CSE 462 : Relational Model and Relational Algebra

Name: ____ Date: January 31, 2011

***** Solved in class, on January 31, 2011. *****

1. Consider th e relation instance R below.

A	B	C
1	2	3
1	3	4
2	3	4
2	3	5

a) Specify a schema for this relation, including a minimal key.

R(A: integer, B: integer, C: integer)

b) Based on your answer to **1a)**, explain whether the tuple (2,4,5) can be inserted into R.

It cannot. It would violate the key constraint: no two tuples may agree on their A and C attribute values, but the new tuple and the existing tuple (2,3,5) would.

c) In how many different ways can R be presented?

$3! \cdot 4!$

2. Consider the relation schema `Employee`(SSN, LastName, FirstName, DoB, Salary, ManagerSSN). Provide a `CREATE TABLE` statement to create this relation using reasonable data types and constraints to guarantee consistency of the relation.

```
CREATE TABLE Employee (
  SSN        CHAR(9) NOT NULL PRIMARY KEY,
  LastName   VARCHAR(100) NOT NULL,
  FirstName  VARCHAR(100) NOT NULL,
  DoB        DATE NOT NULL,
  Salary     NUMERIC NOT NULL CHECK(Salary >= 0),
  ManagerSSN CHAR(9) REFERENCES Employee(SSN)
);
```

3. Suppose relations R and S have n tuples and m tuples, respectively. Give the minimum and maximum number of tuples that the results of the following expressions can have. Provide your answer in terms of m and n. (Exercise 2.4.7 in the textbook)

	$R \cup S$	$R \cap S$	$R \bowtie S$	$\sigma_\theta(R) \times S^*$	$\pi_L(R) - S^\dagger$
min	$max(n,m)$	0	0	0	0
max	$n+m$	$min(n,m)$	$n \cdot m$	$n \cdot m$	n

* θ is an arbitrary selection formula. † L is an arbitrary projection list.

4. The following algebraic laws hold for sets but not for bags. For each of the laws, show that they do not hold for bags by providing a counterexample in terms of relation instances R, S, and T. (Based on exercise 5.1.5 in the textbook)

a) $(R \cap S) - T = R \cap (S - T)$ **b)** $R \cap (S \cup T) = (R \cap S) \cup (R \cap T)$

$R(X) = \{(x)\}$, $S(X) = \{(x),(x)\}$, $T(X) = \{(x)\}$ is a counterexample for both (a) and (b).

(a):

$(\{(x)\} \cap \{(x),(x)\}) - \{(x)\} \neq \{(x)\} \cap (\{(x),(x)\} - \{(x)\})$

$\{(x)\} - \{(x)\} \neq \{(x)\} \cap \{(x)\}$

$\emptyset \neq \{(x)\}$

(b):

$\{(x)\} \cap (\{(x),(x)\} \cup \{(x)\}) \neq (\{(x)\} \cap \{(x),(x)\}) \cup (\{(x)\} \cap \{(x)\})$

$\{(x)\} - \{(x)\} \neq \{(x)\} \cap \{(x)\}$

$\emptyset \neq \{(x)\}$