1. You have been tasked with creating operations for the Hospital Database. The database has 3 tables — `Patients`, `Doctors` and `Admissions`. The schema and sample data are given below.

PatientID	FirstName	LastName	DOB	BloodType
1	Rebecca	Adler	1975-09-15	O+
2	Ali	Mohammed	2010-02-01	A-
3	John	Doe	1980-01-01	AB+
4	Mark	Boston	1992-11-30	B-
5	Esteban	Hernandez	1968-06-10	O-

DoctorID	FirstName	LastName	Specialty	HireDate
701	Gregory	House	Diagnostics	1995-04-11
702	Lisa	Cuddy	Endocrinology	1990-07-01
703	James	Wilson	Oncology	1992-05-20
704	Allison	Cameron	Immunology	2004-11-16
705	Robert	Chase	Intensive Care	2004-11-16
706	Eric	Foreman	Neurology	2004-11-16

AdmissionID	PatientID	DoctorID	AdmissionDate	Diagnosis
1001	1	701	2024-10-20	Vasculitis
1002	2	704	2024-10-21	Infection
1003	3	706	2024-10-22	Amnesia
1004	4	705	2024-10-23	Cardiac Arrest
1005	5	703	2024-11-05	Leukemia
1006	1	701	2024-11-06	Follow-up

Answer the following questions based on the tables above.

(a) (1 point) Write a SQL query to find all blood types that are shared by more than one patient. The query should return the BloodType and the PatientCount in descending order by PatientCount.

```
Select BloodType, COUNT(PatientID) AS patientcount
From Patients
Where patientcount > 1
Order by patientcount Desc;
```

group by?

(b) (1 point) Write a SQL query to find all patients who meet either of these conditions:

- Their LastName is greater than five letters long. (taking > 5)
- Their BloodType ends with 'Negative' (e.g., 'O-', 'AB-').

```
Select *
from patient
Where LastName like '_____%' OR
      BloodType like '%-';
```

extra characters

5 letters compuls

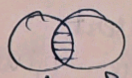
% can be empty

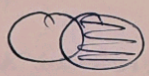
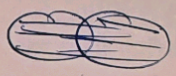
(c) (3 points) The diagnosis for 'Rebecca Adler' was determined to be 'Cluster Headache'. Write the SQL query to update the **most recent admission** for Rebecca Adler by AdmissionDate. **(Note: You have to write a general query that ~~updates the latest~~ record in Admissions, you can not use the AdmissionID directly)**

~~Sele~~ Update ~~Value~~ Admission
~~on~~ Selet
set Diagonsis = 'cluster ~~Headache~~'
on ~~Selet Patient Admission on~~ patrictID = 1
↳ Second Half ↓ AND Ad-Date = '2024-10-26';

(d) (6 points) This part has two sub-parts.

A) **(2 points) List and briefly describe the four main types of SQL JOIN operations.** ?

inner join →  Join the two table on condition
left join → 

All ~~of the~~ value in left are present but for those value if right not there set to NU
right join →  All the value in right are preset remaining set to NUll
Outer join →  All are present (everything)

B) (4 points) Write a single SQL query to list every doctor and the total number of admissions they have handled. **(Note: You must use a JOIN operation; conditional SQL queries are not allowed)**.

- Your result should show the doctor's ID, First and Last Name, and their admission count.
- If a doctor has handled zero admissions, they must still appear in the list with a count of 0.
- Sort the results by the admission count, from highest to lowest.

Selet DoctorID, FirstName, LastName, Count(~~AdmissionID~~ DoctorID) as Admis Co
~~Join~~
From ((patient P innerjoin Admissions A ~~on P.patid ID = A.pate~~
Join Doctor D on A.DoctorID = D.DoctorID
order by Admission count Desc; group by ?

2. Consider the following single table named `Student_Enrollment`, which stores all information about students, the courses they are enrolled in, and the professors who teach those courses.

