CS482 – Midterm 2
October 29, 2002
5pm – 6:10 pm

Name:

Email:

NOTE: There are 6 questions and a total of 105 points. The 6th question is a bonus question. 100 points worth 20% of your grade.

Use as many papers as you need. Write your name on each sheet.

Write clearly and justify your answers.

1. (30) For the relational schema T(A,B,C,D,E) with the set of FD's

   AB à C, DE à C, and B à D

   do the following:

   a. Indicate at least 10 non-trivial BCNF violations (a non-trivial BCNF violation is a non-trivial FD that violates the BCNF condition).
   b. Decompose T into a collection of BCNF relations.
   c. Among the 10 non-trivial BCNF violations of your answer (a) indicate those that violate the 3NF condition. Decompose the relation into a set of 3NF relations.

2. (10) Suppose that we have a relation R(B,C,D) with a MVD D à à B. If we know that the current instance of R contains the tuples (b_1,c_1,d_1), (b_2,c_2,d_1), (b_3,c_3,d_2), and (b_4,c_4,d_2). List all other tuples that must be contained in this instance.

3. (30) Coming back to the database for the registrar office in our first exam. Use ODL to define the classes *Student*, *Courses*, and *Department*, with the usual information such as

   a. For a student, we want to record her/his id, name, major, minor, and courses that she/he has finished and currently taken, her/his closest friend (id is a key).
   b. For a course, we want to record its code and title (code is a key).
   c. For a department, we want to record its code and name (code is a key).

   We assume that each student declares his major in only one department but can declare as a minor in several departments. Identify (possible) integrity constraints and make sure that your definitions satisfy them. Include also the key specification in each class.

   Depending on your class definition, give an example of objects belonging to the classes *Student*, *Course*, and *Department* (at least one for each class). In other words, give a possible value that an object belongs to a class can have.

4. (15) Convert your class definitions into relational schemas. Provide arguments that justify your conversion.

5. (15) Suppose that we have the following information about two students:

   John Handsome: ID = 1; major: CS; minor: Math, BCS; courses finished: CS110, CS171, CS271; course currently taken: CS371, CS482; closest friend: none.

   Mary Cute: ID = 2; major: Math; minor: Economic; courses finished: MA110, MA171; course currently taken: MA271, EC112; closest friend: Harry Porter.

   a. Represent the above information using semi-structured data.
   b. Derive a XML document that represents the information provided by your semi-structured data representation.

6. (5) Convert your ODL descriptions in question 3 into object-relational schemas.