CS3400 Database Systems

Quiz 2 - 4th Dec 2006

A. For the questions given below, write the corresponding relational algebra expression. The primary keys for each of the relations are underlined.

Patient (<u>PatientId</u>, PatientName, Gender, DOB, City)
PatientHistory(<u>PatientId, JoiningDate</u>, DoctorId, NurseId, Leaving_Date, Ward)
Dept (<u>DeptId</u>, DeptName, HOD, No_of_Staff)
Employee(<u>EmpId</u>, EmpName, Salary, Designation, DeptId, DOB, Join_Date)

The foreign key, primary key relationships:
PatientHistory(DoctorId) references Employee(EmpId)
PatientHistory(NurseId) references Employee(EmpId)
PatientHistory(PatientId) references Patient(PatientId)
Employee(DeptId) references Dept(DeptId)
Dept(HOD) references Employee(EmpId)

1. Find all patients (PatientId and PatientName) below the age of 10.

$$\Pi_{PatientId, PatientName} \left(\sigma_{DOB - \$CurrentDate \leq 10} (Patient) \right)$$

Note: Assuming $CurrentDate has the date of today & difference of dates is given in years.

2. Find all patient details(PatientId, JoiningDate) who are under doctors of department `DeptId=3'.

$$\Pi_{PatientID, JoiningDate} \left(PatientHistory \bowtie_{DoctorID = EmpId} \left(\sigma_{DeptID=3} (Employee) \right) \right)$$

3. Find the details of all patients (PatientId, PatientName, City) who are presently under the care of Doctor 'Raghav' and Nurse `lalitha'. Hint: Leaving_Date of current patients is set to NULL.

$$PatientsOfRaghav \leftarrow \Pi_{PatientID, EmpName, NurseID} \left(\sigma_{EmpName = `Raghav'} (Employee) \right) \bowtie_{EmpId = DoctorID} \left(\sigma_{Leaving\_Date = NULL} (PatientHistory) \right)$$

$$ReqdPatientIDs \leftarrow \Pi_{PatientID} \left(\sigma_{EmpName = `Lalitha'} (Employee) \bowtie_{EmpId = NurseId} PatientsOfRaghav \right)$$

$$Result \leftarrow \Pi_{PatientID, PatientName, City} \left(Patient \bowtie_{PatientID = PatientID} Required\,Patient\,IDs \right)$$

(6) Reqd PatientIDS ← $\Pi_{PatientID}$ Patient History ⋈ Employee ⋈
$_{DoctorID=EmpID}$ $_{DeptID=DeptID}$
$\sigma_{No\_of\_Staff>20}$ (Department))

Result ← $\Pi_{PatientName, City}$ (Patient ⋈ Reqd Patient IDS)

4. Find the names of all the doctors that 'Tom' has been treated by.

Doctors ← $\Pi_{DoctorID}$ (Patient History ⋈ ($\sigma_{PatientName='Tom}$ (Patient)))
$_{PatientID=PatientID}$

Result ← $\Pi_{EmpName}$ (Doctors ⋈ Employee)
$_{DoctorID=EmpID}$

5. Find the names of the HOD's of each of the departments.

$\Pi_{DeptId, EmpName}$ (Department ⋈ Employee)
$_{HOD=EmpId}$

6. Retrieve the patient details (PatientName, City) of all patients who are treated by doctors from departments having No._of_staff>20.

7. Find the names of the patients with names same as that of some HOD's who have been treated by doctors of the same department as the HOD belongs to.

HOD Names ← $\Pi_{HODName \to EmpName, HODDeptID \to DeptID}$ (Department ⋈ Employee)
$_{HOD=EmpId}$

Result ← $\Pi_{PatientName}$ ($\sigma_{HODDeptID=E.DeptID}$ (Employee ⋈ (Patient History ⋈ (HODNames ⋈ Patient))))
$_{EmpId=DoctorId}$ $_{PatientID=PatientID}$ $_{HODName=PatientName}$

b. For each of the following updates, find if it violates any integrity constraint. If so, what would you do to handle it.

PatientHistory

PatientId	JoiningDate	DoctorId	NurseId	LeavingDate	Ward
1101	24-08-99	SSN43	SSN53	24-09-99	2
1110	24-10-91	SSN21	SSN23	24-12-91	1
1101	24-10-92	SSN12	SSN33	24-12-92	2

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PatientId	JoiningDate	DoctorId	NurseId	LeavingDate	Ward
1002	24-10-93	SSN12	SSN53	24-12-93	3
1101	24-10-94	SSN43	SSN53	24-12-94	5
1001	24-10-05	SSN43	SSN33	NULL	1

Patient

PatientId	PatientName	Gender	DOB	Address
1001	Ramesh	M	24-08-84	Hyderabad
1002	Neena	F	12-11-84	Kolkata
1101	Tom	M	11-11-80	Chennai
1110	Jack	M	02-10-84	Hyderabad

Department

DeptId	DeptName	HOD	No_of_Staff
D34	Dental	SSN43	12
D54	Cardiac	SSN21	34
D21	Optics	SSN12	19

Employee

EmpId	EmpName	Designation	Salary	DeptID	DOB	JoinDate
SSN43	Suresh	Doctor	39000	D34	19-10-79	19-10-2000
SSN21	Raghav	Doctor	33000	D54	19-10-55	19-10-1980
SSN12	Surendra	Doctor	50000	D21	19-10-59	19-10-1984
SSN22	Lalitha	Nurse	19000	D34	19-10-81	19-10-2002
SSN53	Neena	Nurse	16000	D54	19-10-79	19-10-2004
SSN33	Swati	Nurse	12000	D21	19-10-76	19-10-2006
SSN23	Rekha	Nurse	12000	D21	20-10-76	19-10-2006

1. Insert
a. Insert <'D24', 'Orthpedic', SSN43, 18> into Department.

It does not cause violation of any integrity constraint.

b. Insert <1002, Neha, M, 19-02-1980, Chennai> into Patient.

It causes violation of **primary key constraint** since there is already a tuple with PatientId=1002. We should throw an error to the user to change the PatientID to a value different from (1001, 1002, 1101 and 1110).

2. Delete
a. Delete the Employee tuple with EmpID = 'SSN21'.

It cause violation of **referential integrity constraint** because the relations PatientHistory and Department have tuples with values 'SSN21' for attributes DoctorId and HOD respectively. Either we can set these values in PatientHistory and Department to NULL or thrown an error to the user.

b. Delete all Employee tuples whose joining dates are in 2006 and Salary< 20000.

It cause violation of **referential integrity constraint** because it deletes two tuples from Employee relation with EmpId='SSN33' and 'SSN23' and the relation PatientHistory contains two tuples with these values. Either we can set these values in PatientHistory to NULL or thrown an error to the user.

3. Update

a. Update the DeptId=34 to NULL in table Dept.

It causes the violation of **entity integrity constraint** because DeptId is the primary key in Department relation. Hence we should throw an error to the user.

b. Update in Patient History, change NurseId=SSN23 to NurseId=SSN12.

It does not cause violation of any integrity constraint.