COMP 353 Databases
Assignment no.3

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1 Problem description:

Consider a DB schema consisting of the following relation schemes:

- **Regions** (**Region__ID**, Region_Name)

- **Countries** (**Country__id**, Country_Name, Region_Id)

- **Locations** (**Location__Id**, Street_address, Postal_code, City, State_Province, Country_Id)

- **Jobs** (**Job__Id**, Job_title, Min_Salary, Max_salary)

- **Departments** (**Dep__Id**, Dep_Name, Manager_Id, Location_Id)

- **Employees** (**Emp__ID**, FirstName, Last_Name, E-mail, Phone_number, Hire_date, Job_Id, Salary, Comsn__pct, Manager_Id, Dep_Id)

- **Employee__History** (**Emp__ID**, **Joining__date**, last_date, Job_ID, Dep_ID)

Keys are underlined

Now, express the following queries in Relational Algebra (You are not allowed to use aggregate functions):

1.1 Query 1.

1.1.1 Description

Find the FirstName, LastName, email, phone number, hire date and salary of employees currently working in the research and development department.

1.1.2 Relational Algebra

$$\pi_{\substack{\text{FirstName, Last\_Name,} \\ \text{E-mail, Phone\_number,} \\ \text{Hire\_date, Salary}}}(\sigma_{\text{Dep\_Name="Research and Development"}}(\text{Departments} \bowtie \text{Employees}))$$

1.2 Query 2.

1.2.1 Description

Find the FirstName and LastName of employees who are currently working in Canada but have never worked in the United States.

1.2.2 Relational Algebra

$\rho_A(\pi_{FirstName,Last\_Name}(\sigma_{\text{Country\_Name = "Canada"}}(Employees \bowtie Departments \bowtie Locations \bowtie Countries))$

$\rho_B(\pi_{FirstName,Last\_Name}(\sigma_{\text{Country\_Name = "United States"}}$

$(Employees \bowtie Employee\_History \bowtie Departments \bowtie Locations \bowtie Countries)))$

$A - B$

1.3 Query 3.

1.3.1 Description

Find the FirstName, LastName and Department Name of employees who are currently managers of a department in which they have never worked in the past for the department they are currently managing.

1.3.2 Relational Algebra

$\rho_{Dept}(\pi_{Dep\_Id, Dep\_Name}(Departments))$

$\rho_{(A)}(\pi_{\substack{FirstName \\ Last\_Name \\ Dep\_Name}}(\sigma_{Employees.Manager\_Id=Emp\_ID}(\text{Employees} \bowtie \text{Dept})))$

$\rho_{EH}(Employees \bowtie_{Employees.Emp\_ID=Employee\_History.Emp\_ID} Employee\_History)$

$\rho_{B}(\pi_{\substack{FirstName \\ Last\_Name \\ Dep\_Name}}(\sigma_{Employees.Dep\_Id=Employee\_History.Dep\_Id}(\text{Employees} \bowtie \text{EH})))$

$A - B$

1.4 Query 4.

1.4.1 Description

Find the Job Title and the maximum salary of all jobs that have the max salary as the highest salaries among all other jobs.

1.4.2 Assumption

Assume the question is asking for the highest Max_salary in Jobs

1.4.3 Relational Algebra

$\rho_{\text{TOTAL}}(\pi_{Job\_title, Max\_salary}(Jobs))$

$\rho_{A}(TOTAL)$

$\rho_{B}(\pi_{Max\_salary}(Jobs))$

$\rho_{C}(\pi_{Job\_title, A.Max\_salary}(A \bowtie_{A.Max\_salary<B.Max\_salary} B))$

$TOTAL - C$

1.5 Query 5.

1.5.1 Description

Find the department name of all the departments that are located in the region
of North America

1.5.2 Relational Algebra

$$\pi_{Dep\_Name}(\sigma_{\text{Region\_Name = "North America"}}(Departments \bowtie Locations \bowtie Countries \bowtie Regions))$$

1.6 Query 6.

1.6.1 Description

Find the FirstName and LastName of employees who worked on all jobs through-
out their lifetime (from first day of work till today if they are still working)

1.6.2 Assumption

**Assuming the question asks for people who have worked at every job
in the Jobs relation before**

1.6.3 Relational Algebra

$$\pi_{FirstName,Last\_Name}((Jobs \bowtie (Employees \bowtie Employee\_History)) \div (\pi_{Job\_Id}Jobs))$$

1.7 Query 7.

1.7.1 Description

Find the FirstName and LastName of employees who throughout their career
worked in all the locations that are located in the province of Quebec.

1.7.2 Relational Algebra

$\rho_A($
$\pi_{FirstName,Last\_Name}($
$\sigma_{State\_Province="Quebec"}(Employees \bowtie Employee\_History \bowtie Departments \bowtie Locations)))$
$\rho_B($
$\pi_{FirstName,Last\_Name}($
$\sigma_{State\_Province\neq"Quebec"}(Employees \bowtie Employee\_History \bowtie Departments \bowtie Locations)))$
$A - B$