2.9 (a)主码 (b)外码

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)

2.13

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

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

c. $\Pi_{customer\_name}(\sigma_{balance>6000 \wedge branch\_name = "Uptown"}(account \bowtie depositer))$

6.11 employee (person_name, street, city)
works (person_name, company_name, salary)
company (company_name, city)
manages (person_name, manager_name)

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

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

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

d. $\Pi_{person\_name}(employee \bowtie works \bowtie company)$

e. $\Pi_{company\_name}(company \div \Pi_{city}(\sigma_{company\_name="small\ bank\ Corporation"}(company)))$

6.13 a. $t_1 \leftarrow \text{company\_name}\mathcal{G}\text{count-distinct}(\text{person\_name})(\text{works})$

$t_2 \leftarrow \mathcal{G}_{\max(\text{num\_employees})}(\rho_{\text{company\_strength}(\text{company\_name}, \text{num\_employees})}(t_1))$

$\Pi_{\text{company\_name}} (\rho_{t_3(\text{company\_name}, \text{num\_employees})}(t_1) \bowtie \rho_{t_4(\text{num\_employees})}(t_2))$

b. $t_1 \leftarrow \text{company\_name}\mathcal{G}\text{count-distinct}(\text{salary})(\text{works})$

$t_2 \leftarrow \mathcal{G}_{\min(\text{payroll})}(\rho_{\text{company\_payroll}(\text{company\_name}, \text{payroll})}(t_1))$

$\Pi_{\text{company\_name}} (\rho_{t_3(\text{company\_name}, \text{payroll})}(t_1) \bowtie \rho_{t_4(\text{payroll})}(t_2))$

C. $t_1 \leftarrow \text{company\_name}\mathcal{G}\text{avg}(\text{salary})(\text{works})$

$t_2 \leftarrow \sigma_{\text{company\_name} = \text{"First Bank Corporation"}}(t_1)$

$\Pi_{t_3.\text{company\_name}}((\rho_{t_3(\text{company\_name}, \text{avg\_salary})}(t_1)) \bowtie_{t_3.\text{avg\_salary} > \text{first\_bank.avg\_salary}} (\rho_{\text{first\_bank}(\text{company\_name}, \text{avg\_salary})}(t_2)))$