1. Consider the employee database of figure below. Give an expression in the relational algebra to express each of the following queries:

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

• Find the ID and name of each employee who works for “BigBank”.

$\prod_{ID,\ person\_name}(\sigma_{company\_name=”BigBank”}(works))$

• Find the ID, name, and city of residence of each employee who works for “BigBank”.

$\prod_{ID,\ person\_name}(\sigma_{company\_name\ =\ ”BigBank”}\ (works\ X\ employee))$

• Find the ID, name, street address, and city of residence of each employee who works for “BigBank” and earns more than $10000.

$\prod_{ID,\ person\_name,\ street,\ city}(\sigma_{company\_name=\ ”BigBank”\ \wedge\ salary\ >\ 10000}(works\ X\ employee))$

• Find the ID and name of each employee in this database who lives in the same city as the company for which she or he works.

$\prod_{ID,\ person\_name}(\sigma_{company.city\ =\ employee.city}\ (company\ X\ employee))$

or

$\prod_{ID,\ person\_name}(company \bowtie_{company.city=\ employee.city} employee)$

2. Consider the employee database of figure above. Give an expression in the relational algebra to express each of the following queries:

• Find the ID and name of each employee who does not work for “ BigBank”.

$\prod_{ID,\ person\_name}(\sigma_{company\_name\neq”BigBank”}(works))$

• Find the ID and name of each employee who earns at least as much as every employee in the database.

$\prod_{ID,\ person\_name}\ (\sigma\ (\rho_{\ max(salary)}\ (works))\ (works))$

3. Consider the foreign-key constraint from the *dept_name* attribute of instructor to the *department* relation. Give examples of inserts and deletes to these relations that can cause a violation of the foreign-key constraint.

If we try to insert a record that references some value in the dept_name table, but that table does not contain a record with that key value, we will get a foreign key constraint. If we delete some value from the dept_name table, it can cause a foreign key constraint, if a tuple in department table refers to primary key from dept_name.

4. Consider the employee database of figure above. What are the appropriate primary keys?

person_name, company_name, ID of employee