Assignment 1 (Relational Algebra)

* Write the following query in relational algebra using the following university schema: →

classroom (building, room_number, capacity)
department (dept_name, building, budget)
course (course_id, title, dept_name, credits)
instructor (ID, name, dept_name, salary)
section (course_id, sec_id, semester, year, building, room_number, time_slot_id)
teaches (ID, course_id, sec_id, semester, year)
student (ID, name, dept_name, tot_cred)
takes (ID, course_id, sec_id, semester, year, grade)
advisor (s_ID, i_ID).
prereq (course_id, prereq_id)

(1) Find the title of courses in the comp. sci department that have 3 credits.

→ $\Pi_{title}(\sigma_{dept\_name = 'comp.\ sci' \wedge credits = 3}(course))$

(2) Find the highest salary among all instructors.

→ $\mathcal{G}_{max(salary)}(instructor)$

(3) Find all instructors earning the highest salary.

→ $instructor \bowtie (\mathcal{G}_{max(salary)} \rightarrow_{Msalary}(instructor))$

(4) Find the IDs of all students who were taught by an instructor name "Sullivan". (Join multiple table)

→ $\Pi_{id}(\sigma_{name = "Sullivan"}(takes \bowtie teaches))$

(5) Find the IDs & names of all students who have not taken any course offering before 2009. (using set difference)

→ $\Pi_{ID, name}(student) - \Pi_{ID, name}(\sigma_{year < 2009}(student \bowtie takes))$

⑥ For each department, find the maximum salary of instructors in that department. You may assume that every department has at least one instructor.

→ $dept\_name\ \mathcal{G}_{max(salary)}(instructor)$

⑦ Find the lowest, across all department, of the pre-department maximum salary computed by the preceding query. (use assignment operation to get the maximum salary per department first)

→ $\mathcal{G}_{min(max\_sal)}(dept\_name\ \mathcal{G}_{max(salary)}\ as\ max\_sal(instructor))$

⑧ Find the enrollement of each section that was offered in fall 2009.

→ $course\_id, sec\_id\ \mathcal{G}_{count(*)}\ as\ enrollment(\sigma_{year=2009 \wedge semester=fall}(takes))$

⑨ Find the maximum enrollment i.e the no. of students, across all sections in fall 2009.

→ $R_1 \leftarrow course\_id, sec\_id\ \mathcal{G}_{count(*) \rightarrow enrollment}(\sigma_{year=2009 \wedge semester=fall}(takes))$

$\Rightarrow Result = \mathcal{G}_{max(enrollment)}(R)$

⑩ Find the section that had the maximum enrollment in Fall 2009

→ $R_1 \leftarrow course\_id, sec\_id\ \mathcal{G}_{count(*)\ as\ enrollment}(\sigma_{year=2009 \wedge semester=fall}(takes))$

$R_2 \leftarrow \mathcal{G}_{max(enrollment)\ as\ enrollment}(R_1)$

$Result = R_1 \bowtie R_2$