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CS465

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<div align="center">Homework 4</div>

1.
- a. **Functional Dependencies:**
    -   i. patientNo → fullName
        Given a patient number it is possible to identify the name of the patient.
    -   ii. wardNo → wardName
        Given a ward number we can uniquely identify a ward name.
        should have a unique wardNo.
    -   iii. drugNo → drugName, description, dosage, adminMethod
        The drug number will given these attributes regardless of the patient.
    -   iv. patientNo, drugNo, startDate → unitsPerDay, finDate
        Knowing the patient, drug number, and start date of the meds allows for finding out the units per day and end date for the individual patient's medication.
- b. 1NF:

    TotalInfo(patientNo, wardNo, startDate, fullName, bedNo, wardName, drugNo, drugName, description, adminMethod, unitsPerDate, finDate)

    patientNo→fullname

    drugNo → drugName, description, dosage, adminMethod

    These functional dependencies are depending on whole primary keys and are partial dependencies that need to be removed before moving onto 2NF.

    2NF:

    TotalInfo(patientNo, drugNo, startDate, wardNo, wardName, bedNo, unitsPerDay, finDate)

    PatientInfo(patientNo, fullName)

    DrugInfo(drugNo, drugName, description, dosage, adminMethod)

    wardNo→wardName

This dependency needs to be separated out in 3NF to have all non-key columns depend on the whole primary key and eliminate further redundancy.

3NF:
TotalInfo(patientNo, drugNo, startDate, wardNo, wardName, bedNo, unitsPerDay, finDate)

PatientInfo(patientNo, fullName)

DrugInfo(drugNo, drugName, description, dosage, adminMethod)

WardInfo(wardNo, wardName)

c.

TotalInfo(patientNo (FK), drugNo (FK), startDate, wardNo (FK), wardName, bedNo, unitsPerDay, finDate)
PatientInfo(patientNo, fullName)
DrugInfo(drugNo, drugName, description, dosage, adminMethod)
WardInfo(wardNo, wardName (AK))

NOTE: Red denotes primary key, 'FK' denotes foreign key, and 'AK' denotes alternate key.

2.

a. INSERTION: Inserting new patient data without having a doctor assigned will cause an anomaly because the primary key cannot have a NULL value, which would happen without a staff number.
DELETION: Deleting a dentist from the database will delete multiple records and data regarding patients assigned to them will be lost as seen with Ian MacKay.
MODIFICATION: Modifying a dentist name will lead to anomalies because they need to be modified throughout the database, such as changing appointment times since they will now have a different dentist that probably has a different schedule. This can be seen with Tony Smith: multiple records will need to be changed.

b.
   i. staffNo → dentistName
   ii. patNo → patName, surgeryNo
   iii. staffNo, appointment(date, time) → patNo, patName
   iv. staffNo, appointment(date) → surgeryNo
   v. patNo, appointment(date, time) → staffNo, dentistName

c. 1NF:
TotalInfo(staffNo, appointment(date), appointment(time), patNo, dentistName, patName, surgeryNo)

staffNo → dentistName
staffNo, appointment(date) → surgeryNo

These dependencies are partially dependent on the candidate keys but not the whole key.

2NF:
TotalInfo(staffNo, appointment(date), appointment(time), patNo, patName)

DentistInfo(staffNo, dentistName)

AppointmentInfo(staffNo, appointment(date), surgeryNo)

patNo → patName, surgeryNo

This dependency violates 3NF because surgeryNo and patName are transitive dependencies on staffNo because they depend on patNo, which is a non-key depending on another non-key.

3NF:
TotalInfo(staffNo, appointment(date), appointment(time), patNo (FK))
DentistInfo(staffNo, dentistName)
AppointmentInfo(staffNo (FK), appointment(date), surgeryNo)
PatientInfo(patNo, patName, surgeryNo)

NOTE: Red denotes primary key and 'FK' denotes foreign key.