TDDD81 Assignment 3

1.

FD1: {A} → {B, C} FD2: {C} → {A, D} FD3: {D, E} → {F}

a) {C} → {A, D} => {C} → {A} => {A} → {B, C} => {A} → {B}

Decomposition (after {C} → {A, D})

Decomposition (after {A} → {B, C})

Transitivity

=> {C} → {B}

b)

{A} → {B, C} => {A} → {C} (Decomposition)

{C} → {A, D} => {C} → {D} (Decomposition)

{A} → {D} (Transitivity)

{D, E} → {F} (reflexivity)

=> {A, E} → {F}

2.

a) $X^+ = \{A, B, C\}$ b) $X^+ \{A, C, D, E, F\}$

3. a) $D^+ = \{D, B\}$ (using FD3)

$E^+ = \{E, F\}$ (using FD2)

$(A, B)^+ = \{A, B, C, D, E, F\}$ (using FD1) = R

$(A, B)^+$ is a superkey since all attributes are covered, $(A, B)^+ \rightarrow R$

D^+ & E^+ are not superkeys.

Therefore the candidate key for R is (A, B)

b) FD2 & FD3 violate BCNF since the left hand sides are not superkeys.

c)

$R_1(\underline{A, B}, C, D, E, F)$ $R_2(\underline{E}, F)$ $R_3(\underline{D}, E)$

c) F2 violates BCNF

$R_1(\underline{E}, F)$ with FD2 $\quad R_2(\underline{A}, \underline{B}, \underline{C}, D, E)$ with FD1, FD3

Decompose R2 since FD3 violates BCNF

$R_1(\underline{E}, F)$ FD2 $\quad R_2(\underline{D}, B)$ FD3 $\quad R_3(\underline{A}, \underline{B}, \underline{C}, D, E)$

This step removes the dependency of FD1, therefore we don't find a dependency-preserving decomposition.

4.

a) $(A,B,C)^+ = \{A,B,C,D,E\}$, (A,B,C) is a superkey

$(B,C,D)^+ = \{A,B,C,D,E\}$ (B,C,D) is a superkey

$(C)^+ = \{D,C\}$, C is not a superkey which violates BCNF. Q.E.D

b) FD3 violates BCNF

$R_1(\underline{C}, D)$ $\quad R_2(\underline{A}, \underline{B}, C, E, F)$

Violates both FD1 & FD2 therefore we don't find a dependency-preserving decomposition