StudentID	StudentName	CourseID	CourseName	ProfName	ProfOffice
S1001	Alice Chen	CS101	Intro to CS	Dr. Elara	D-210
S1002	Bob Davis	CS101	Intro to CS	Dr. Elara	D-210
S1001	Alice Chen	MTH200	Calculus II	Dr. Khan	F-105
S1003	Charlie Fox	MTH200	Calculus II	Dr. Khan	F-105
S1004	Dana White	PHY301	Adv. Physics	Dr. Boro	D-210

Using only the `Student_Enrollment` table above, answer if an anomaly is present here (INSERT/UPDATE/DELETE). Assume that the data is complete and that there is no other entries except these. Justify your answer clearly.

(a) (2 points) Another student, 'Joan Smith' has enrolled in the course MTH200 ('Calculus II') course.

yes NO proble, we can insert
If only student name is given they problem arises because we must know course ID otherwise we ~~cant~~ can insert

(b) (2 points) The 'D' building wing is being renovated. All professors in office D-210 must move.

- Dr. Elara is moving to a new office, E-301.
- Dr. Boro is moving to a new office, E-302.

yes
If the update query is change profoffice E301 where profName = DrElara
is correct and we can do it
Same with the 2nd state also
~~If we are given~~ Yes we can do it

(c) (2 points) Student 'Dana White' (S1004) decides to drop her 'Adv. Physics' (PHY301) course.

NO, because as she is the ~~as~~ only student in Adv physic, if she drop the adv physics is gone, so we cant do it

3. (2 points) A new database analyst is trying to find the total sales for each `EmployeeID` from the `Sales` table, but only for sales where the `SaleAmount` was over $100. **(Note: Assume a `Sales` table with at least `EmployeeID` and `SaleAmount` columns exists).** The analyst write two queries.

Query A:

```
SELECT EmployeeID, SUM(SaleAmount)
FROM Sales
WHERE SaleAmount > 100
GROUP BY EmployeeID;
```

Query B:

```
SELECT EmployeeID, SUM(SaleAmount)
FROM Sales
GROUP BY EmployeeID
HAVING SaleAmount > 100;
```

Determine which query, if any, correctly fulfills the analyst's request, and justify your reasoning. If any query fails, explain what was the reason for it doing so.

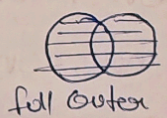
Query A, first we select what column we want then remove the rows who don't statisfy the requriment, then ~~sort~~ it acc to Employee ID

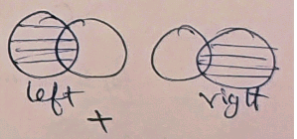
(1)

4. (3 points) You are building SQL queries for a database but the legacy system does not seem to have the `FULL OUTER JOIN` operation built in along with other JOIN operations! Quick, use the basic SQL commands to compute the `FULL OUTER JOIN` of two tables joined on an attribute.

To ~~prove~~ write without full outer join

Select
Join Table a
Full outer join table b
on . . .

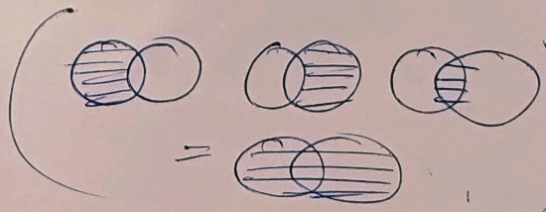


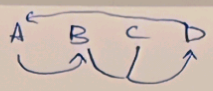


right join
on A.key=NUL

Select . . .
Join Table a
Left join Table b on B.key = NULL
right join Table b on A.key = NULL
join Table b

(0)





5. (6 points) You are given a relation R(A, B, C, D) and the following set of functional dependencies (FDs):

   - $A \rightarrow B$
   - $BC \rightarrow D$
   - $D \rightarrow A$

   (a) What are all the candidate keys for this relation? [1 point]

BC, AC, CD
are the candidate keys

   (b) Is this relation in 3NF? Explain your reasoning. [3 point]

Yes it is 3NF
we must check for transitive dependendy
$X \rightarrow Y$ means $X \rightarrow Z$ and $Z \rightarrow Y$
Z is a non prime attribute
There is no non prime attibute, all are prime attrib
So this 3NF

did not do 2NF test

   (c) Is this relation in BCNF? Explain your reasoning. [2 point]

NO
So we must, in BCNF if there is $X \rightarrow Y$
then X must be candidate key So wrong

wrong explanation

6. (12 points) The Department of Computer Science at a university maintains a database to keep track of the courses it offers each semester. The current database schema stores details such as the course name, instructors, departments, and textbooks used. However, the database was designed by a new intern, and the data has not been properly normalized. As a result, several issues have emerged. Note: Both of the following tables are part of the same database schema.

