**2015336661 이승수’s database homework#7 due date: 2016.11.08**

**8.1 Suppose that we decompose the schema r(A, B, C, D, E)into r1(A, B, C), r2(A, D, E).**

**Show that this decomposition is a lossless-decomposition if the following set F of functional dependencies holds:**

**A→BC, CD→E, B→D, E→A**

At r1, A->BC and r1 union r2 is A. By A->BC, A->ABC is held, so r1 union r2 holds r1. So r1, r2 is lossless-decomposition of schema r.

**8.4 Use Armstrong’s axioms to prove the soundness of the union rule. (Hint: Use the augmentation rule to show that, if α→β, then α→ αβ. Apply the augmentation rule again, using α→γ, and then apply the transitivity rule.)**

If α→β, we can determine α→αβ by augmentation rule. And from α→γ, we can determine αβ→γβ by augmentation rule. As a result, we can determine α→αβ→γβ, by transitivity rule. So we can prove the soundness of union rule, α→γβ from α→β, α→γ.

**8.5 Use Armstrong’s axioms to prove the soundness of the pseudo transitivity rule.**

If α→β is given, αγ →βγ is held by augmentation rule. If γβ→δ is given, α→δ is held by transitivity rule.

**8.6 Compute the closure of the following set F of functional dependencies for relation schema**

**r (A, B, C, D, E).**

**F= {A→BC, CD→E, B→D, E→A}**

**List the candidate keys for R.**

A->BC : we can conclude A->B, A->C by decomposition rule,.

We can conclude A->D(since transitivity rule of A->B,B->D)

Then we can conclude A->CD(since union A->C,A->D).

CD->E : we can conclude A->E(since transitivity rule of A->CD,CD->E)

So we can conclude A->BCDE(since union A->BC,A->D,A->E).

A->A is formed so we can conclude A->ABCDE.

E->A : we can conclude E->ABCDE(since transitivity of E->A,A->ABCDE).

CD->E : we can conclude CD->ABCDE(since transitivity of CD->E,E->ABCDE).

B->D : we can conclude BC->CD(augementative rule).

Then we can conclude BC->ABCDE(since transitivity of BC->CD,CD->ABCDE).i

Finally we can conclude A,BC,CD, and E are candidate key for R.

**8.7 Using the functional dependencies of Practice Exercise 8.6, compute the canonical cover Fc.**

\*\*\*\*\*\*\*\*\*\*\*\* canonical cover의 기준이 dependency 수가 적어지는 것? 뭐지??

Nothing is extraneous in A->BC. Set is {A->BC}.

Nothing is extraneous in CD->E. Set is {A->BC, CD->E}.

Nothing is extraneous in B->D. Set is {A->BC, CD->E, B->D}.

Nothing is extraneous in E->A. Canonical cover set is {A->BC, CD->E, B->D, E->A}.

**8.19 Give a lossless-join decomposition into BCNF of schema R of Practice Exercise 8.1**.

Schema R is given, r={A,B,C,D,E}.

If we decompose r into r1={A,B,C} and r2={A,D,E}, A can be a superkey of R as in Exercise 8.6.

A->BCDE is trivial so r can be lossless-join decomposed into BCNF if divided into r1{A,B,C}, r2{A,D,E}.

**8.20 Give a lossless-join, dependency-preserving decomposition into 3NF of schema R of Practice Exercise 8.1.**

A !∈ β implies β → A is nontrivial

Since β → α does not hold, β is not a superkey

A is not any candidate key, since A is nonprime

we show that if R is in 3NF according to the exercise definition, it is in 3NF according to the textbook definition. Suppose R is not in 3NF according the textbook definition.

Then there is an FD α → β that fails all three conditions. Thus

α → β is nontrivial.

α is not a superkey for R.

Some A in β − α is not in any candidate key.

This implies that A is nonprime and α → A. Let γ be a candidate key for R. Then γ → α, α → γ does not hold (since α is not a superkey), A !∈ α, and A !∈ γ (since A is nonprime). Thus A is transitively dependent on γ, violating the exercise definition

**8.25 Consider the following proposed rule for functional dependencies: If α→β and γ →β, then α→γ. Prove that this rule is not sound by showing a relation r that satisﬁes α→β and γ →β, but does not satisfy α→γ.**

Pretend relation r={A,B,C,D,E}.

If FD={A->B, C->B, B->C}, functional dependency A->C is formed by union rule.

However without B->C functional dependency, A->C cannot be formed.

**8.26 Use Armstrong’s axioms to prove the soundness of the decomposition rule.**

If α→βγ is formed, βγ⊆β and βγ⊆γ so βγ→β and βγ→γ will be formed by reflexivity.

Then α→ β and α→γ will be formed by transitivity.