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CS465

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Homework 4

1.

a. **Functional Dependencies:**

- i. $\text{patientNo} \rightarrow \text{fullName}$
Given a patient number it is possible to identify the name of the patient.
- ii. $\text{wardNo} \rightarrow \text{wardName}$
Given a ward number we can uniquely identify a ward name.
should have a unique wardNo.
- iii. $\text{drugNo} \rightarrow \text{drugName, description, dosage, adminMethod}$
The drug number will give these attributes regardless of the patient.
- iv. $\text{patientNo, drugNo, startDate} \rightarrow \text{unitsPerDay, finDate}$
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:** (patientNo, wardNo, startDate, fullName, bedNo, wardName, drugNo, drugName, description, adminMethod, unitsPerDay, finDate)

$\text{patientNo} \rightarrow \text{fullName}$

$\text{drugNo} \rightarrow \text{drugName, description, dosage, adminMethod}$

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

2NF: (patientNo, drugNo, startDate, wardNo, wardName, bedNo, unitsPerDay, finDate)

(patientNo, fullName)

(drugNo, drugName, description, dosage, adminMethod)

$\text{wardNo} \rightarrow \text{wardName}$

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

(patientNo, fullName)

(drugNo, drugName, description, dosage, adminMethod)

(wardNo, wardName)

- c. (patientNo (FK), drugNo (FK), startDate, wardNo (FK), wardName, bedNo, unitsPerDay, finDate)
(patientNo, fullName)
(drugNo, drugName, description, dosage, adminMethod)
(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: (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: (staffNo, appointment(date), appointment(time), patNo, patName)

(staffNo, dentistName)

(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: (staffNo, appointment(date), appointment(time), patNo (FK))

(staffNo, dentistName)

(staffNo (FK), appointment(date), surgeryNo)

(patNo, patName, surgeryNo)

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