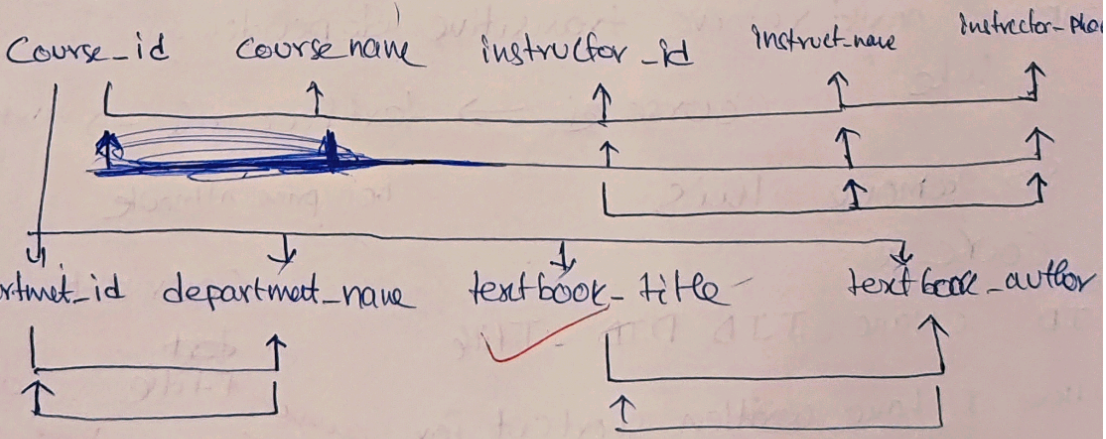
course_id	course_name	instructor_id	instructor_name	instructor_phone
C101	Database Systems	I11, I14	Dr. Mehta, Dr. Singh	9876543210, 9876543215
C102	Operating Systems	I12	Dr. Rao	9876543211
C103	Data Structures	I13	Dr. Patel	9876543212
C104	Linear Algebra	I21	Dr. Sharma	9876543213
C105	Calculus I	I21	Dr. Sharma	9876543213
C106	Database Systems Lab	I11	Dr. Mehta	9876543210
C107	Algorithms	I13, I15	Dr. Patel, Dr. Verma	9876543212, 9876543216
C108	Probability	I22	Dr. Banerjee	9876543214
C109	Machine Learning	I11	Dr. Mehta	9876543210
C110	Numerical Methods	I22	Dr. Banerjee	9876543214

department_id	department_name	textbook_title	textbook_author
D10	Computer Science	Database System Concepts, Fundamentals of DB	Silberschatz
D10	Computer Science	Modern Operating Systems	Tanenbaum
D10	Computer Science	Data Structures and Algorithms	Weiss
D20	Mathematics	Linear Algebra Done Right	Axler
D20	Mathematics	Calculus Early Transcendentals, Calculus Made Easy	Stewart
D10	Computer Science	Database System Concepts	Silberschatz
D10	Computer Science	Introduction to Algorithms	Cormen
D20	Mathematics	Introduction to Probability Models	Ross
D10	Computer Science	Pattern Recognition and Machine Learning	Bishop
D20	Mathematics	Numerical Analysis	Burden

(a) List all Functional Dependencies (FDs) that hold in the given schema, based on the data shown. [2 points]

(b) Normalize the schema to 1NF (3 points), 2NF (4 points) and 3NF (3 points). At each stage clearly state the reason for normalization and the new schema(s) obtained. If a relation is already in a normal form, explicitly mention it and explain why. [10 points]

(a)



(b) to convert to 1NF all attribute must be atomic

means for instructor-id, instructor-phone is multivalue attribute

instructor name

in 1NF multivalued attribute should not be present

111, 114 we write in two steps like 111

114

the same for mobile numbers instructor name