(1)

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. (2)

a. $\sigma_{year \geq 2009}(takes) \bowtie student$

b. $\sigma_{year \geq 2009}(takes \bowtie student)$

c. $\Pi_{ID, name, course\_id}(student \bowtie takes)$

(1) a.

(2) a. For each student who takes course(s) in (after) 2009, show all the information of courses and students

b. Select the information of courses that students take after 2009 and non-redundant information of students.

c. Select ID.name and course_id from the table of all students taking any course in the university

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".

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

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

employee (*person_name*, *street*, *city*)
works (*person_name*, *company_name*, *salary*)
company (*company_name*, *city*)

Figure 2.14 Relational database for Exercises 2.1, 2.7, and 2.12.

a. $\Pi_{person\_name}(\sigma_{city = \text{"Miami"}}(employee))$

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

c. $\Pi_{person\_name}(\sigma_{salary > 100,000 \wedge city = \text{"Miami"}}(employee \bowtie works))$

2.13 Consider the bank database of Figure 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.

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

c. Find the names of all depositors who have an account with a value greater than $6,000 at the "Uptown" branch.

branch(*branch_name*, *branch_city*, *assets*)
customer (*customer_name*, *customer_street*, *customer_city*)
loan (*loan_number*, *branch_name*, *amount*)
borrower (*customer_name*, *loan_number*)
account (*account_number*, *branch_name*, *balance*)
depositor (*customer_name*, *account_number*)

Figure 2.15 Banking database for Exercises 2.8, 2.9, and 2.13.

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

b. $\Pi_{\text{customer\_name}}(\sigma_{\text{balance}>6000}(\text{account} \bowtie \text{depositor}))$

c.

$$\Pi_{\text{customer\_name}}\left(\sigma_{\substack{\text{balance}>6000 \wedge \\ \text{branch\_name}=\text{"Uptown"}}}(\text{account} \bowtie \text{depositor})\right)$$