Name_____

EECS495 Introduction to Database Systems
Sample Midterm Questions

Fall 2015

Professor P. Scheuermann

Note: I have included 8 questions, which is much more then you will get on the exam. The purpose is to help you review all the material that we covered so far.

1. In each of the first 3 questions, you are asked to compare two queries Q1 and Q2. You must tell whether the queries are:

1. The same [choice (a)], meaning that for every database the answers to the two queries are the same. That is, the same tuples are produced by each query, and a tuple is produced the same number of times by each query. The order in which tuples are produced is not to be considered.

2. Completely different [choice (d)], meaning that there are databases where Q1 produces more of some particular tuple, and other databases where Q2 produces more of some particular tuple. Note that the query producing the smaller number of copies of a tuple may produce zero copies of that tuple.

3. One is contained in the other but they are not the same [choice (b) or (c)]. For instance, Q1 is contained in Q2 if on every database, Q2 produces at least as many copies of each tuple as Q1 does. Note that it is possible Q2 produces one or more copies of a tuple, while Q1 produces none of that tuple.

General advice:
- Do not assume a query has a trivial syntactic error and therefore produces nothing.
- Relations mentioned in the queries may have attributes not mentioned, but their existence should not affect the answer.
- Relations may have NULL's..
- In SQL, it is possible that there may be duplicate tuples, but in relational algebra we assume the relations are sets.

In the following three problems, assume the schemas are R(A; B) and S(B; C):

Question 1: **(10 PTS)**

Q1: $\sigma_{A=1}(R \bowtie S)$
Q2: $(\sigma_{A=1}(R)) \bowtie$ S)

(a) Q1 and Q2 produce the same answer.

(b) The answer to Q1 is always contained in the answer to Q2.
(c) The answer to Q2 is always contained in the answer to Q1.
(d) Q1 and Q2 produce different answers.

Name_____

Question 2:

Q1: SELECT R.A FROM R, S WHERE R.B = S.B;
Q2: SELECT R.A FROM R WHERE R.B IN (SELECT B FROM S);

(a) Q1 and Q2 produce the same answer.
(b) The answer to Q1 is always contained in the answer to Q2.
(c) The answer to Q2 is always contained in the answer to Q1.
(d) Q1 and Q2 produce different answers.

Question 3:

Q1: SELECT DISTINCT * FROM R;
Q2: (SELECT * FROM R) INTERSECT (SELECT * FROM R);

(a) Q1 and Q2 produce the same answer.
(b) The answer to Q1 is always contained in the answer to Q2.
(c) The answer to Q2 is always contained in the answer to Q1.
(d) Q1 and Q2 produce different answers.

Question 4:

For this problem assume that the schemas are R(B,A) and S(B,A)
and B is a primary key in both relations.

Q1. $\pi_B(R-S)$
Q2: $\pi_B(R)-\pi_B(S)$

(e) Q1 and Q2 produce the same answer.
(f) The answer to Q1 is always contained in the answer to Q2.
(g) The answer to Q2 is always contained in the answer to Q1.
(h) Q1 and Q2 produce different answers.

Question 5:

