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"

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

   • Find the ID, name, and city of residence of each employee who works for "BigBank". $\prod_{ID,person\_name,city}(\sigma_{company\_name="BigBank"}(employee))$

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

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

   • 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

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

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". $\prod_{ID,person\_name}(\sigma_{company\_name\neq"BigBank"}(employee))$

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

   $$\rho_s(works)$$
   $$\rho_t(works)$$

   $$\prod_{ID,person\_name}(works - \sigma_{t.salary<x.salary}(t \ X \ s))$$

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.

ID	name	dept_name	salary
10101	Srinivasan	Comp. Sci.	65000
12121	Wu	Finance	90000
15151	Mozart	Music	40000
22222	Einstein	Physics	95000
32343	El Said	History	60000
33456	Gold	Physics	87000
45565	Katz	Comp. Sci.	75000
58583	Califieri	History	62000
76543	Singh	Finance	80000
76766	Crick	Biology	72000
83821	Brandt	Comp. Sci.	92000
98345	Kim	Elec. Eng.	80000

Figure 2.1 The *instructor* relation.

dept_name	building	budget
Biology	Watson	90000
Comp. Sci.	Taylor	100000
Elec. Eng.	Taylor	85000
Finance	Painter	120000
History	Painter	50000
Music	Packard	80000
Physics	Watson	70000

Figure 2.5 The *department* relation.

Insert (0112, Leonardo, Math, 12000) into instructor but in department there is no information about Math department -> violation

Delete (15151, Mozart, Music, 40000) from instructor then there will no reference with Music department -> violation

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

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

Figure 2.17 Employee database.

person_name, company_name