Preview Test: Practice Midterm CS 450/550

This is a short practice Midterm so the actual Midterm will not come as a complete shock.

Conditions: Closed book. Open Handwritten Notes: 1 side of one page. Your notes, with your name on them must be submitted with the test.

By submitting this Midterm you acknowledge the terms of the ODU Honor Code and Honor Pledge. In particular, you have not received help while taking this Midterm and will not have given help to anyone who shall have taken the Midterm for this course while they are taking the Midterm.

Advice: The conceptual questions are quicker to answer than the SQL and RA Questions

Relational Algebra to SQL.

These are instructions for the following three questions. In each question the Relational Algebra is shown in both the Mathematical and the Keyboard version.

To get full credit for a relational algebra query translation you have to do two things.

1. Chose the correct translation into English
2. Create a single equivalent SQL Query.

You may receive partial credit for erroneous SQL if you choose the correct English translation of the relational algebra.

The database is essentially the one in our book, namely (keys underlined):

- EMPLOYEE(fname, minit, lname, ssn, bdate, address, sex, salary, superssn, dno)
- DEPARTMENT(dname, dnumber, mgrssn, mgrstartdate)
- WORKS_ON(essn, pno, hours)
- PROJECT(pname, pnumber, plocation, dnum)
- DEPT_LOCATIONS(dnumber, dlocation)
- DEPENDENT(essn, dependentname, sex, bdate, relationship)

Scoring for each problem:

- Correct English only: 4pts;
- Correct SQL only: 8 pts;
- both correct: 10pts.

450 Students: Answer any 2 of RA to SQL questions. 550 Students: Answer all 3.

If a CS 450 student answers all 3, only the first two will be graded.
Query n).

1. \( R_1 \leftarrow \pi_{\text{mgrssn}} (\text{DEPARTMENT}) \)
2. \( R_2 \leftarrow \text{EMPLOYEE} \bowtie \text{ssn} = \text{mgrssn} R_1 \)
3. RESULT \( \leftarrow \pi_{\text{fname}, \text{lname}} (R_2) \)

(Keyboard equivalent)

1. \( R_1 \leftarrow \text{PROJECT}[\text{mgrssn}] (\text{DEPARTMENT}) \)
2. \( R_2 \leftarrow \text{EMPLOYEE} \bowtie \text{TJOIN}[\text{ssn} = \text{mgrssn}] R_1 \)
3. RESULT \( \leftarrow \text{PROJECT}[\text{fname}, \text{lname}] (R_2) \)

I. Get the first and last names of employees and their supervisors.

II. Get the first and last names of employees who are supervised.

III. Get the first and last names of department managers.

IV. Get the first and last names of supervisors.

In the space provided, show the SQL translation of the Relational Algebra above. Your answer must be a single SQL statement.
SQL to Relational Algebra.

These are instructions for the following three problems.

To get full credit for a relational algebra query translation you have to do two things.
1. Choose the correct translation into English
2. Create an equivalent Relational Algebra query, almost certainly requiring several steps.

Scoring for each problem:
- Correct English only: 4pts;
- Correct SQL only: 8 pts;
- both correct: 10pts.

The database is the same one as in the previous set of questions.

450 Students: Answer any 2 of the follow three problems. 550 Students: Answer all 3
If a CS 450 student answers all 3, only the first two will be graded.

Query n).

```
SELECT dnumber, dname
FROM department
WHERE mgrssn in (  
    select ssn  
    from employee  
    where salary < 45000)
```

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<tr>
<td>I.</td>
<td>Get the number and name of departments that has an employee who earns less than 45000.</td>
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<tr>
<td>II.</td>
<td>Get the number and name of departments that has no employees who earn 45000 or more.</td>
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<tr>
<td>III.</td>
<td>Get the number and name of departments whose managers earn less than 45000.</td>
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<tr>
<td>IV.</td>
<td>Get the number and name of departments whose employees, altogether, earn less than 45000.</td>
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In the space provided, show the Relational Algebra translation of the SQL above.
Database Concepts and Architecture

This series of questions tests your knowledge of database architecture and the relational model.

m.) Which of the following are part of the multi-level database architecture?

- BOUNDARY LAYER
- EXTERNAL LAYER
- EGG LAYER
- HYDROSONIC MAPPING
- EXTERNAL-CONCEPTUAL MAPPING
- VIEW-CATALOG MAPPING
- CATALOG

n) CS 550 students only.

Consider this SQL query:

```sql
SELECT CNAME, LOCATION FROM CVM, C
WHERE CVM.CNUM = C.CNUM AND C.RANK > 10;
```

In the space below make two diagrams:

1. A simple, completely unoptimized query tree for the SQL query above.
2. A restructured tree that contains two optimizations.

The provide a brief explanation why each of the two is an optimization.

Note: 10 optimizations get no more credit than two.