**Third Laboratory Session: Generation of Normalized Database Schema**

Group Number: SSP4 Group 2

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Assumption: The following schema is based on a school-wide database, which means there will be no circumstances such as staff in different schools having the same Staff\_ID.

**State(Name)**

* Key: Name
* Primary Key: Name
* FD: Name → Name
* The relation is in BCNF

**City(City\_Name, State\_Name)**

* Key: {City\_Name, State\_Name}
* Primary Key: {City\_Name, State\_Name}
* FD: City\_Name, State\_Name → City\_Name, Sate\_Name
* The relation is in BCNF

**Person(Person\_ID, Name, Schools, Phone, Email, Address, ZIP, City\_Name, State\_Name)**

* Key: Person\_ID
* Primary Key: Person\_ID
* FDs:
  + Person\_ID→ Name, School, Phone, Email, Address, ZIP, City\_Name, State\_Name
  + Address → ZIP, City\_Name, State\_Name (violates BCNF)
* Normalization:

1. R1(Address, ZIP, City\_Name, State\_Name)

Key: Address

Primary Key: Address

FD: Address → ZIP, City\_Name, State\_Name

The relation is in BCNF

1. R2(Address, Person\_ID, Name, School, Phone, Email)

Key: Person\_ID

Primary Key: Person\_ID

FD: Person\_ID → Address, Name, School, Phone, Email

The relation is in BCNF

**Staff(Person\_ID, Staff\_ID, Date\_Hired, Position)**

* Keys: Person\_ID; Staff\_ID
* Primary Key: Staff\_ID
* FDs:
  + Staff\_ID → Person\_ID, Date\_Hired, Position
  + Person\_ID → Staff\_ID, Date\_Hired, Position
* The relation is in BCNF

**Admin\_Staff(Person\_ID, Admin\_Staff\_ID)**

* Keys: Person\_ID; Admin\_Staff\_ID
* Primary Key: Admin\_Staff\_ID
* FDs:
  + Admin\_Staff\_ID → Person\_ID
  + Person\_ID → Admin\_Staff\_ID
* The relation is in BCNF

**Technical\_Staff(Person\_ID, Technical\_Staff\_ID, Lab\_Name, Lab\_School)**

// Technical\_Staff -- assign → Laboratory; many to one with laboratory

* Keys: Person\_ID; Technical\_Staff\_ID
* Primary Keys: Technical\_Staff\_ID
* FDs:
  + Person\_ID → Lab\_Name, Lab\_School
  + Person\_ID → Lab\_Location
  + Technical\_Staff\_ID → Lab\_Name, Lab\_School
  + Technical\_Staff\_ID → Lab\_Location
* The relation is in BCNF

**Laboratory(Lab\_Name, Lab\_School, Location)**

* Keys: {Lab\_Name, Lab\_School}
* Primary Key: {Lab\_Name, Lab\_School}
* FD: Lab\_Name, Lab\_School → Location
* The relation is in BCNF

**Equipment(Lab\_Name, Lab\_School, Equipment\_ID, Model\_No, Name, Date\_Purchased)**

* Keys: {Lab\_Name, Lab\_School, Equipment\_ID}
* Primary Keys: {Lab\_Name, Lab\_School, Equipment\_ID}
* FD: Lab\_Name, Lab\_School, Equipment\_ID → Model\_No, Name, Date\_Purchased

(Assume two pieces of equipment can have the same Model\_No)

* The relation is in BCNF

**Teaching Laboratory(Lab\_Name, Lab\_School)** // many-to-many with Undergraduate

* Keys: {Lab\_Name, Lab\_School}
* Primary Key: {Lab\_Name, Lab\_School}
* FD: Not applicable
* The relation is in BCNF

**Experiments(Teaching\_Lab\_Name, Teaching\_Lab\_School, Undergraduate\_Person\_ID, Undergraduate\_Student\_ID, Date, Attendance)**

* Key: {Teaching\_Lab\_Name, Teaching\_Lab\_School, Undergraduate\_Person\_ID, Undergraduate\_Student\_ID, Date} (assume one student does not do experiments in different labs on the same date)
* Primary Key: {Teaching\_Lab\_Name, Teaching\_Lab\_School, Undergraduate\_Person\_ID, Undergraduate\_Student\_ID}
* FD: Teaching\_Lab\_Name, Research\_Lab\_School, Undergraduate\_Person\_ID, Undergraduate\_Student\_ID, Date → Attendance

