Quiz 4 (Solution)

➔ Each question is 25 Points ←

Given the following relation R = (A, B, C, D, E, F), and the following dependencies
F = {AB → DE,   CD → E,   B → EF,   DF → AC,   BD → AF}

Question 1: **Do the following functional dependencies hold or not (Yes or No). Show your work.**

Using transitivity, augmentation, union and decomposition rules we get the following
dependencies:
AB→DE
AB→D
AB→E
AB→AE
AB→AD

CD→E
CD→CE
CD→DE

B→EF
B→E
B→F
BC→CE
BC→CF
BD→DF
BD→AC
AB→AE
AB→AF

DF→AC
DF→A
DF→C
DF→AD
DF→AF

BD→A
BD→C

B→BE
B→BF

BD→AF

BD→A
BD→F

As we can see:
BD→DF => BD→F
BD→F, BD→C => <u>BD→CF</u>

But we are unable to get dependency of attribute D on BC. BC→CEF and that's it.

BC → CDF   NO

BD → CF   YES

Question 2: What are the attribute closures of {DF}. That is, compute {DF}⁺. Show your work.

Start:	{DF}
Adding attributes for D	{DFEAC}
Adding attributes for F	{DFEAC}
Adding attributes for E	{DFEAC}
Adding attributes for A	{DFEAC}
Adding attributes for C	{DFEAC}

$\{DF\}^+ = \{ACDEF\}$

Question 3: Report all candidate keys of R. Show your work.

- Since B is not determined by anything else, then it must be part of the key.
- Also since B determines EF, then no need to check BE and BF.
- What's left is to check BA, BC, and BD. You will find that only BA and BD are keys.

B→BEF

Using union:
AB→ABEF→ ABDEF→ABDEFC   (AB → DE, DF → AC)
BC→CEF
BD→DBEF→DBEFAC   (DF → AC)

$\{AB\}$, where $\{AB\}^+ = \{ABCDEF\}$ and none of A^+ or B^+ contains all keys

{BD} , where ${BD}^+ = {ABCDEF}$ and none of D^+ or B+ contains all keys

Question 4: If R is decomposed into two relations R1 = (A, B, D, F) and R2 = (C, D, E, F), is it lossy or lossless decomposition, and Why?

The common columns are {DF}, Is it candidate key in either of R1 or R2 ??

In R1 ➜ ${DF}^+$ = D F A   (cannot get B, not it is not key)

In R2 ➜ ${DF}^+$ = D F C E   (so DF is a candidate key in R2)

So this decomposition is lossless