CS 386/586 ASSIGNMENT 2
FALL 2011

Part I

Write the following queries in Relation Algebra, using ONLY the *select*, *project* and *cross product* operators:

(a) Find the address and city for all agents with last name Li.

$$\pi_{address,\ city}\ (\sigma_{last='Li'}\ Agent)$$

(b) List salary and last name of all agents with the Cryptographer skill.

$$\pi_{salary,\ last}\ (\sigma_{Agent.agent_{id}=SkillRel.agent_{id}}\ (Agent\ \times\ (\sigma_{Skill.skill_{id}=SkillRel.skill\_id}\ (SkillRel\ \times\ (\sigma_{skill='Cryptographer'}\ Skill)))))$$

(c) List the city, country and clearance description of all agents who speak Vietnamese.

$$\pi_{Agent.city,\ Agent.country,\ SecurityClearance.description}($$
$$\sigma_{SecurityClearance.sc.id=Agent.clearance\_id}\ (SecurityClearance\ \times$$
$$(\sigma_{Agent.agent_{id}=LanguageRel.agent\_id}(Agent\ \times$$
$$(\sigma_{LanguageRel.lang_{id}=Language.lang\_id}\ (LanguageRel\ \times$$
$$(\sigma_{language='Vietnamese'}\ Language)))))))$$

Part II

Write the SQL for the following queries. Show (at most) the first five rows of the result for each query and the number of rows returned. You should be able to write these SQL queries using only the features covered in the first two sets of lecture notes.

(a) Find the agent id and salary in Euros for all agents whose country is France. Name the result columns France_ids and Euro_pay. (Assume the stored salary is in dollars.)

```
SELECT agent_id AS France_ids, (salary * 0.72) AS Euro_pay
FROM   Agent
WHERE  country = 'France'
```

55 rows

france_ids	euro_pay
2	36687.60
8	38417.04
20	36123.12
49	42382.08
64	39789.36

(b) Find the number of different skills

```
SELECT COUNT (DISTINCT skill)
FROM   Skill
```

1 row

count
66

(c) Find the high, low and total salary for all agents with Top-Secret clearance.

```
SELECT MAX (A.salary), MIN (A.salary), SUM (A.salary)
FROM   Agent A, SecurityClearance SC
WHERE  A.clearance_id = SC.sc_id AND SC.sc_level = 'Top Secret'
```

1 row

max	min	sum
366460	50008	7377007

(d) Find the team name for all teams with at least one agent with the French language.
Do this query two ways: Once using NATURAL JOIN and one without any JOIN operator in the FROM clause. (You only need to submit one copy of the result.)

```
SELECT DISTINCT Team.name
FROM   Team
       NATURAL JOIN TeamRel
       NATURAL JOIN Agent
       NATURAL JOIN LanguageRel
       NATURAL JOIN Language
WHERE  Language.language = 'French'
```

```
SELECT DISTINCT T.name
FROM   Team T, TeamRel TR, Agent A, LanguageRel LR, Language L
WHERE  T.team_id = TR.team_id
       AND TR.agent_id = A.agent_id
       AND A.agent_id = LR.agent_id
       AND LR.lang_id = L.lang_id
       AND L.language = 'French'
```

32 rows

name
Boat Team 4
Terminator
Vikings
Charley Hunter
Swing Voters

(e) List the affiliations for each agent, but also include agents with no affiliations. The result should have first name, last name, affiliation strength and affiliation title.

```
SELECT first, last, affiliation_strength, title
FROM   Agent NATURAL LEFT OUTER JOIN
       (AffiliationRel NATURAL JOIN Affiliation)
```

1114 rows

first	last	affiliation_strength	title
Nick	Black	*NULL*	*NULL*
Bill	Bundt	weak	FSV
Mathew	Cohen	weak	Interpol
Jim	Cowan	*NULL*	*NULL*
George	Fairley	medium	Mafia

(f) List the team name for each team that has an agent who can speak German and an agent who can speak Hebrew. Do this query twice: Once using INTERSECT and once without using that operator.

```
SELECT Team.name
FROM   Team NATURAL JOIN TeamRel
            NATURAL JOIN LanguageRel
            NATURAL JOIN Agent
            NATURAL JOIN Language
WHERE  Language.language = 'German'
INTERSECT
SELECT Team.name
FROM   Team NATURAL JOIN TeamRel
            NATURAL JOIN LanguageRel
            NATURAL JOIN Agent
            NATURAL JOIN Language
WHERE  Language.language = 'Hebrew'
```

```
SELECT DISTINCT T.name
FROM   Team T, TeamRel TR1, TeamRel TR2, Agent A1, Agent A2,
       LanguageRel LR1, LanguageRel LR2, Language L1, Language L2
WHERE  T.team_id = TR1.team_id
       AND TR1.agent_id = A1.agent_id
       AND A1.agent_id = LR1.agent_id
       AND LR1.lang_id = L1.lang_id
       AND T.team_id = TR2.team_id
       AND TR2.agent_id = A2.agent_id
       AND A2.agent_id = LR2.agent_id
       AND LR2.lang_id = L2.lang_id
       AND L1.language = 'German'
       AND L2.language = 'Hebrew'
```

26 rows

name
Blue Dagger
Boat Team 4
Vikings
Charley Hunter
Swing Voters

(g) Find all agents who can speak Hindi or who have the Pilot skill. Do this query twice: Once with UNION and once without using that operator.

```
SELECT DISTINCT Agent.first, Agent.last
FROM   Agent NATURAL JOIN LanguageRel NATURAL JOIN Language
WHERE  Language.language = 'Hindi'
UNION
SELECT DISTINCT Agent.first, Agent.last
FROM   Agent NATURAL JOIN SkillRel NATURAL JOIN Skill
WHERE  Skill.skill = 'Pilot'
```

```
SELECT DISTINCT A.first, A.last
FROM   Agent A
       NATURAL JOIN LanguageRel LR
       NATURAL JOIN Language L
       NATURAL JOIN SkillRel SR
       NATURAL JOIN Skill S
WHERE  L.language = 'Hindi' OR S.skill = 'Pilot'
```

149 rows

first	last
George	Josephson
Orrin	Nelson
Tim	Deleeuw
Raphael	Santiago
Pete	Pavletich

(Note: You could get a different answer when selecting agent_id instead of first and last name, if there were different agents with the same name. For our database instance, the answer is the same, even though there are a couple instances of agents with the same name.)