**Research Laboratory(Lab\_Name, Lab\_School)**

* Keys: {Lab\_Name, Lab\_School}
* Primary Key: {Lab\_Name, Lab\_School}
* FD: Not applicable
* The relation is in BCNF

**Assign(Graduate\_Person\_ID, Graduate\_Student\_ID, Lab\_Name, Lab\_School)**

（Note: Research Lab -- Assign -- Graduate）

* Keys: {Graduate\_Person\_ID, Lab\_Name, Lab\_School}, {Graduate\_Student\_ID, Lab\_Name, Lab\_School}
* Primary Key: {Graduate\_Student\_ID, Lab\_Name, Lab\_School}
* FD: Not applicable
* The relation is in BCNF

**Professor(Person\_ID, Fields\_of\_Expertise)**

* Key: Person\_ID
* Primary Key: Person\_ID
* FD: Professor\_Persion\_ID → Fields\_of\_Expertise
* The relation is in BCNF

**Timetable(Prof\_ Person\_ID, Date\_Time, Class)**

* Keys:{Prof\_ Person\_ID, Date\_Time, Class}
* Primary Key: {Prof\_ Person\_ID, Date\_Time, Class}
* FD: Not applicable; assume that a course can happen on many time slots
* The relation is in BCNF

**Course(ID, Name, Date, Prof\_Person\_ID)**

* Key: ID (by assumption)
* Primary Key: ID
* FDs:
  + Course\_ID → Name, Date, Prof\_Person\_ID (assume you cannot find two records with the same Course\_ID but different (prof, date) combinations)
  + Course\_ID → Prof\_Field\_of\_Expertise
* The relation is in BCNF

Note:

splitting Take to 2 binary relationships: Student -- take -- Course, Course -- teach → Professor

**Take(Person\_ID, Student\_ID, Course\_ID, Take\_Date)**

Key: {Person\_ID, Course\_ID}; {Student\_ID, Course\_ID}

Primary: {Student\_ID, Course\_ID}

FD:

Student\_ID, Course\_ID → Take\_Date

Person\_ID, Course\_ID → Take\_Date

The relation is in BCNF

**Stakeholder(Person\_ID, Domain)**

* Keys: Person\_ID
* Primary Key: Person\_ID
* FD: Stakeholder\_Person\_ID → Domain
* The relation is in BCNF

**Comments/Suggestions(Stakeholder\_Person\_ID, Date, Topic)**

* Keys: {Stakeholder\_Person\_ID, Date, Topic} (assume the same person can comments on different topics on the same date)
* Primary Key: {Stakeholder\_Person\_ID, Date, Topic}
* FD: Stakeholder\_Person\_ID, Date, Topic → Stakeholder\_Person\_ID, Date, Topic
* The relation is in BCNF

**Student(Person\_ID, Student\_ID, Majors\_Minors, Admission\_Date, takecourse\_Prof\_Person\_ID)**

* Keys: Person\_ID; Student\_ID
* Primary Key: Student\_ID
* FDs:
  + Person\_ID → Majors\_Minors, Admission\_Date, takecourse\_Prof\_Person\_ID
  + Student\_ID → Majors\_Minors, Admission\_Date, takecourse\_Prof\_Person\_ID
* The relation is in BCNF

**Undergraduate(Person\_ID, Undergraduate\_Student\_ID)**

* Keys: Person\_ID; Undergraduate\_Student\_ID
* Primary Key: Undergraduate\_Student\_ID
* FDs:
  + Person\_ID → Undergraduate\_Student\_ID
  + Undergraduate\_Student\_ID → Person\_ID
* The relation is in BCNF

**Graduate(Student\_Person\_ID, Graduate\_Student\_ID, Prof\_ Person\_ID, Supervise\_Topic)**

// Graduate -- supervise → Professor; many to one

* Keys: Student\_Person\_ID; Graduate\_Student\_ID
* Primary Keys: Graduate\_Student\_ID
* FDs:
  + Graduate\_Student\_ID → Prof\_ Person\_ID, Supervise\_Topic
  + Graduate\_Student\_ID → Prof\_Field\_of\_Expertise
* The relation is in BCNF