
5. [4 points] Find the names of customers who booked 'Parasite' and 'End game'.
6. [4 points] Find the names of movies that are playing at the theaters where the movie 'End game' is on (exclude 'End game' in your answer).

Exercise 3 (Relational Algebra) [22 points]

Consider the following relations. The primary keys are underlined. All attributes are of type string if not indicated otherwise.

- Suppliers (sID, sname, address)
- Parts (pID, pname, color)
- Catalog (sID, pID, cost: integer)

1. [6 points] Find the names of the most expensive parts supplied by supplier named 'NESCS'.
2. [4 points] Find the names of the parts supplied by at least two different suppliers.
3. [4 points] Find the ids of suppliers who supply every red part or supply every green part.
4. [4 points] Find pairs of supplier ids such that the supplier with the first sID charges more for the same part than the supplier with the second sID.
5. [4 points] Find the names of suppliers who supply only red parts.

Exercise 4 (Relational Algebra) [28 points]

The following questions let you think deeper about the concepts of the Relational Algebra.

1. [6 points] Let R be the schema of a relation R , and let $A_1, A_2, \dots, A_n \subseteq R$. Is the term $\pi_{A_1}(\pi_{A_2}(\dots(\pi_{A_n}(R))\dots)) = \pi_{A_1}(R)$ correct, in general? If yes, argue why. If not, argue why not. If your answer is no, are there any restrictions that could make the statement true? If so, what are these restrictions in mathematical notation?
2. [6 points] Let R be the schema of a relation R , and let $A \subseteq R$. What is the condition in mathematical notation such that $\pi_A(\sigma_F(R)) = \sigma_F(\pi_A(R))$ holds where F is assumed to be a correct predicate on R ?
3. [16 points] Let $R(A, B)$ be a relation with $r > 0$ tuples, and let $S(B, C)$ be a relation with $s > 0$ tuples. We assume that A , B , and C have the *same data type*. For each of the following Relational Algebra expressions, in terms of r and s , determine the *minimum* and *maximum number of tuples* that the result relation can have. In other words, we are interested in the number of tuples the following Relational Algebra expressions can have *at least* and *at most*. The numbers have to be given by using the two variables r and s . Please note that you have to give precise explanations for your answers.
 - a. [4 points] $R \cup \rho_{T(A,B)}(S)$
 - b. [3 points] $(R \bowtie R) \bowtie R$
 - c. [4 points] $\pi_{A,C}(R \bowtie S)$
 - d. [5 points] $\sigma_{A=C}(R \bowtie S)$