

**UNCA CSCI 343**  
**Exam 2 Spring 2014**  
9 April, 2014

This is a closed book and closed notes exam. It is to be turned in by 11:15 AM. Calculators, PDA's, cell phones, and any other electronic or communication devices may not be used during this exam.

*If you want partial credit for imperfect answers, explain the reason for your answer!*

*If you need to take a break during the exam, make it quick and leave your exam with the instructor.*

Name: \_\_\_\_\_

**Problem 1 (5 points)**

In Derek Morgan's presentation in CSCI 343, he discussed the uses of vector and raster data in spatial databases. Describe at least one common use of vector data *and* at least one common use of raster data in GIS.

Now we will look at the relational algebra and some SQL queries using Stanford's social relations database.

**Problem 2 (10 points)**

Use relational algebra, with the operators  $\Pi$  for projection,  $\sigma$  for selection, and  $\times$  for Cartesian product, to encode the following SQL query.

```
SELECT H.name, H.ID
FROM   Friend F, Highschooler H
WHERE  H.ID = F.ID1 AND H.grade = 10 ;
```

**Problem 3 (10 points)**

Write an SQL query to list the names of all Highschoolers in the 10th grade. Sort the list by the name.

**Problem 4 (10 points)**

Write an SQL query to list the number of students in each grade named Alison. Order your list by the grade number.

**Problem 5 (10 points)**

Write an SQL query to list the number of friends each student has in their own grade. Order your list by student name.

**Problem 6 (15 points)**

Write an SQL query to list the name of every student who has at least two friends in a different grade than their own. Order your list by the student name.

If you are stuck, start by drawing a picture!

The remaining questions are about database design. Write your answers on the paper provided for you.

**Be sure to write your name on each page and please number your pages**

We return to our usual example .....

Represent the people involved in field trips for an elementary school.

- A field trip is composed of the following three types of people: teachers, students, and chaperons.
- Each person is identified by a name. Assume that each person can be uniquely identified by their name.
- Each student also has an emergency contact phone number.
- The people of the field trip are organized into groups.
- Each teacher is in charge of a few groups and every group is assigned to a single teacher.
- Each chaperon is assigned to a single group and every group is assigned to a single chaperon.
- Each student is assigned to a single group and every group contains two, three, or four students.

**Problem 7 (5 points)**

Write or draw, a representation of a field trip with one teacher, two chaperons, and five students organized into two groups. Give names for the seven people involved on the field trip.

**Problem 8 (5 points)**

Write a *single* SQL CREATE TABLE statement that defines a one-table representation for the field trip. We **all** know that a one table database isn't a good idea for this application, but do it anyway. Pretend the table is a list of students with their teachers and chaperons.

**Problem 9 (10 points)**

Draw a UML diagram suitable for representing a field trip.

**Problem 10 (5 points)**

Write functional dependencies appropriate for the field trip.

**Problem 11 (5 points)**

Normalize the table you described in Problem 8 into Boyce-Codd Normal Form.

A table is in Boyce-Codd Normal Form if for every dependency  $X \rightarrow Y$  either  $X$  is a *superkey* or  $Y$  is a subset of  $X$ .

**Problem 12 (10 points)**

Write SQL CREATE TABLE statements to create the tables you described in Problem 11. When appropriate include PRIMARY KEY and FOREIGN KEY constraints.