**Answer 1:**

There are obvious problems in this database design.

For instance, the following example anomalies spring to mind:

* Insert: cannot insert a new diagnosis without a provider specialty without listing a city (ProvNo part of PK)
* Update: change a provider specialty; change every patient visit to the provider
* Delete: remove fourth row; lose information about provider D3 and P2

**Answer 2:**

PatNo  PatAge

PatNo  PatZip9

PatZip9  PatCity

ProvEmail ® ProvNo

ProvNo  ProvSpecialty

ProvNo ® ProvEmail

VisitNo  PatNo

VisitNo  VisitDate

VisitNo, ProvNo  Diagnosis

Step 1: Arranging the remaining FDs into groups by determinant

PatNo  PatAge, PatZip9

PatZip9  PatCity

ProvNo  ProvSpecialty, ProvEmail

ProvEmail ® ProvNo

VisitNo  PatNo, VisitDate

VisitNo, ProvNo  Diagnosis

Step 2: For each FD group, making a table with the determinant as the primary key. In the table list, the primary keys are underlined.

Patient (PatNo, PatAge, PatZip9)

FOREIGN KEY (PatZip9) REFERENCES PatientAddress

PatientAddress (PatZip9, PatCity)

Provider (ProvNo, ProvSpecialty, ProvEmail)

FOREIGN KEY (ProvEmail) REFERENCES ProviderEmail

ProviderEmail (ProvEmail, ProvNo)

FOREIGN KEY (ProvNo) REFERENCES Provider

VisitPatient (VisitNo, PatNo, VisitDate)

FOREIGN KEY (PatNo) REFERENCES Patient

VisitProvider (VisitNo, ProvNo, Diagnosis)

FOREIGN KEY (VisitNo) REFERENCES VisitPatient

FOREIGN KEY (ProvNo) REFERENCES Provider

Step 3: Merging tables with the same columns. The Author and AuthEmail tables are merged. The Reviewer and ReviewerEmail tables are merged. UNIQUE constraints are added for AuthEmail and RevEmail.

Patient (PatNo, PatAge, PatZip9, PatCity)

UNIQUE (PatZip9)

Provider (ProvNo, ProvSpecialty, ProvEmail)

UNIQUE (ProvEmail)

VisitPatient (VisitNo, PatNo, ProvNo, VisitDate, Diagnosis)

FOREIGN KEY (PatNo) REFERENCES Patient

FOREIGN KEY (ProvNo) REFERENCES Provider

**Answer 3:**

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

Lender (LenderNo, LenderName)

Institution (InstNo, InstName, InstMascot)

I actually think this above model is in BCNF, because for each entity, the related attributes are all pertaining to that entity, and derive from the determinant or primary key. For instance, having a student entry would mean having associated name, email, city, state, zip, or null entries in the cases where that information is not obtained. However, it is directly relevant.

Same with the lender and institution entities. An institution may occasionally not have a mascot; however, it must have a name.

**Answer 4:**

*OrdNo* FDs and sample rows that falsify the FDs. The rows refer to the sample data above.

|  |  |
| --- | --- |
| **FD** | **Falsifications** |
| *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 |