Database Systems

CSCE 413/813 Test 1 Fall 2003

1. (8 points) *Name* and *define* the four levels of data abstraction.

2. Consider the baby girls height chart shown in the Figure on the next page.

   (a) (6 points) Represent using a constraint relation $Girls\_Height(Percent, Inch, Month)$ the 95th, 50th, and the 5th percentile curves of the chart. (Hint: Use a piecewise linear approximation with the first piece between 0 to 6 months, and the second piece between 6 and 18 months.)

   (b) (6 points) Assume that above 95 percentile height means *tall*, between 95 and 5 percentile means *normal*, and less than 5 percentile means *short*. Represent using a constraint relation $Girls\_Group(Type, Inch, Month)$ the three types of heights.

   (c) (5 points) Assume that relation $Baby(Name, Sex, Inch, Month)$, where *Sex* is either the string "M" or "F", records some growth information about babies. Write a relational algebra query that finds the name of those baby girls who are either *tall* or *short* at any time. (Hint: Use the relations *Baby* and *Girls_Group*.)

   (d) (5 points) Write an SQL query with an aggregation operator that finds the inches heights of the shortest baby girl and the shortest baby boy. (Hint: Use relation *Baby*.)

   (e) (5 points) Write a nested SQL query that finds the name of the baby girl who is the tallest at 10 months. (Hint: Use relation *Baby*.)

   (f) (5 points) Assume that each baby is measured each month. A baby is said to be on *watch* at any given month if (1) he/she did not grow anything since the previous month or (2) was on watch the previous month and grew less than one inch since then. Write a Datalog query that finds the output relation $Watch(name, month)$, which contains all pairs $(name, month)$ such that a baby with *name* is on watch at *month*. (Hint: Use relation *Baby* as input relation and two different Datalog rules for the two conditions.)

3. (5 points) Suppose a bakery produces three types of products: bread, cookie, croissant. Each bread needs 30 units of flour, 7 units of yeast, and 3 units of salt. Each cookie needs 5 units of flour, 2 units of baking powder, 9 units of sugar, and 1 unit of butter. Each croissant needs 8 units of flour, 4 units of yeast, 6 units of sugar, and 3 units of butter. The bakery can use each day at most only 1000 units of flour, 50 units of yeast, 70 units of salt, 80 units of baking powder, 300 units of sugar, and 60 units of butter. Represent as a constraint relation with scheme $Produce(x, y, z)$ all production possibilities where x, y, and z are, respectively, the number of bread, cookies, and croissants produced.

4. (5 points) Write a Datalog query that finds the maximum profit for the bakery if the profit made on each bread, cookie, and croissant is 120, 20, and 15 cents, respectively, and it sells all the items produced.