Dependency preservation Example

Decomposition D = { R_1, R_2, R_3,,.., ,R_m} of R is said to be dependency-preserving with respect to F if the union of the projections of F on each R_i, in D is equivalent to F. In other words, R ⊂ join of R_1, R_1over X.

Example 1: Let a relation R(A,B,C,D) and set a FDs F = { A -> B , A -> C , C -> D} are given.
A relation R is decomposed into -

R_1 = (A, B, C) with FDs F_1 = {A -> B, A -> C}, and

R_2 = (C, D) with FDs F_2 = {C -> D}.

F' = F_1 ∪ F_2 = {A -> B, A -> C, C -> D}

so, F' = F.

And so, $F'^{+} = F^{+}$.

Example 2: R(A,B,C) is decomposed into R1(A,B) and R2(B,C)
The relation R contains following data.

A	B	C
1	1	1
2	1	2
3	2	1
4	2	2

Answer:
Here the FD's for R, F = { A ->B, A -> C, BC ->A}

Now for R1(A,B) the relation would be

A	B
1	1
2	1
3	2
4	2

Hence, F1 = { A -> B}

Now for R2(B,C) the relation would be

B	C
1	1
1	2
2	1
2	2

Hence F2 = { }

Here, F != F1 U F2
Hence the relation is not dependency preserved.

Example 3: R(A,B,C,D,E) and F = { A -> B, B ->C, C->D, D->A}
and R1(A,B,C) and R2 (C,D,E)

Answer: **For R1(A,B,C) we will find F1**

We need to find closure of A,B,C

A+ = { ~~A~~, B, C, ~~D~~} hence FD will be A -> BC

B+ = { ~~B~~,C,~~D~~,A} hence FD will be B -> CA

C+ = {~~C~~,~~D~~,A,B} hence FD will be C -> AB

AB+ = {~~A~~,~~B~~, C,~~D~~} hence FD will be AB -> C duplicate FD as A -> C and definitely AB-> C. Hence we will discard it.

AC+ = {~~A~~,~~C~~,B,~~D~~} hence FD will b AC -> B hence duplicated

BC + = {~~B,C,D~~,A} hence FD will be BC -> A hence duplicated.

ABC+ no need to calculate as it is trivial dependency,

Hence F1 = { A -> BC, B -> CA, C -> AB}

For R2(C,D,E) we will find F2

C+ = {~~C~~,D,~~A,B~~} hence FD will be C -> D

D+ = {~~D,A,B~~,C} hence FD will be D -> C

E+ = {~~E~~}

CD+ = { ~~C,D, A,B~~}

DE+ = {~~D,E,A,B~~,C} hence FD will be DE -> C which is duplicated as D -> C.

CE + = {~~C,E~~,D,~~A,B~~} hencde FD will be CE -> D duplicated as C -> D

Hence F2 = { C -> D, D -> C}

For dependency preservation, F = F1 U F2

F1 U F2 = { A -> BC, B -> CA, C -> AB, C -> D, D -> C}

Simplified F1 U F2 after applying Armstrong’s axiom:

F1 U F2 = { A -> B , A -> C, B -> C, B -> A, C -> A, C -> B, C->D,D->C}

F = { A -> B, B ->C, C->D, D->A}

For, A -> B, B ->C, C->D they are part of F1 U F2 but D->A is not a part of F1 U F2, Hence find D+ from F1 U F2

D+ = {D,C,A,B} here A is in closure of D hence D -> A is already preserved.

Hence This relation R is dependency preserved.