CSE 305 Homework 3

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Question 6.18

The projection of dependencies on ADE includes E → A, A → D and D → E however, B → E is not included anywhere hence this is not dependency-preserving.

Let r be a relation over ABCDE, and rAB, rBCD, rADE be its projections on the corresponding sets of attributes. We need to show that rAB JOIN rBCD JOIN rADE ⊆ r.

Every tuple can now be represented as abcde, where ab ∈ rAB, bcd ∈ rBCD and ade ∈ rADE.

The tuple ab must be a projection of some tuple $abc_1d_1e_1$. ade must be a projection of some ab_2c_2de and bcd must be a projection of some a_3bcde_3

Now since, B → E, $e_1 = e_3$. Since E → A and since $e_1 = e_3$, the tuples must agree on A as well, hence $a = a_3$. Since A → D, $d = d_1$ and since D → E, $e = e_1 = e_3$

Using all these, we have $abc_1d_1e_1$ = abcde, hence this is lossless

Question 6.23

Provided FDs:

- BG → CD
- G → F
- CD → GH
- C → FG
- F → D

To convert this into a minimal cover, we first split all the right hand sides into FD with a single RHS :

- BG → C
- BG → D
- G → F
- CD → H
- CD → G
- C → F
- C → G
- F → D

Next we reduce the left hand sides. CD → H reduces to C → H and CD → G reduces to C → G (Which is elimintaed) and BG → D reduces to G → D. After this we elimnate all redundant FDs which leaves us with

- BG → C
- G → F
- C → H
- C → G
- F → D

This gives us the decomposition into 3NF : (BGC; {BG → C, C → G}), (GF; {G → F}), (CGH ; {C → GH }), (FD; {F → D})

Out of this, (BGC; {BG → C, C → G}) is not a BCNF. A decomposition with respect to C → G gives us (CG; {C → G}) and (CB; {}) which makes it BCNF but it loses the BG → C FD