**Schema for practice exercises**

CUSTOMERS(FName, LName, CAddress, Account)

PRODUCTS(Prodnname, Category)

SUPPLIERS(SName, SAddress, Chain)

orders((FName, LName) → CUSTOMERS,
       SName  → SUPPLIERS,
       Prodnname  → PRODUCTS, Quantity)

offers(Sname  → SUPPLIERS, Prodnname  → PRODUCTS, Price)
Exercise 1

Translate the following Datalog queries to (a) relational algebra, (b) SQL, and (c) English.

1. \( \text{ans}(x, y) \leftarrow \text{CUSTOMERS}(x, y, _, z) \text{ AND } z > 1000 \)

2. \( \text{ans}(x) \leftarrow \text{SUPPLIERS}(x, _, _) \text{ AND} \)
   \( \quad \text{offers}(x, y, _) \text{ AND} \)
   \( \quad \text{PRODUCTS}(y, "As seen on TV") \)

3. \( \text{cname}(x) \leftarrow \text{CUSTOMERS}(x, _, _, _) \)
   \( \text{cname}(y) \leftarrow \text{CUSTOMERS}(_, y, _, _) \)
   \( \text{sname}(x) \leftarrow \text{SUPPLIER}(x, _, _) \)
   \( \text{pname}(x) \leftarrow \text{PRODUCT}(x, _) \)
   \( \text{ans}(x) \leftarrow \text{cname}(x) \text{ AND} \)
   \( \quad \text{NOT sname}(x) \text{ AND} \)
   \( \quad \text{NOT pname}(x) \)
Answers:

1. (a) \( \pi_{\text{Fname}, \text{Lname}}(\sigma_{\text{Account} > 1000}(\text{CUSTOMERS})) \)
   (b) select Fname, LName
       from CUSTOMERS
       where Account > 1000;
   (c) Find names of customers with more than 1000 dollars in their accounts.

2. (a) \( \pi_{\text{Sname}}(\sigma_{\text{Category} = \text{"As seen on TV"}}(\text{SUPPLIERS} \bowtie \text{offers} \bowtie \text{PRODUCTS})) \)
   (b) select Sname
       from SUPPLIERS S, offers O, PRODUCTS P
       where S.Sname = O.Sname
           and O.Pname = P.Pname
           and P.Category = 'As Seen on TV';
   (c) Find all suppliers offering a product from the “as seen on TV” category.
Answers, cont’d:

3. (a) $\left((\rho_{\text{Fname}} \rightarrow \text{name} (\pi_{\text{Fname}} \text{CUSTOMERS})) \cup \rho_{\text{Lname}} \rightarrow \text{name} (\pi_{\text{Lname}} \text{CUSTOMERS})) - \left((\rho_{\text{Sname}} \rightarrow \text{name} (\pi_{\text{Sname}} \text{SUPPLIERS})) \cup \rho_{\text{Pname}} \rightarrow \text{name} (\pi_{\text{Pname}} \text{PRODUCTS})\right)\right)$

(b) select name from (  
  select Fname as name  
  from CUSTOMERS  
  union  
  select Lname as name  
  from CUSTOMERS  
) as S  
except  
select name from (  
  select Sname as name  
  from SUPPLIERS  
  union  
  select Pname as name  
  from PRODUCTS  
) as T

(c) Find all names (first or last) of customers that are not also names of products or suppliers.
Exercise 2

Translate the following queries to Datalog.

1. Find the names of products ordered by Jane Doe.

2. \( \pi_{\text{Fname,Lname}}(\sigma_{\text{CAddress=SAddress}}(\text{CUSTOMERS} \bowtie \text{orders} \bowtie \text{SUPPLIERS})) \)

3. with recursive reachable(fname,lname) as ( 
    select fname, lname  
    from CUSTOMERS  
    union  
    select C.fname, R.lname  
    from CUSTOMERS C, reachable R  
    where C.lname = R.fname  
  )  
  select fname, lname  
  from reachable  
  where fname = 'Eve';
Answers:

1. \( \text{ans}(x) \leftarrow \text{orders}("Jane", "Doe", _, x, _) \)

2. \( \text{ans}(x,y) \leftarrow \text{CUSTOMERS}(x,y,z,_) \text{ AND} \)
\( \text{orders}(x,y,u,_) \text{ AND} \)
\( \text{SUPPLIERS}(u,z,_) \)

3. \( \text{reachable}(x,y) \leftarrow \text{CUSTOMERS}(x,y,_,_) \)
\( \text{reachable}(x,y) \leftarrow \text{CUSTOMERS}(x,z,_,_,_) \text{ AND} \)
\( \text{reachable}(z,y) \)
\( \text{ans}(x,y) \leftarrow \text{reachable}(x,y) \text{ AND} x = "Eve" \)