

CMPS340 Fall 2008
HW #1: Developing Queries in Relational Algebra
Sample Solutions

Note that two solutions are given for each problem, one in “standard” relational algebra and the other in a syntactically-sugared variety of that language. In the former, the notation $\rho_n(E)$ indicates that n will be used to refer to the table given by expression E . The corresponding notation in the latter is “ E AS n ”.

Using the COMPANY database (as illustrated in Figure 5.6 of the Elmasri/Navathe textbook), devise solutions, in Relational Algebra, to the following informally-stated queries:

1. Retrieve the first and last names of any employee who is male and has a salary greater than \$45,000.

Solution: $\pi_{Fname, Lname}(\sigma_{Sex='M' \wedge Salary > 45000}(Employee))$

```
PROJECT Fname, Lname
FROM (RESTRICT Employee WHERE Sex = 'M'  $\wedge$  Salary > 45000)
```

2. Retrieve the name and birthdate of anyone who is either a female dependent of an employee who works for Department 3 or a dependent (of either sex) of an employee who works for Department 4.

Solution:

$$\pi_{Dependent_name, Bdate}(\sigma_{Dno=3}(Employee) \bowtie_{Ssn=Essn} \sigma_{Sex='F'}(Dependent)) \cup (\sigma_{Dno=4}(Employee) \bowtie_{Ssn=Essn} Dependent)$$

```
PROJECT Dependent_name, Bdate
FROM ((JOIN (RESTRICT Employee WHERE Dno = 3)
           WITH (RESTRICT Dependent WHERE Sex = 'F')
           WHERE Ssn = Essn
        )
      UNION
      (JOIN (RESTRICT Employee WHERE Dno = 4)
           WITH Dependent
           WHERE Ssn = Essn
        )
     )
```

3. Retrieve the last name of any employee who works for a different department than does her/his direct supervisor.

Solution: $\pi_{e.Lname}(\rho_e(\text{Employee}) \bowtie_{e.Super_ssn=s.Ssn \wedge e.Dno \neq s.Dno} \rho_s(\text{Employee}))$

```
PROJECT e.Lname
FROM JOIN Employee AS e WITH Employee AS s
      WHERE e.Super_ssn = s.Ssn & e.Dno <math>\neq</math> s.Dno
```

4. Retrieve the last name and birthdate of any employee who is no one's direct supervisor.

Solution:

$\pi_{Lname,Bdate}(\rho_e(\text{Employee}) \bowtie_{e.Ssn=ns.Ssn} (\rho_{ns}(\pi_{Ssn}(\text{Employee}) - \pi_{Super_ssn}(\text{Employee}))))$

```
PROJECT Lname, Bdate
FROM JOIN Employee AS e
      WITH ((PROJECT Ssn FROM Employee)
            EXCEPT
            (Project Super_Ssn FROM Employee)
            ) AS ns
      WHERE e.Ssn = ns.Ssn
```

5. Retrieve the last name and birthdate of any employee who works on a project that is controlled by a department different from the one for which the employee works.

Solution: $\pi_{Lname,Bdate}((\text{Employee} \bowtie_{Ssn=Essn} \text{WorksOn}) \bowtie_{Dno \neq Dnum} \text{Project})$

```
PROJECT Lname, Bdate
FROM (JOIN (JOIN Employee WITH WorksOn WHERE Ssn = Essn)
      WITH Project
      WHERE Dno <math>\neq</math> Dnum
      )
```