201533661 이승수's homework#2 date: 2016.09.21

2.1 Consider the relational database of Figure 2.14. What are the appropriate primary keys?

For each table employee, works, company, the appropriate primary keys for each table is person_name, person_name, company_name.

2.6 Consider the following expressions, which use the result of a relational algebra operation as the input to another operation. For each expression, explain in words what the expression does.

a. 세타year≥2009(takes) ⋈ student

find tuples from takes table whose year is bigger than 2009 and then natural join them with the student table.

b. 세타year≥2009(takes ⋈ student)

natural join the takes and student table and then find the tuples whose year is greater than 2009.

c. 파이ID,name,course id(student ⋈ takes)

natural join student and takes table. Then get only 3 attributes(ID,name,course_id) and then delete duplicated.

2.7 Consider the relational database of Figure 2.14. Give an expression in the relational algebra to express each of the following queries:

a. Find the names of all employees who live in city "Miami".

$$\Pi_{person\_name}(\sigma_{city='Miami'}(employee))$$

b. Find the names of all employees whose salary is greater than $100,000.

$$\Pi_{person\_name}(\sigma_{salary>100,000}(\sigma_{employee.person\_name=works.person\_name}(employee \times works)))$$

c. Find the names of all employees who live in "Miami" and whose salary is greater than $100,000.

$$\Pi_{person\_name}(\sigma_{city='Miami' \wedge salary>100,000}(\sigma_{employee.person\_name=works.person\_name}(employee \times works)))$$

2.8 Consider the bank database of Figure 2.15. Give an expression in the relational algebra for each of the following queries.

a. Find the names of all branches located in "Chicago".

$\Pi_{branch\_name}(\sigma_{branch\_city="Chicago"}(branch))$

b. Find the names of all borrowers who have a loan in branch "Downtown".

$\Pi_{customer\_name}(\sigma_{branch\_name="Downtown"}(\sigma_{borrower.loan\_number=loan.loan\_number}(loan \times borrower)))$

2.9 Consider the bank database of Figure 2.15.

a. What are the appropriate primary keys?

branch: branch_name loan: loan_number account: account_number
customer: customer_name borrower: loan_number depositor: account_number

b. Given your choice of primary keys, identify appropriate foreign nkeys.

loan_number(loan, borrower), account_number(account, depositor)

2.12 Consider the relational database of Figure 2.14. Give an expression in the relational algebra to express each of the following queries:

a. Find the names of all employees who work for "First Bank Corporation".

$\Pi_{person\_name}(\sigma_{company\_name="First\ Bank\ Corporation"}(\sigma_{employee.person\_name=works.person\_name}(employee \times works)))$

b. Find the name sand cities of residence of all employees who work for "First Bank Corporation".

$\Pi_{person\_name, city}(\sigma_{company\_name="First\ Bank\ Corporation"}(\sigma_{employee.person\_name=works.person\_name}(employee \times works)))$

c. Find the names, street address, and cities of residence of all employees who work for "First Bank Corporation" and earn more than $10,000. 2.13 Consider the bank database of Figure

$\Pi_{person\_name, city, street}(\sigma_{company\_name="First\ Bank\ Corporation" \wedge salary > 100,000}(\sigma_{employee.person\_name=works.person\_name}(employee \times works)))$

2.15. Give an expression in the relational algebra for each of the following queries:

a. Find all loan numbers with a loan value greater than $10,000.

$\Pi_{loan\_number}(\sigma_{amount > 10,000}(loan))$

b. Find the names of all depositors who have an account with a value greaterthan $6,000.

$\Pi_{customer\_name}(\sigma_{balance > 6,000}(\sigma_{depositor.account\_number=account.account\_number}(account \times depositor)))$

c. Find the names of all depositors who have an account with a value greaterthan $6,000 at

$\Pi_{customer\_name}(\sigma_{branch\_name="Uptown" \wedge balance > 6000}(\sigma_{depositor.account\_number=account.account\_number}(account \times depositor)))$