CSE 132A

Solutions to practice problems on relational algebra

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

$$\pi_{bar}(serves \bowtie \sigma_{drinker=Joe}(likes)).$$

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

$$\pi_{drinker}(frequents \bowtie serves \bowtie likes)$$

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

$$\pi_{drinker}(frequents) - \pi_{drinker}[frequents - \pi_{drinker,bar}(serves \bowtie likes)].$$

   (d) List the drinkers that frequent no bar that serves a beer that they like.
   This is just the complement of (b):

$$\pi_{drinker}(frequents) \; - \; \pi_{drinker}(frequents \bowtie serves \bowtie likes)$$

2. (a) List the actors cast in no movie directed by Berto.

$$\pi_{actor}(movie) \; - \; \pi_{actor}(movie \bowtie \pi_{title}(\sigma_{dir=Berto}(movie)))$$

   (b) List the actors cast only in movies by Berto

$$\pi_{actor}(movie) - \pi_{actor}(movie \bowtie (\pi_{title}(movie) - \pi_{title}(\sigma_{dir=Berto}(movie))))$$

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

$$\pi_{actor_1,actor_2}[\delta_{actor\to actor_1}(\pi_{title,actor}(movie)) \bowtie \delta_{actor\to actor_2}(\pi_{title,actor}(movie))]$$

The above does not make the closed world assumption about the movie database. With the closed world assumption (for each title, all combinations of directors and actors appear explicitly in the datbase) the query can be simplified as follows:

$$\pi_{actor_1,actor_2}[\delta_{actor\to actor_1}(movie) \bowtie \delta_{actor\to actor_2}(movie)]$$

(d) List the directors such that every actor is cast in one of his/her movies.

$$\pi_{director}(movie) \;-\; \pi_{director}[\pi_{director}(movie) \bowtie \pi_{actor}(movie) \;-$$
$$\pi_{director,actor}(\pi_{director,title}(movie) \bowtie \pi_{title,actor}(movie))]$$

If we make the closed world (or the unique director) assumption, the solution is simpler:

$$\pi_{director}(movie) - \pi_{director}[\pi_{director}(movie) \bowtie \pi_{actor}(movie) - \pi_{director,actor}(movie)]$$

With these assumptions, this also works:

$$\pi_{director,actor}(movie) \div \pi_{actor}(movie).$$

3. (a) True. The proof uses distributivity of existential quantification over disjunction.

(b) False (note that this says, essentially, that existential quantifica tion distributes over conjunction). A counterexample is:

R	A	B
	0	0

S	A	B
	0	1

(c) False. Same counterexample as for (b).

4. One way to make the evaluation more efficient is to rewrite the query as

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

This cuts down the size of relations participating in the join and avoids building up an unnecessarily large intermediate result (resulting from the join).