Assignment 5: Relational Database design

1. R1(A, B, C, D) F1 = {A → B, B → C, C → A}

1) A^+ {A} A → B {A B}

{A B} B → C {A B C}

A^+ ={A B C}

2) AB → C. Yes because of the transitive property A → B and B → C so A → C. Since B → C and A → C, AB → C exists.

3) No sets with one attribute are candidate keys

A^+ = {A B C}, B^+ = {A B C}, C^+ = {A B C}, D^+ = {D}

3 sets with two attributes are candidate keys

$(AD)^+$ = {A B C D}, $(BD)^+$ = {A B C D}, $(CD)^+$ = {A B C D}

Sets with more than two attributes are repetitive therefore (AD), (BD), (CD) are candidate keys.

2. R2(A, B, C, D) F2 = {A → B, C → D, D → AC }

1) $(AD)^+$ Yes AD contains all attributes

AD A → B ADB

ADB C → D ADB

ADB D → AC ABCD

2) Check if LHS of FD is a super key

A → B A^+ = {A,B} no

R2 is not in BCNF because A → B A^+ is not a super key

3) A → B not a super key

R_1(A,B) R_2(A,C,D)

Check if decompostion is in BCNF

R_1 A^+ = {A,B}

B^+ = {B} $B^+ \cap (R_1 - B)$ = empty set

$(AB)^+$ = {A,B}

R_1 is in BCNF

R_2 A^+ = {A,B} $A^+ \cap (R_2 - A)$ = empty set all other subsets are super keys so R_2 is in BCNF

This decomposition dependency is not preserving, not all FD's can be used in a single relations instance.

3. R3(A,B,C,D,E) F3 = {$A \rightarrow BC$, $AC \rightarrow BD$}

1) $(AC)^+$ = {A, B, C, D}

$(AE)^+$ = {A, B, C, D, E}

2) $AB \rightarrow C$. No because B cannot reach C from any point

3) F_c of F3

C? A^+ = {A,B,C,D} C is extraneous, therefore $A \rightarrow BD$

$A \rightarrow BC$ $F^1 = (F - (A \rightarrow BC)) \cup (A \rightarrow (BC-B))$

F^1 = {$A \rightarrow BD$, $A \rightarrow C$)

A^+ = {A, B, C , D} B is extraneous, therefore $A \rightarrow C$

F_C = {$A \rightarrow C$, $A \rightarrow BD$ }

4) A^+ = {A,B,C,D} $(AC)^+$ = {A,B,C,D}

BC – A = BC BD – AC = BD

It is not in 3NF because the attributes of $\beta - \alpha$ are not candidate keys of R3.

F_C = {$A \rightarrow C$, $A \rightarrow BD$}

R_1(A, C) R_2(A,B,D)

Both don't contain candidate keys so:

R_3(A, C, E) and R_1 can be removed

R_3(A, C, E) R_2(A,B,D)