CSE 232 **Problem Set # 1** **Fall, 2000**

Practice Problems on Queries

1. The beer drinkers' database consists of the following three relations

   frequents: drinker, bar
   serves: bar, beer
   likes: drinker, beer

   The first indicates the bars each drinker frequents, the second tells what beers each bar serves, and the last indicates which beers each drinker likes to drink. Express the following queries in (i) tuple calculus (ii) domain calculus (iii) relational algebra (iv) SQL and (v) QBE:

   (a) List the bars that serve a beer that Joe likes.

   (b) List the drinkers who frequent at least one bar that serves a beer they like.

   (c) List the drinkers who frequent only bars that serve some beer that they like.
   (Assume each drinker likes at least one beer and frequents at least one bar.)

   (d) List the drinkers who frequent no bar that serves a beer that they like.

2. Consider the database consisting of one relation:

   film: title, director, actor.

   Express the following queries in (i) domain calculus, (ii) relational algebra, (iii) QBE, and (iv) SQL.

   (a) List the actors cast in at least one movie by Kurosawa.

   (b) List the actors cast in every movie by Kurosawa.

   (c) List the actors cast only in movies by Kurosawa.

   (d) List all pairs of actors who act together in at least one movie.

(e) List all pairs of actors cast in exactly the same movies.

(f) List the directors such that every actor is cast in one of his/her films.
(Assume that a film is uniquely identified by its title.)

3. Let R and S be relations with attributes AB. Prove or disprove the following:

   (a) $\pi_A(R \cup S) = \pi_A(R) \cup \pi_A(S)$

   (b) $\pi_A(R \cap S) = \pi_A(R) \cap \pi_A(S)$

   (c) $\pi_A(R - S) = \pi_A(R) - \pi_A(S)$

4. Consider the movie database consisting of two relations

   movie: *title, director, actor*
   schedule: *title, theater*

   Consider the relational algebra query:

$$\pi_{director}[\sigma_{theater \neq \text{"}Cove\text{"}}(movie \bowtie schedule)]$$

   (find the directors of all movies playing elsewhere than the Cove). How should a query optimizer rewrite this query to make its evaluation more efficient? Explain why the rewritten query is better.

5. Consider the following rspj algebra query (R is a relation with attribut es ABC):

$$\pi_{AC}[\pi_{AB}(R) \bowtie \pi_{BC}(R)] \bowtie \pi_A[\pi_{AC}(R) \bowtie \pi_{CB}(R)].$$

   (a) Find the tableau corresponding to the above query.

   (b) Minimize the tableau obtained in (a).

   (c) Construct an rspj algebra query corresponding to the minimized tableau.

   (d) Redo (a),(b),(c) for the query:

$$\pi_{AC}[\pi_{AB}(R) \bowtie \pi_{BC}(\sigma_{B=8}(R))] \bowtie \pi_A[\pi_{AC}(\sigma_{A=5}(R)) \bowtie \pi_{CB}(R)].$$

6. Let R be a relation over attributes ABC.
(i) Simplify the following query, knowing that it is applied only to relations R satisfying the fds $\{AC \to B, B \to C, C \to A\}$ (use tableau minimizati on and the chase):

$$q = \pi_{AB}[\pi_{AC}(R) \bowtie \pi_{CB}(R)] \bowtie \pi_{BC}[\pi_{BA}(R) \bowtie \pi_{AC}(R)].$$

(ii) Redo (i) for the query:

$$q = \pi_{AB}[\pi_{AC}(R) \bowtie \pi_{CB}(\sigma_{C=5}(R))] \bowtie \pi_{BC}[\pi_{BA}(R) \bowtie \pi_{AC}(\sigma_{A=8}(R))].$$