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CMSC461 Summer 2006
Homework 2

Problem 1:
R = ABCDE
F = {A → BC, CD → E, B → D, E → A}

a) compute candidate keys:
$(A)^+$ = ABCDE
$(B)^+$ = BD
$(C)^+$ = C
$(D)^+$ = D
$(E)^+$ = EABCD
$(BC)^+$ = BCDEA
$(BD)^+$ = BD
$(CD)^+$ = CDEAB

keys: A, E, BC, CD

b) compute canonical cover for F:

F = {A → BC, CD → E, B → D, E → A}

is B redundant in A → BC? F' = {A → C, CD → E, B → D, E → A}
$(A)^+_{F'}$ = AC, no.
is C redundant in A → BC? F' = {A → B, CD → E, B → D, E → A}
$(A)^+_{F'}$ = ABD, no.
is C redundant in CD → E?
$(D)^+_F$ = D, no.
is D redundant in CD → E?
$(C)^+_F$ = C, no.
is E redundant in CD → E? F' = {A → BC, CD → ∅, B → D, E → A}
$(CD)^+_{F'}$ = CD, no.
is D redundant in B → D? F' = {A → BC, CD → E, B → ∅, E → A}
$(B)^+_{F'}$ = B, no.
is A redundant in E → A? F' = {A → BC, CD → E, B → D, E → ∅}
$(E)^+_{F'}$ = E, no.

The canonical cover for F is F: F_c = F

c) compute a BCNF decomposition for R:
R = ABCDE, F = {A → BC, CD → E, B → D, E → A}

B → D, B ⊆ R, D ⊆ R, is nontrivial. B is also not a superkey.

ABCDE
/ \ $B \to D$
BD ABCE

ABCE are all superkeys.

d) computer a 3NF decomposition for R:
It is already in a 3NF because all attributes are either candidate keys or contained in one.

e)
BCNF is a lossless join but it not dependency preserving.
3NF is a lossless join and preserves dependencies.

Problem 2:
$R = ABCDE$, $F = \{A \to B, A \to C, CD \to E, CE \to B\}$

a) compute candidate keys:
$(A)^+_F = ABC$
$(B)^+_F = B$
$(C)^+_F = C$
$(D)^+_F = D$
$(CE)^+_F = E$
$(AB)^+_F = ABC$
$(AC)^+_F = ABC$
$(AD)^+_F = ABCDE$
$(AE)^+_F = ABCE$
$(BC)^+_F = BC$
$(BD)^+_F = BD$
$(BE)^+_F = BE$
$(CD)^+_F = CDEB$
$(CE)^+_F = CEB$
$(DE)^+_F = DE$

keys: AD

b) compute the canonical cover for F:
$F = \{A \to B, A \to C, CD \to E, CE \to B\}$

Automatically combine $A \to B$, and $A \to C$ to $A \to BC$

$F' = \{A \to BC, CD \to E, CE \to B\}$

is B redundant in $A \to BC$? $F'' = \{A \to C, CD \to E, CE \to B\}$
$(A)^+_{F''} = AC$, no.
is C redundant in $A \to BC$? $F'' = \{A \to B, CD \to E, CE \to B\}$

$(A)^{+}_{F''}$ = AB, no.

is C redundant in CD $\rightarrow$ E?

$(D)^{+}_{F'}$ = D, no.

is D redundant in CD $\rightarrow$ E?

$(C)^{+}_{F'}$ = C, no.

is E redundant in CD $\rightarrow$ E? F'' = {A $\rightarrow$ BC, CD $\rightarrow$ $\varnothing$, CE $\rightarrow$ B}

$(CD)^{+}_{F''}$ = CD, no.

is C redundant in CE $\rightarrow$ B?

$(E)^{+}_{F'}$ = E, no.

is E redundant in CE $\rightarrow$ B?

$(C)^{+}_{F'}$ = C, no.

is B redundant in CE $\rightarrow$ B? F'' = {A $\rightarrow$ BC, CD $\rightarrow$ E, CE $\rightarrow$ $\varnothing$}

$(CE)^{+}_{F''}$ = CE, no.

F_c = {A $\rightarrow$ BC, CD $\rightarrow$ E, CE $\rightarrow$ B}

c) compute a BCNF decomposition of R:

R = ABCDE F_c = {A $\rightarrow$ BC, CD $\rightarrow$ E, CE $\rightarrow$ B}

A $\rightarrow$ BC, A is not a superkey and it is nontrivial.

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        ABCDE
        /       \  A → BC
    ABC      ADE
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d) compute a 3NF decomposition of R:

not sure.

e) I can't really answer this as I got confused, but I will ask in class.