**Problem 1**

1. Insertion anomaly:   
   VisitNo and ProvNo must be entered for each row because they are the primary key.
2. Update anomaly:   
   multiple rows may be needed to be changed to update patient zipcode, visit date, patient city, provider specialty, provider email, and patient age.
3. Deletion anomaly:   
   deleting a row can cause deletion of a patient, visit, provider, and zip code if any of these entities are associated with just a single diagnosis

**Problem 2**

Step 1: Arrange the remaining FDs into groups by determinant

|  |
| --- |
| PatNo → PatAge, PatZip9 |
| PatZip9 → PatCity |
| ProvNo → ProvSpecialty |
| VisitNo → PatNo, VisitDate  ProvEmail → ProvNo |
| VisitNo, DocNo → Diagnosis |

Step 2: Make a table with the determinant as the primary key.

Patient (PatNo, PatAge, PatZip9)

FOREIGN KEY (PatZip9) REFERENCES ZipCode

ZipCode(PatZip9, PatCity)

Provider(ProvNo, ProvSpecialty, ProvEmail)

ProviderEmail(ProvEmail, ProvNo)

FOREIGN KEY (ProvNo) REFERENCES Provider

Visit(VisitNo, VisitDate, PatNo)

FOREIGN KEY (PatNo) REFERENCES Patient

DiagnosisTbl(VisitNo, ProvNo, Diagnosis)

FOREIGN KEY (VisitNo) REFERENCES Visit

FOREIGN KEY (ProvNo) REFERENCES Provider

Step 3: The Provider and ProviderEmail tables are merged and a unique constraint is added.

Patient (PatNo, PatAge, PatZip9)

FOREIGN KEY (PatZip9) REFERENCES ZipCode

ZipCode(PatZip9, PatCity)

Provider(ProvNo, ProvSpecialty, ProvEmail)

UNIQUE ProvEmail

Visit(VisitNo, VisitDate, PatNo)

FOREIGN KEY (PatNo) REFERENCES Patient

DiagnosisTbl(VisitNo, ProvNo, Diagnosis)

FOREIGN KEY (VisitNo) REFERENCES Visit

FOREIGN KEY (ProvNo) REFERENCES Provider

**Problem 3**

LenderName, InstName, and StdEmail are determinants.

The tables Student, Lender, and Institution should not be split because they are in BCNF and determinants are unique. Unique constraints should be added for LenderName, InstName, and StdEmail.

Student (StdNo, StdName, StdEmail, StdAddress, StdCity, StdState, StdZip )

UNIQUE (StdEmail)

Lender(LenderNo, LenderName)

UNIQUE (LenderName)

Institution(InstNo, InstName, InstMascot)

UNIQUE (InstName)

**Problem 4**

List FDs with the column *OrdNo* as the determinant and identify at least one pair of sample rows that falsify it or indicate that no falsification example exists for the FD

|  |  |
| --- | --- |
| **FD** | **Falsification** |
| OrdNo -> ItemNo | (1,2), (3,4) |
| OrdNo -> QtyOrd | (3,4) |
| OrdNo -> CustNo | none |
| OrdNo -> CustBal | none |
| OrdNo -> CustDisc | none |
| OrdNo -> ItemPrice | (1,2), (3,4) |
| OrdNo -> OrdDate | none |