# **CSCI X370: Database Management**

**Spring 2018**

## **Project 4: Database Design and Normalization**

Due: Mar 29 (Thursday), 2018 (11:59 pm)

This project requires your skills to design and normalize database.

No programming required.

**Problem Statement:**

Suppose we have the following requirements for a **university database** that is used to keep track of students’ transcripts:

(a) The university keeps track of each student's name (SNAME), student number (SNUM), social security number (SSN), current address (SCADDR) and phone (SCPHONE), permanent address (SPADDR) and phone (SPPHONE), birthdate (BDATE), sex (SEX), class (CLASS) (freshman, sophomore, ..., graduate), major department (MAJORDEPTCODE), minor department (MINORDEPTCODE) (if any), and degree program (PROG) (B.A., B.S., ..., Ph.D.). Both ssn and student number have unique values for each student.

(b) Each department is described by a name (DEPTNAME), department code (DEPTCODE), office number (DEPTOFFICE), office phone (DEPTPHONE), and college (DEPTCOLLEGE). Both name and code have unique values for each department.

(c) Each course has a course name (CNAME), description (CDESC), code number (CNUM), number of semester hours (CREDIT), level (LEVEL), and offering department (CDEPT). The value of code number is unique for each course.

(d) Each section has an instructor (INSTUCTORNAME), semester (SEMESTER), year (YEAR), course (SECCOURSE), and section number (SECNUM). Section numbers distinguish different sections of the same course that are taught during the same semester/year; its values are 1, 2, 3, ..., up to the number of sections taught during each semester.

(e) A grade record refers to a student (SSN), semester (SEMESTER), year (YEAR), a course and its section (CNUM, SECNUM), and grade (GRADE).

Design three relational database schemas for this database application:

* One from ER to relational model,
* Second from BCNF decomposition, and
* Third from 3NF synthesis.

1. Draw **ER diagram** using MySQL Workbench for the five (a-e) entities of university database as described above.
2. Convert the ER diagram to **Relational Model.**
3. Perform **BCNF decomposition** for the university database.
4. Perform **3NF synthesis** for the university database.
5. Fill the comparison table of all the 3 designs in the table as shown below:

|  |  |  |  |
| --- | --- | --- | --- |
|  | ER | BCNF | 3NF |
| No. of tables |  |  |  |
| Lossless |  |  |  |
| Functional dependencies preserved |  |  |  |

1. Create 3 Schema.sql files, one each for three designs.

**Note for documentation:**

First show all the functional dependencies that should hold among the attributes. Specify the key attributes of each relation. Then, design relation schemas for the database that are each in BCNF and 3NF. Note any unspecified requirements, and make appropriate assumptions to make the specification complete. **Explain your work clearly.**

**What to submit:** Please submit

1. **A document**, in MS Word or PDF including all the three designs with each step. It should include an ER diagram from MySQL Workbench, Conversion from ER to relational model, Step by Step BCNF and 3NF normalizations and their resultant designs and comparison of each model (i.e., fill the comparison table of all the 3 designs in the table).
2. **3 Schema.sql** files, one for each design model.

**How to Submit:**

Submit your ".zip" file using ELC. Only team leaders need to make a submission. **Every student needs to submit a peer-evaluation within 24 hours of the project submission deadline** to the same project number drop box on ELC.

Do not place your solution on a public web site. Submit your own work and follow the course misconduct policy.