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CS 143 HW 6

1. {A,B,C,F}+ = {A, B, C, D, E, F}. Because {A,B,C,F}+ contains a key, we can say that this decomposition is lossless.

2. AC -> B, BC -> A

3. (a) If we have a cyclic functional dependency, then we can determine that it's one-to-one.
(b) If it is acyclic FD, then it can be many-to-one.

4. (a) {E}+ = {A, B, C, D, E). Because of this, E is a key.
(b) {B, C}+ = {B, C, D, E, A}. Because of this and that BC is minimal, BC contains a key.

5. {A}+ = {A, B, C, D, E} | {C}+ = {C, E} | {B}+ = {D}
Because these non-trivial FD's does not equal R, we can see that this is not in BCNF.
R1(A, B, C, D, E)
R2(A, F) – in BCNF
Now using FD's for R1:
{A}+ = {A, B, C, D, E} | {C}+ = {C, E}
Since {C}+ doesn't equal R1, we split R1 into:
R3(C, E) – in BCNF
R4(A, B, C, D)
Using FD's for R4:
{A}+ = {A, B, C, D} | {B}+ = {B, D}
Since {B}+ doesn't equal R4, we split R4 into:
R5(B,D)
R6(A,B,C)
This should be in BCNF using R2, R3, R5, R6.

6. We also know that the following are tuples in R:
(a, b1, c1, d2), (a, b1, c1, d3), (a, b2, c2, d1), (a, b2, c2, d3), (a, b3, c3, d1), (a, b3, c3, d2)

7. {AB}+ = {A, B, E}
Split R into:
R1 (A, B, E)
R2 (A, B, C, D, F)
Split R1 into:
R3 (A, B) – in 4NF
R4 (B, E) – in 4NF
Split R2 using the MVD A ->-> B:
R5(A, B)
R6(A, C, D, F)
Now this is in 4NF using R3, R4, R5, R6.