

School of Computer Science Engineering & Information Systems

WINTER SEMESTER-- 2024

PMCA503L-Database Systems

Digital Assignment-1

Note: For the below 5 questions, only the handwritten answers are accepted and the answers should be precise. All the five questions need to be answered.

1. Consider the following relations that represent part of a real estate database:

Agent(Id, AgentName)

House(Address, OwnerId, AgentId)

Amenity(Address, Feature)

The Agent relation keeps information on real estate agents, the House relation has information on who is selling the house and the agent involved, and the Amenity relation provides information on the features of each house. Each relation has its keys underlined.

Consider the following query:

```
SELECT H.OwnerId, A.AgentName FROM House H, Agent A, Amenity Y
```

```
WHERE H.Address=Y.Address
```

```
AND A.Id = H.AgentId AND Y.Feature = '5BR' AND H.AgentId = '007';
```

Identify a relational algebra expression that reflects the order of operations that a decent heuristics query optimizer would choose.

2. The following is partial schema for a public library database, where the keys are underlined:

Customer(CustId, Name)

Borrowings(CustId, ItemId, BorrowDate, DueDate)

Item(ItemId, Author, Title)

Consider the following query:

```
 $\pi_{CustId}(\sigma_{Name='JohnDoe' \text{ AND } 2006/05/19 < BorrowDate < 2006/05/25 \text{ AND } Author='JoePublic'}($   
CUSTOMER  $\bowtie$  BORROWINGS  $\bowtie$  ITEM  
 $)$ 
```

Identify a SQL query that reflects the order of operations that a decent heuristics query optimizer would choose.

3. Consider the relational conceptual database schema below for keeping track of course registration of students: COURSES (Code, Title, Dept) Registered (Code, SSN) STUDENTS (SSN, Name, Dept, GPA) Here, COURSES contains a tuple for each course, recording its code, title, and department offering the course. STUDENTS records the SSN, name, home department, and GPA of the students. REGISTERED keeps the relation between courses and students.

Describe what the following SQL statement does?

```
SELECT UNIQUE(c.title) FROM courses c, students s, registered r  
WHERE r.code = c.code AND r.SSN = s.SSN  
AND c.code = (SELECT c1.code FROM courses c1, students s1, registered r1  
WHERE r1.code = c1.code AND r1.SSN = s1.SSN GROUP BY c1.code  
HAVING COUNT(c1.code) >= (SELECT MAX(COUNT(c2.code)) FROM courses c2,  
students s2, registered r2  
WHERE r2.code = c2.code AND r2.SSN = s2.SSN AND c2.dept <> s2.dept  
GROUP BY c2.code) )
```

4. Consider the following two transactions and schedule. Is this schedule conflict-serializable? [Note: c_0 and c_1 are commit statements for the respective transactions]

Transaction T_0	Transaction T_1
$r_0[A]$	
$w_0[A]$	
	$r_1[A]$
	$r_1[B]$
	c_1
$r_0[B]$	
$w_0[B]$	
c_0	

n

5. Consider the following two transactions:

T1	T2
read(A) read(B) if A=0 then B:= B+1; write(B)	read(B) read(A) if B=0 then A:=A+1 write(A)

Add lock and unlock instructions to T1 and T2 so that they observe the two-phase locking protocol. Can the execution of these transactions result in a deadlock? Explain.