# CISC637 Spring 2015, Homework 1

Due date Tuesday, Feb 24, at 11:55pm on Sakai. You will need to install MySQL on your own computer. You can download it from `http://dev.mysql.com/downloads/` (choose the "MySQL Community Server"), and there are installation instructions for various platforms at `http://dev.mysql.com/doc/refman/5.6/en/installing.html`. You may also want to install the MySQL Workbench GUI available at `http://dev.mysql.com/downloads/workbench/`.

The following diagram represents a relational schema for a university (from the textbook).
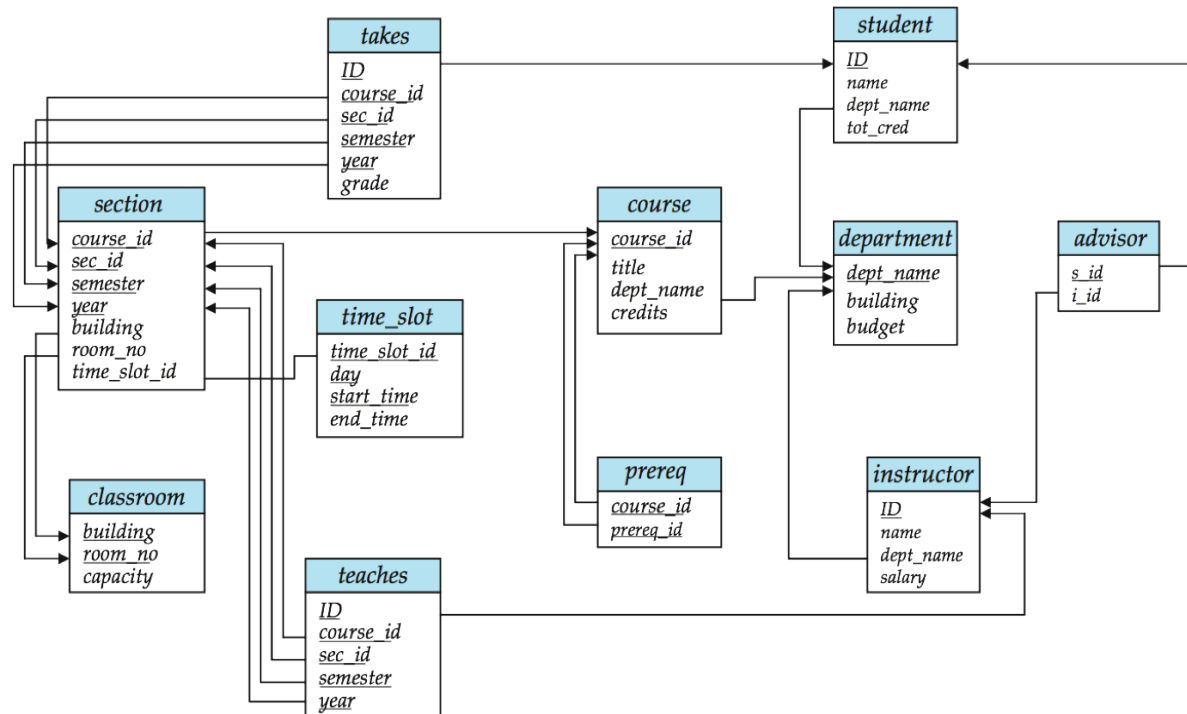
Underlined attributes indicate primary keys; arrows between tables indicate foreign keys. The arrow from `section.time_slot_id` to `time_slot.time_slot_id` should have an arrowhead pointing to `time_slot`. We will assume that the `day` field in `time_slot` takes a string like "MWF" or "TR".

For this homework you will implement this schematic in your MySQL database, add some data to it, and formulate SQL queries.

1. **45 pts.** Create all the tables shown above in your MySQL database. You may use whatever domains you think are appropriate. Define *all* primary key and foreign key constraints. Use `engine = innodb` to ensure that foreign key constraints are enforced by MySQL.

   For each foreign key, be sure to define the actions to take ON DELETE and ON UPDATE to maintain referential integrity.

2. **35 pts.** Formulate SQL queries to answer each of the following questions. Turn in the queries on Sakai.

   - What are the names and total credits of students majoring in math? (Assume `dept_name` refers to major.)

- What are the titles and credit hours of courses taught by Professor Einstein?

- What are the titles of courses taught in Purcell?

- Suppose some courses are on MW and some are on MWF. What are the titles of courses taught on Mondays in Smith Hall?

- What are the titles of courses that are prerequisites for 400-level CIS courses?

- What is the GPA of the student with ID=1? (Assume there are only five letter grades with values A=4, B=3, C=2, D=1, and F=0, and GPA is the sum of course credits × course grade value divided by total credits.)

- What courses were taught in either Spring of 2014 or Fall of 2014?

- What courses were taught in both Spring of 2014 and Fall of 2014?

- What are the average salaries of instructors in each department?

- How many open seats are there in section 010 of CISC437 in Spring 2015?

- How many students does each instructor in computer science advise?

- What are the average GPAs for students by department?

3. **10 pts.** Insert data into tables as necessary to test the queries you wrote above. Make sure to insert relevant data as well as irrelevant data into each table involved in each query. The values can be whatever you want as long as the queries are answered correctly.

4. **10 pts.** On data consistency.

   (a) Why are *semester* and *year* part of the primary key of the *teaches*, *takes*, and *section* relations? If they were not part of the key, how would that change the data that could be stored?

   (b) Suppose we want to store information about university buildings (such as address, abbreviated name, full name, year built, etc.). How could we add this information without introducing any redundancy in the data? What would we have to change in the schema and foreign key constraints?

   (c) Find three cases in the university database diagram in which valid data can be stored that would be considered *invalid* in a real university. Give examples of data that is valid for the database but invalid in reality.

What to turn in on Sakai:

1. your SQL queries for #2 in a document or inline on Sakai;

2. your answer to #4 in the same document or inline on Sakai;

3. a dump of your MySQL database containing all the tables from #1 and all the data from #3 as an attachment.

Please *do not* turn in a separate document listing all of your CREATE TABLE queries from #1 or INSERT queries from #3. We only want the database dump.