In the SQL 3-valued logic, the value of expression

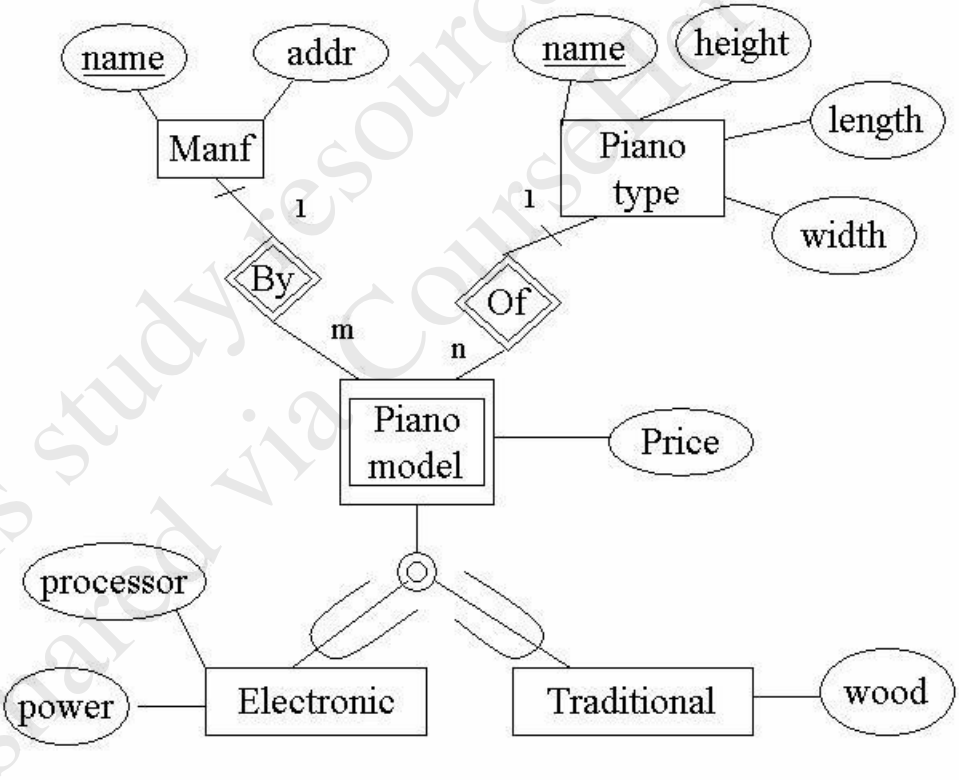
R.a > R.b OR R.a <= 0 OR R.b > = 0 can be:

(a) Only TRUE or FALSE
(b) Only FALSE or UNKNOWN
(c) Only TRUE or UNKNOWN
(d) (d) Any of TRUE, FALSE, or UNKNOWN.

Name_____

Question 6:

The figure below is an E/R diagram about pianos, their manufacturers and types. A typical manufacturer could be Steinway or Casio. Typical names of types are Grand, Baby-Grand, Spinet, and (electronic) Keyboard. Pianos are either electronic or "traditional"; some could be both, and some could be neither. For traditional pianos we record the wood from which it is made, and for electronic pianos, we record the processor used and the power.



a) Convert this E/R diagram to a relational database schema, using the "E/R" approach to handling the isa-hierarchy (generalization hierarchy). It suffices to list the schemas with their attributes and primary keys.

Name_____

b) Convert the same E/R diagram to a database schema using the "object-oriented" approach to handling the isa-hierarchy.

Question 7.

The relations below represent information about the 15 members of the UN Security Council and the resolutions (*res*) that they voted on.

Members(*name; status*)
Votes(*res; country; vote*)
The status of a country is either permanent or elected. A vote is either YES, NO or ABSTAIN.

Complete the SQL schema for Members and Votes which are started as follows:

```
CREATE TABLE Members(
name CHAR(10),
status CHAR(10)
)

CREATE TABLE Votes(
res INT,
country CHAR(10),
vote CHAR(10)
)
```

Include in your scheme:

(a) The keys indicated by underlines in the informal schema.

(b) The constraint that any country mentioned in the Votes relation appears in the *name* column of Members.

(c) The constraint that no vote can be *NULL*

(d) The constraint that if a country is deleted from the members relation, then its votes are automatically deleted from the Votes relation.

==========

Consider the database schema.

Employee(employee-name, street, city)
Works(employee-name, company-name, salary)
Company(company-name, city)
Manages(employee-name, manager-name)

The following questions ask you to formulate the appropriate SQL queries to

8. Find all employees who live in the same cities as the companies for which they work.

9. Find all employees who earn more than average salary of all employees of their company.

10. Find those companies whose employees earn a higher salary, on average than the average salary at First Bank Corporation.

11. Find all employees who earn more than each employee of 'Small Bank Corporation'