The assignment is to be turned in before Midnight (by 11:59pm) on January 18th. You should turn in the solutions to this assignment as a PDF file through the TEACH website. The solutions should be produced using editing software programs, such as LaTeX or Word, otherwise they will not be graded.

1: Relational Model and SQL (8 points)

Consider the following relational schema:
Emp(*eid*:integer, *ename*:string, *age*:integer, *salary*:real)
Works(*eid*:integer, *did*:integer, *pc_time*:integer)
Dept(*did*:integer, *dname*:string, *budget*:real, *managerid*:integer)

The underlined attributes are keys for their relations. Note that a manager is an employee as well and their manager id and employee id are the same. An employee can work in more than one department. The pct_time field of the Works relation shows the percentage of time that a given employee works in a given department. Write the following queries in SQL.

(a) Print the *did* and *dname* of the departments with at least one full-time (100%) employee. (1 point) **(solution)**

```
SELECT did, dname
 FROM dept
 WHERE dept.did
  IN (SELECT did
      FROM works
      WHERE works.pct_time > 99);
```

(b) Print the names and ages of each employee who works in both the "Hardware" department and the "Software" department. (1 point) **(solution)**

```
 SELECT ename, age FROM emp WHERE emp.eid IN
(SELECT eid FROM
        (SELECT eid
                FROM works as w
                        WHERE w.did =
                                (SELECT did
                                 FROM dept AS d
                                 WHERE dname = 'Software')) AS es
                        WHERE eid IN
                                (SELECT eid
                                 FROM works as w
                                 WHERE w.did =
                                  (SELECT did
                                 FROM dept AS d
                                 WHERE dname = 'Hardware')));
```

(c) Print the name of each employee whose salary does *not* exceed the budget of any department

that he or she works in. (2 point) **(solution)**

```
        SELECT emp.ename
FROM emp
WHERE emp.eid NOT IN
 (SELECT es.eid
   FROM (SELECT emp.eid, emp.salary, works.did
   FROM emp, works
   WHERE emp.eid = works.eid) AS es
   WHERE es.salary > (SELECT budget from dept WHERE dept.did = es.did));
```

(d) If a manager manages more than one department, he or she controls the sum of all the budgets for those departments. Find the managerids of managers who control more than $5 million. (2 points) **(solution)**

```
SELECT managerid FROM dept
        GROUP BY dept.managerid
        HAVING sum(budget) > 5000000
```

(e) For each department with more than 4 full-time-equivalent employees (i.e., where the part-time and full-time employees add up to at least that many full-time employees), print the did together with the number of employees that work in that department. (2 points) **(solution)**

```
SELECT did, COUNT(eid)
        FROM WORKS
        GROUP BY did
        HAVING SUM(pct_time) > 400;
```