DB - HW2

Consider the bank database of Figure 2.18. Assuming that branch names and customer names uniquely identify branches and customers, but loans and accounts can be associated with more than one customer.
a. What are the appropriate primary keys?
b. Given your choice of primary keys, identify appropriate foreign keys.

Answer：

a. Assuming branch names and cumstomer names are unique, the appropriate primary keys of the schemas are underliened：
branch(<u>branch_name</u>, branch_city, assets);
customer(<u>ID</u>, <u>customer_name</u>, customer_street, customer_city);
loan(<u>loan_number</u>, branch_name, amount);
borrower(<u>ID</u>, <u>loan_number</u>);
account(<u>account_number</u>, branch_name, balance);
depositor(<u>ID</u>, <u>account_number</u>);

b. The primary keys and foreign keys of each schema are as follows:

   i. *branch*:
      Primary Key: branch_name

   ii. *customer*:
      Primary Key: customer_name

   iii. *loan*:
      Primary Key: loan_number
      Foreign Key: loan_number ~ *borrower*

   iv. *borrower*:
      Primary Key: ID
      Foreign Key: ID ~ *customer*
                     loan_number ~ *loan*

   v. *account*:
      Primary Key: account_number
      Foreign Key: branch_name ~ *branch*

   vi. *depositor*:
      Primary Key: ID
      Foreign Key: ID ~ *customer*
                     account_number ~ *account*

Consider the employee database of Figure 2.17. Given an expression in the relational algebra to express each of the following queries:
a. Find the ID and name of each employee who works for "BigBank".
b. Find the ID, name, and city of residence of each employee who works for "BigBank".
c. Find the ID, name, street address, and city of residence of each employee who wroks for "BigBank" and earns more than $10000.
d. Find the ID and name of each employdee in this database who lives in the same city as the company for which she or he works.

Answer：

$$employee \ (person\_name, \ street, \ city)$$
$$works \ (person\_name, \ company\_name, \ salary)$$
$$company \ (company\_name, \ city) \qquad \text{可是这里没有ID}$$

Figure 2.17 Employee database.

a. $\Pi_{person\_name}\left(\sigma_{company\_name = "BigBank"}\left(works\right)\right)$

b. $\Pi_{person\_name, \ city}\left(\sigma_{company\_name = "BigBank"}\left(employee \bowtie works\right)\right)$

c. $\Pi_{person\_name, \ street, \ city}\left(\sigma_{company\_name = "BigBank" \wedge salary > 10000}\left(employee \bowtie works\right)\right)$

d. $\Pi_{person\_name}\left(\sigma_{employee.city = comp.city}\left(employee \bowtie \rho_{comp}\left(works \bowtie company\right)\right)\right)$

Consider the bank database of Figure 2.18. Given an expression in the relational algebra for each of the following queries:
a. Find each loan number with a loan amount greater than $10000.
b. Find the ID of each depositor who has an account with a balance greater than $6000.
c. Find the ID of each depositor who has an account with a balance greater than $6000 at the "Uptown" branch.

Answer：

a. $\Pi_{loan\_number}\left(\sigma_{amount > 10000}\left(loan\right)\right)$

b. $\Pi_{ID}\left(\sigma_{balance > 6000}\left(account \bowtie depositor\right)\right)$

c. $\Pi_{ID}\left(\sigma_{balance > 6000 \wedge branch\_name = "Uptown"}\left(account \bowtie depositor\right)\right)$