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## Q0:

R(A,B,C,D,E)

AE → D, CE → B, A → C, B→ D, AE→ C

1. A+ = {AC} , B+ = {BD} , C+ = {C}, D+ = {D}, E+ = {E}

AB+ = {ABCD}, AC+ = {AC}, AD+ = {ACD}, AE+ = {ABCDE}

BC+ = {BCD}, BD+ = {BD}, BE+ = {BE}, CD+ ={CD}, CE+ = {BCDE}

DE+ = {DE}

Keys = AE

Superkeys = AEB, AEC, AED

1. CE -> D, BC -> D, AB -> CD
2. (A,E)
3. R1=CDE

C+ = {C}, D+ = {D}, CD+ = {CD}, CDE+ = {CDE}

CE -> D is the non trivial dependency projected on decomposition

1. R1=BCDE, R2=ABE

|  | A | B | C | D | E |
| --- | --- | --- | --- | --- | --- |
| R1 | a1 | b | c | d | e |
| R2 | a | b | c2 | d2 | e |

For lossless decomposition the common attribute in R1 and R2 has to be a candidate key in at least one relation.

E+ = {E}

Since E does not drive any attribute in R1 nor in R2, it is not a key in either of them. Thus this decomposition is lossy.

1. R(A,B,C,D,E)

AE → D, CE → B, A → C, B→ D, AE→ C

Key is AE

Prime candidates are A,E

We split R by:

B+ = {BD}

R1 = BD and R2 = ACE

In R1, B is the key with which we can determine all attributes in it. So we need to have B in R2 also.

R1 = BD and R2 = ABCE

* In R1 key is B and projections are B->D == R1 is in BCNF form
* In R2 key is AE and projections are AE->D, A->C, AE->C, CE -> B

We further divide A->C and CE->B in R23 and R24 respectively since they are not in BCNF form

R21 = AC and R22 = BCE

* In R21 key is A and projection is A->C
* In R22 key is CE and projection is CE -> B

Both are in BCNF form now

So our new relation can be R1 = BD, R2 = ABCE, R3 = AC, R4 = BCE

1. CE->B, A->C, B->D