ASSIGNMENT #04:

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Q1: Data Management Issues for a Pharmaceutical Company

As a data administrator in a large pharmaceutical company operating in Europe, Japan, and the US, the most concerning data management issues would be:

- **Data Privacy and Compliance**:

  Different regions in Europe and in the US have different regulations for handling sensitive data.

- **Data Integration**:

  Unifying data from various sources (e.g., sales, marketing, clinical trials) across multiple countries and systems.

- **Data Consistency**:

  Ensuring uniform data definitions, formats, and business rules across distributed databases.

- **Security**:

  Protecting sensitive data from unauthorized access, especially due to the high-value nature of pharmaceutical data.

- **Latency and Availability**:

  Ensuring global access with low latency and high availability despite geographical dispersion.

Q2: 3NF vs BCNF with Examples

- **3NF**:
  A relation is in 3NF if it is in 2NF and every non-prime attribute is non transitively dependent on the primary key.

- **BCNF (Boyce Codd Normal Form)**:
  Stronger than 3NF; a relation is in BCNF if for every functional dependency $X \rightarrow Y$, X is a superkey.

Example when 3NF but not BCNF:

Table: Course (CourseID, Instructor, Department)

Dependencies:

- CourseID → Instructor
- Instructor → Department

Here, Instructor is not a superkey, so it violates BCNF even though it may be in 3NF.

When 3NF is also BCNF:

If all functional dependencies have a candidate key on the left side, then 3NF = BCNF.

Q3: Role of DBA Beyond DBMS Functionalities

Yes, maintaining database consistency and availability involves more than just basic DBMS features.

Role of DBA includes:

- **Backup & Recovery**: Ensuring regular backups and quick recovery from failures.
- **Disaster Recovery Planning**: Planning for data loss events.
- **Performance Monitoring**: Ensuring consistent and optimal performance.
- **Access Control**: Enforcing user permissions and ensuring data integrity.
- **Maintenance**: Indexing, partitioning, and database tuning.

Thus, a DBA is critical for **business continuity** and not just managing schemas and queries.

Q4: Normalization of Wellmeadows Hospital Form

(a) Functional Dependencies & Assumptions

Assumptions:

- Each patient can have multiple medications.
- Drug Name is functionally dependent on Drug Number.

- Dosage and method are dependent on Drug Number.

Dependencies:

- PatientNumber → FullName, WardNumber, WardName, BedNumber
- WardNumber → WardName
- DrugNumber → DrugName, Description, Dosage, MethodOfAdmin
- (PatientNumber, DrugNumber, StartDate) → UnitsPerDay, FinishDate

(b) Normalization Process to 3NF

1. UNF (Unnormalized Form)

Flat table with repeating group of medications.

2. 1NF

Remove multivalued attributes → Each row represents one drug per patient per date.

3. 2NF

Remove partial dependencies (only full key determines non-key attributes):

Tables:

- Patient (PatientNumber, FullName, WardNumber, BedNumber)
- Ward (WardNumber, WardName)
- Drug (DrugNumber, DrugName, Description, Dosage, MethodOfAdmin)
- Prescription (PatientNumber, DrugNumber, StartDate, UnitsPerDay, FinishDate)

4. 3NF

Remove transitive dependencies:

Already separated into:

- **WardNumber → WardName**
- **DrugNumber → Dosage, etc.**

All non-key attributes are dependent on the whole key and nothing else.

(c) Keys in 3NF Relations

- **Primary Keys:**

  - ❖ Patient: PatientNumber
  - ❖ Ward: WardNumber
  - ❖ Drug: DrugNumber
  - ❖ Prescription: (PatientNumber, DrugNumber, StartDate)

- **Foreign Keys:**

  - ❖ Patient.WardNumber → Ward.WardNumber
  - ❖ Prescription.PatientNumber → Patient.PatientNumber
  - ❖ Prescription.DrugNumber → Drug.DrugNumber

- **Alternate Key (if any):**

  - ❖ Could consider (PatientNumber, BedNumber) as alternate if unique.

END