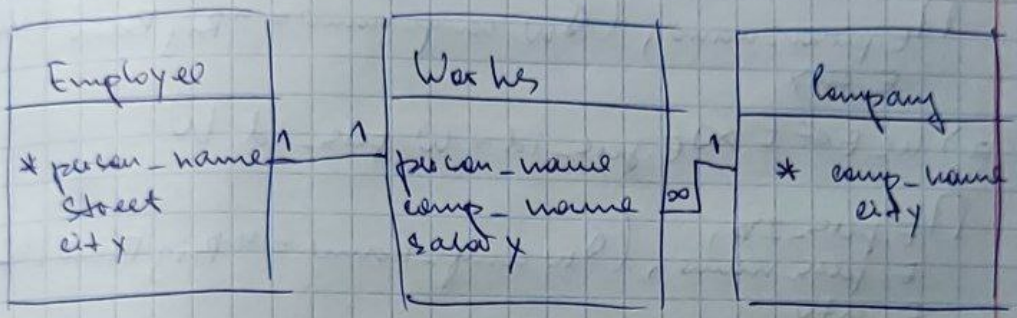
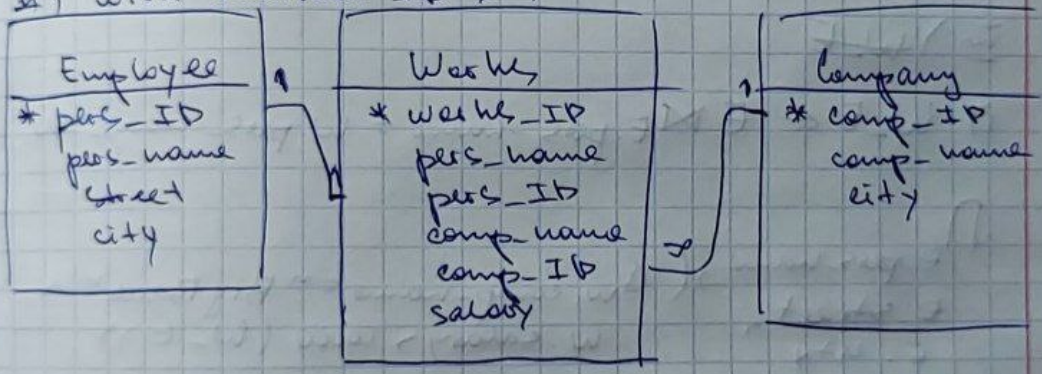
#1.

E ← employee W ← works C ← company.

I) Without distinct ID's.



II) With distinct ID's.



#1.

~~+) $\Pi_{works.pers\_name}(\sigma_{Works.}$~~

1) $\Pi_{W.pers\_name}(\sigma_{W.comp\_name = "BigBank"}(Works))$.

2) $W\_E \leftarrow E \bowtie_{E.pers\_ID = W.pers\_ID} W$.

$\Pi_{W.pers\_ID, W.pers\_name}(\sigma_{W\_E.comp\_name = "BigBank"}(W\_E))$

II)

1) $W\_E \leftarrow E \bowtie_{E.person\_name = W.person\_name} W$.

$\Pi_{E.person\_name,\ E.city}(\sigma_{W.comp\_name = \text{"Big Bank"}}(W\_E))$

2) $W\_E \leftarrow E \bowtie_{E.pers\_id = W.pers\_id} W$.

$\Pi_{E.pers\_ID,\ E.pers\_name,\ E.city}(\sigma_{W.comp\_name = \text{"Big Bank"}}(W\_E))$

III) ~~W_E~~

1) $W\_E \leftarrow E \bowtie_{E.pers\_name = W.pers\_name} W$.

$\Pi_{E.pers\_name,\ E.street,\ E.city}(\sigma_{W.comp\_name = \text{"Big Bank"} \wedge W.salary > 10000}(W\_E))$.

2) $W\_E \leftarrow E \bowtie_{E.pers\_ID = W.pers\_ID} W$.

$\Pi_{E.pers\_ID,\ E.pers\_name,\ E.street,\ E.city}(\sigma_{W.comp\_name = \text{"Big Bank"} \wedge W.salary > 10000}(W\_E))$.

IV)

1) $W\_E \leftarrow E \bowtie E.pers\_name = W.pers\_name\ W$.

$W\_E\_C \leftarrow W\_E \bowtie W\_E.comp\_name = C.comp\_name$.

$\Pi_{E.pers\_name}(\sigma_{E.city = C.city}(W\_E\_C))$.

2) $W\_E \leftarrow E \bowtie E.pers\_ID = W.pers\_ID\ W$.

$W\_E\_C \leftarrow W\_E \bowtie W\_E.comp\_ID = C.comp\_ID\ C$.

$\Pi_{E.pers\_ID,\ E.pers\_name}(\sigma_{E.city = C.city}(W\_E\_C))$.

#2.

I) 1) $\Pi_{Works.person\_name}(\sigma_{Works.comp\_name = "Big\ Bank"}(Works))$

2) $Employee\_Works \leftarrow Employee \bowtie_{Employee.person\_ID = Works.person\_ID} (Works)$

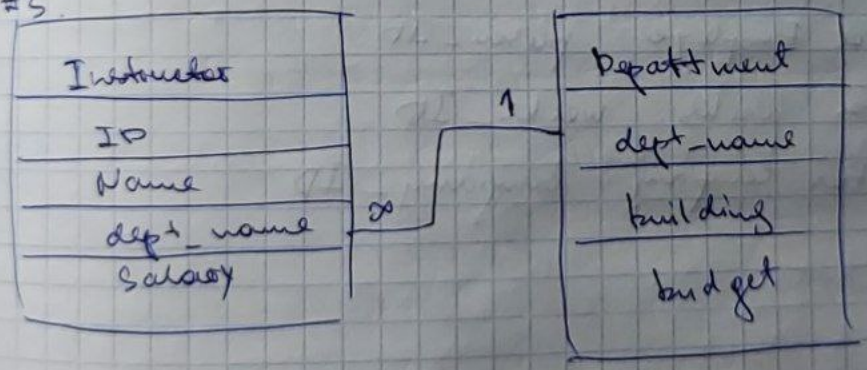
$\Pi_{Employee.person\_name, Employee.person\_ID}(\sigma_{works.comp\_name = "Big\_Bank}(Employee\_Works))$.

II) 1) $\Pi_{works.person\_name}(Works)$.

2) $Employee\_Works \leftarrow Employee \bowtie_{Employee.person\_ID = Works.person\_ID} (Works)$

$\Pi_{Employee.person\_ID, Employee.person\_name}(Employee\_(Works))$.

#3.



Violation:

If we don't have certain dept_name is relation, but we add it to Instructor table, an error may occur.

If we delete / update certain dept_name in Department table, we may have error, because Instructor table will reference non-existing / changed dept_name. That is why, very often we restrict these actions when working with databases.

#4.

1) In case we don't have distinct ID attributes:

For Employee: "person_name" attribute.

For Works: ~~"salary" as~~ composite primary key consisting of "person_name" and "comp_name"

For Company: "company_name" attribute.

II) In case when we have distinct ID attributes:

For Employee: person_ID.

For Works: works_ID

For Company: company_ID.