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1) Consider the relation schema R(A, B, C, D, E, F) and the set of functional dependencies F = { FD1: A → BC; FD2: C → AD; FD3: DE → F }. Use the Armstrong rules to derive each of the following two functional dependencies. In both cases, describe the derivation process step by step (i.e., which rule did you apply to which FDs).
    a) Show that C → B
       FD4: C → A (decomposition of FD2)
       FD5: C → BC (transitive rule with FD4 and FD1)
       FD6: C → B (decomposition of FD5)
    b) Show that AE → F
       FD6: A → C (decomposition of FD1)
       FD7: A → D (transitivity FD6 and FD2)
       FD8: AE → F (Pseudo-transitivity FD7 and FD3)

2) For the aforementioned relation schema with its functional dependencies, compute the attribute closure X+ for each of the following two sets of attributes.
    a) X = { A } w.r.t FD1-3 is X+ = {A,B,C,D}
    b) X = { C, E } w.r.t FD1-3 is X+ = {A, B, C, D, E, F}

3) Consider the relation schema R(A, B, C, D, E, F) with the following FDs
   FD1: AB → CDEF
   FD2: E → F (← violates)
   FD3: D → B (← violates)
    a) Determine the candidate key(s) for R.
       Answer: The candidate keys are {AB, AD}
    b) Note that R is not in BCNF. Which FD(s) violate the BCNF condition?
       Answer: The FDs that violate the BCNF condition are FD2 and FD3
    c) Decompose R into a set of BCNF relations, and describe the process step by step (don't forget to determine the FDs and the candidate key(s) for all of the relation schemas along the way).
        1. Using FD2:
           R1(E, F) with FD2, CK: {E}
           R2(A,B,C,D,E) with FD3 and FD4 : AB → CDE (decomposition of FD1), CK : {AB, AD}
        2. Using FD3:
           R3(D,B) with FD3, CK: {D}
           R4(A,C,D,E) with FD5: AD → CE (augment FD3 with A, transitivity with FD4, decomposition to remove D), CK: {AD}

       Answer: The resulting decomposed tables in BCNF form are R1,R3,R4
4) Consider the relation schema R(A, B, C, D, E) with the following FDs:
   FD1: ABC → DE
   FD2: BCD → AE
   FD3: C → D
    a) Show that R is not in BCNF

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Because C is not a superkey to the relation schema R we have a FD where the left hand side is not a superkey (FD3). Therefore R is not in BCNF.

b) Decompose R into a set of BCNF relations (describe the process step by step).
    1. Using FD3:
       R1(C,D) with FD3, CK : {C}
       R2(A,B,C,E) with FD4: ABC → E, FD5: BC → AE (augment FD3 with BC, transitivity with FD2), CK {BC}

The resulting decomposed tables are R1 (with FD3) and R2 (with FD4 and FD5)