ITWS-4250/6250 Database Applications and Systems

Lab 1

This lab will focus on the use of relational algebra to query a relational schema, as well as concepts related to functional dependencies.

You will have twenty to thirty minutes of time during the scheduled lecture period to complete it, but it's not due on Submitty until **4:30pm on Thursday September 10**.

You may work in teams of up to three (3).

1. Assume the existence of a database with the following relations:

   $Ingredient(\underline{name}, calories, cost, containsNuts)$
   $Recipe(\underline{name}, \underline{ingredientName}, amount)$
   $Menu(recipeName, season)$

   which is used by a restaurant to manage its menu items. Assume that all amounts are in the same unit (e.g., grams) and that:

   $\pi_{ingredientName} Recipe \subseteq \pi_{name} Ingredient$
   $\pi_{recipeName} Menu \subseteq \pi_{name} Recipe$

   Two facts that may be helpful to remember:

   - the natural join ($\bowtie$ with no condition) will pair tuples that agree on attributes with the *same name*, regardless of the semantic meaning of that name.
   - recipes that contain nuts may also contain some ingredients without nuts

   Write relational algebra expressions for the following:

   (a) (3 points) List the names of all recipes on the menu for either the Summer or Fall seasons

   (b) (3 points) List the names of the recipes on the Fall menu that contain nuts

(c) (4 points) List the names of the recipes on the Winter menu that *do not* contain nuts

(d) (3 points) List the names of recipes that contain more than 4 units of salt

2. Assume the relation $R(a, b, c, d, e, f)$ with the following FDs:

   $ab \rightarrow c$
   $c \rightarrow de$
   $f \rightarrow ac$
   $be \rightarrow f$

   (a) (4 points) Find the key(s) of R

   (b) (1 point) Why isn't $\{f, b, e\}$ a key?

(c) (2 points) Compute $\{ac\}+$. Show your work.

(d) (2 points) Comput $\{b, d\}+$. Show your work

(e) (3 points) Would $ac \rightarrow d$ form part of a minimal basis? Why or why not?