

Homework Assignment 1
(due Thursday, October 9, 2003)

- Read Chapters 1 and 3. If you have difficulty following section 3.1, you are invited to also read Chapter 2, which, however, will be covered later in detail.
- Exercises 3.1, 3.2, 3.5 parts (a)-(f) (included)
- The *beer drinkers* database consists of information about drinkers, beers, and bars telling which drinkers like which beers, which drinkers frequent which bars, and which bars serve which beers and at what prices.
 1. Describe an appropriate relational database schema for this and give an instance of your schema.
 2. Write relational algebra expressions for the following queries:
 - “List all bars that serve AMSTEL for less than \$3.00”
 - “List all bars that serve AMSTEL for less than \$3.00 and are frequented by customer “Joe Mug”.
 - “List all drinkers that frequent at least one bar that serves a beer they like”.
- Show that each of the following operations can be expressed in relational algebra:
 1. The *converse* \check{R} of a binary relation R , where \check{R} consists of all pairs (a, b) such that $(b, a) \in R$.
 2. The *symmetric part* R^* of a binary relation R , where R^* consists of all pairs (a, b) such that both (a, b) and (b, a) are in R .
 3. The *symmetric difference* $R\Delta S$ of two relations, where $R\Delta S$ consists of all tuples that belong to exactly one of R and S .
 4. The *composition* $R_1 \circ R_2$ of two binary relations R_1, R_2 , where $R_1 \circ R_2$ consists of all pairs (a, c) for which there is an element b such that $(a, b) \in R_1$ and $(b, c) \in R_2$.
- An airline maintains a FLIGHTS database that includes a table called DIRECT with two attributes FROM and TO containing information about direct flights between two cities. Give a relational algebra expression for the relation AT-MOST-TWO consisting of all pairs (c, d) of cities such that one can travel from city c to city d with at most two intermediate stops.