CSC430/530 – Database Management Systems
Assignment #3 **ANSWERS**– Relational Algebra

Using relational algebra operations, construct queries that satisfy provided descriptions. Provide resulting relation (table with tuples) for each query. Database schema and state are provided for your reference. To help with creating the symbols, here is a reference. Feel free to copy/paste:

SELECT: $\sigma_{<\text{selection condition}>}(R)$	PROJECT: $\pi_{<\text{attribute list}>}(R)$	RENAME: $\rho_{s(B1,B2,\ldots,Bn)}(R)$
JOIN: $R_1 \bowtie_{<\text{join condition}>} R_2$	NATURAL JOIN: $R_1 *_{<\text{join condition}>} R_2$	
UNION: $R_1 \cup R_2$	INTERSECTION: $R_1 \cap R_2$	DIFFERENCE: $R_1 - R_2$
CARTESIAN PRODUCT: $R_1 \times R_2$	DIVISION: $R_1 \div R_2$	

a. Retrieve last name and SSN of all male employees with salary more than 20000.

$$\text{RESULT} \leftarrow \pi_{\text{Lname, Ssn}}(\sigma_{\text{Sex='M' AND Salary > 20000}}(\text{EMPLOYEE}))$$

Lname	Ssn
Smith	123456789
Wong	333445555
Narayan	666884444
Jabbar	987987987
Borg	888665555

b. Retrieve project numbers and project locations of all projects that belong to the Administration department.

$$\text{ADMIN\_DEPT} \leftarrow \sigma_{\text{Dname="Administration"}}(\text{DEPARTMENT})$$
$$\text{ADMIN\_PROJECTS} \leftarrow (\text{ADMIN\_DEPT} \bowtie_{\text{Dnumber=Dnum}} \text{PROJECT})$$
$$\text{RESULT} \leftarrow (\pi_{\text{Pnumber,Plocation}}(\text{ADMIN\_PROJECTS}))$$

Pnumber	Plocation
10	Stafford
30	Stafford

c. Retrieve first name, last name, and date of birth of all employees who work more than 18 hours on project 1.

$$WORKS\_18\_ON\_P1 \leftarrow \sigma_{Pno=1\ AND\ Hours > 18}(WORKS\_ON)$$
$$EMPLOYEES\_18\_ON\_P1 \leftarrow EMPLOYEES \bowtie_{Ssn=Essn} WORKS\_ON\_P1$$
$$RESULT \leftarrow \pi_{Fname,\ Lname,\ Bdate}(EMPLOYEES\_18\_ON\_P1)$$

Fname	Lname	Bdate
John	Smith	1965-01-09
Joyce	English	1972-07-31

d. Retrieve name, date of birth, and relationship of all male dependents of employees who work for department 4.

$$DEPT\_4\_EMPLOYEES \leftarrow \sigma_{Dno=4}(EMPLOYEE)$$
$$DEPT\_4\_DEPENDENTS \leftarrow DEPT\_4\_EMPLOYEES \bowtie_{Ssn=Essn} DEPENDENT$$
$$RESULT \leftarrow \pi_{Dependent\_Name,\ Bdate,\ Relationship}(\sigma_{Sex='M'}(DEPT\_4\_DEPENDENTS))$$

Dependent_Name	Bdate	Relationship
Abner	1942-02-28	Spouse

e. Retrieve first name, last name, and salary of employees who manage departments with projects located in Houston.

$$HOUSTON\_PROJECTS \leftarrow \sigma_{Plocation="Houston"}(PROJECT)$$
$$HOUSTON\_PROJECTS\_DEPT\_INFO \leftarrow DEPARTMENT \bowtie_{Dnumber=Dnum} HOUSTON\_PROJECTS$$
$$HOUSTON\_PROJECT\_MANAGERS \leftarrow HOUSTON\_PROJECTS\_DEPT\_INFO \bowtie_{Mgr\_ssn=Ssn} EMPLOYEE$$
$$RESULT \leftarrow \pi_{Fname,\ Lname,\ Salary}(HOUSTON\_PROJECT\_MANAGERS)$$

Fname	Lname	Salary
Franklin	Wong	40000
James	Borg	55000