21BDS0340

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Question 1

a. Keys are: ABCDEF, ABCDE, ABDEF, ABCDF, ABCD, ABDE, ABD, BCD

Candidate keys: ABD, BCD

b. using ABD as candidate key

BCNF needs all X in X → Y for X to be a super key

AB → C

DC → AE

E → F

↑

all do not satisfy

3CNF is also not satisfied.

∴ DC → AE and C is not a prime attribute

∴ This relation is only at 2NF

c. (A, B, C, D), (B, C, D, E, F)

AB → C is preserved in the first

DC → AE is not preserved in either

∴ The decomposition is not dependency preserving

Question 2

SSN → ENAME, BDATE, ADDRESS, DNUMBER

DNUMBER → DNAME, DMGRSSN

a. $SSN^+ = \{$ENAME, BDATE, ADDRESS, DNUMBER, DNAME, DMGRSSN$\}$, SSN$\}$

$DNAME^+ = \{DNAME\}$

b. No dependency can be removed

∴ The set of relations G is minimal

Any removals causes loss of data

c. Update anomaly:

If DNUMBER changes in the Department relation, then the SSN → DNUMBER may not be updated properly

Insertion anomaly:

If an employee is added without DNUMBER ex is taken

Deletion anomaly:

If an employee department is deleted, then DNUMBER does not exist any more

Question 3

AB → C

C → D

D → A

a. Non-trivial FD's :

AB → C , C → D , D → A

∴ AB → D , AB → A , C → A

b. candidate keys:

AB, CB, DB

c. BCNF violations :

C → D , D → A

AB → C is valid

d. Decomposition :

R1 (A, B, C) , R2 (C, D) , R3 (D, A)

QUESTION 4

$A \rightarrow C$

$AB \rightarrow C$

$C \rightarrow D1$

$CD \rightarrow 1$

$EC \rightarrow AB$

$E1 \rightarrow C$

$C \rightarrow D1$, $\therefore CD \rightarrow 1$ is redundant

$A \rightarrow C$, $\therefore AB \rightarrow C$ is redundant

$A \rightarrow C$

$C \rightarrow D1$

$EC \rightarrow AB$

$E1 \rightarrow C$

$A \rightarrow C$, $\therefore C \rightarrow D1$ is redundant

$A \rightarrow D1$

$EC \rightarrow AB$

$E1 \rightarrow C$

Question 5

i. The relation is not in INF due to the last row of the data. The relation itself is in INF.

ii. The relation is ~~not~~ in 2NF as the candidate key is student_ID and no partial dependencies exist

iii. The relation is not in 3NF as there exists a transitive fd relation:

Student_ID → Hostel_Block

Hostel_Block → fees

converting to 3NF:

R1(student_ID, Hostel_Block), R2(Hostel_Block, fees)

Question 6

The combination of SPJ is a candidate key

i. Insertion anomaly: The same SPJ combo can be inserted, which destroys the uniqueness

Deletion anomaly: If a P or J is deleted, the reference number is now lost

ii.

SP

S#	P#
S1	P1
S1	P2
S2	P1

PJ

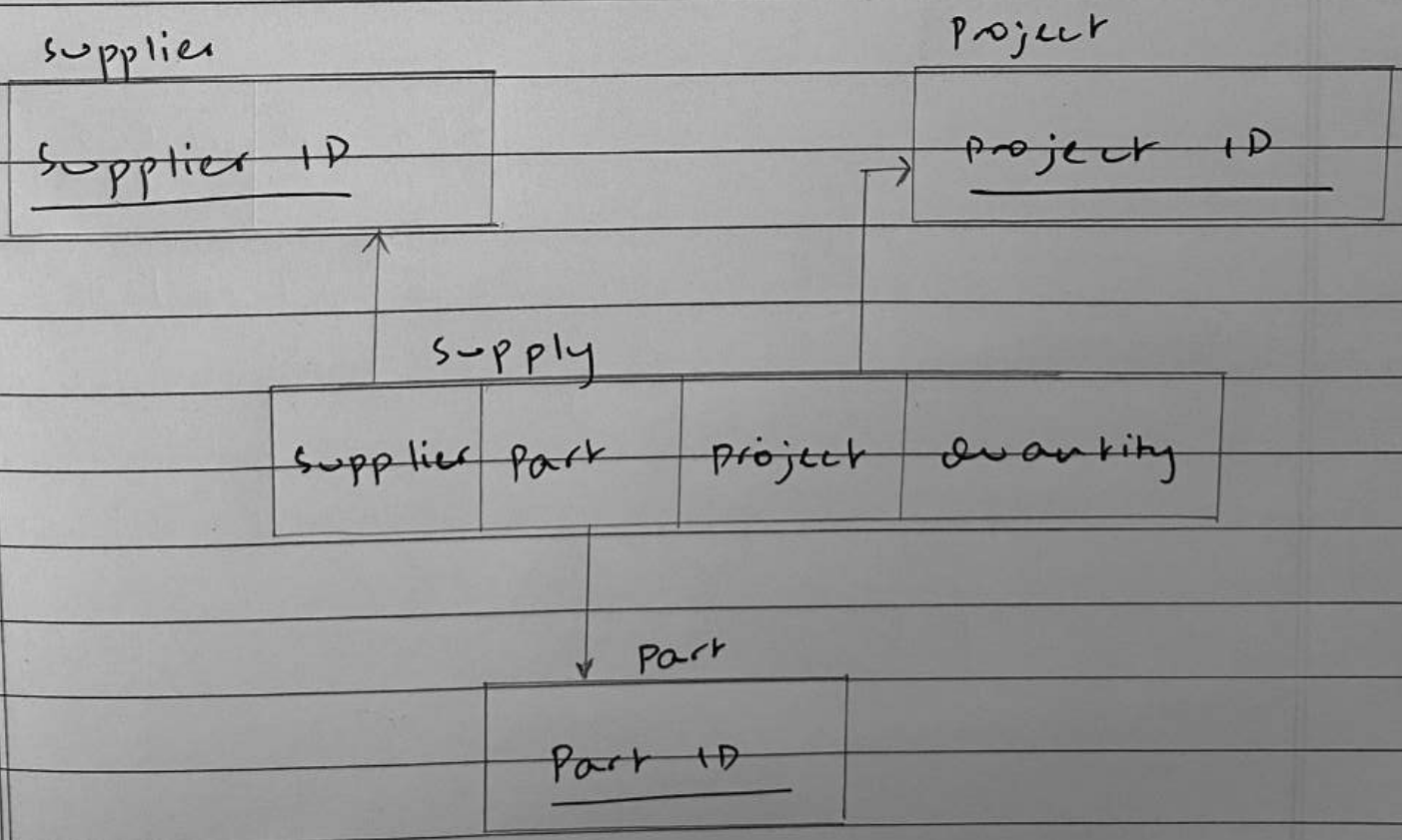
P#	J#
P1	J1
P2	J1

SJ

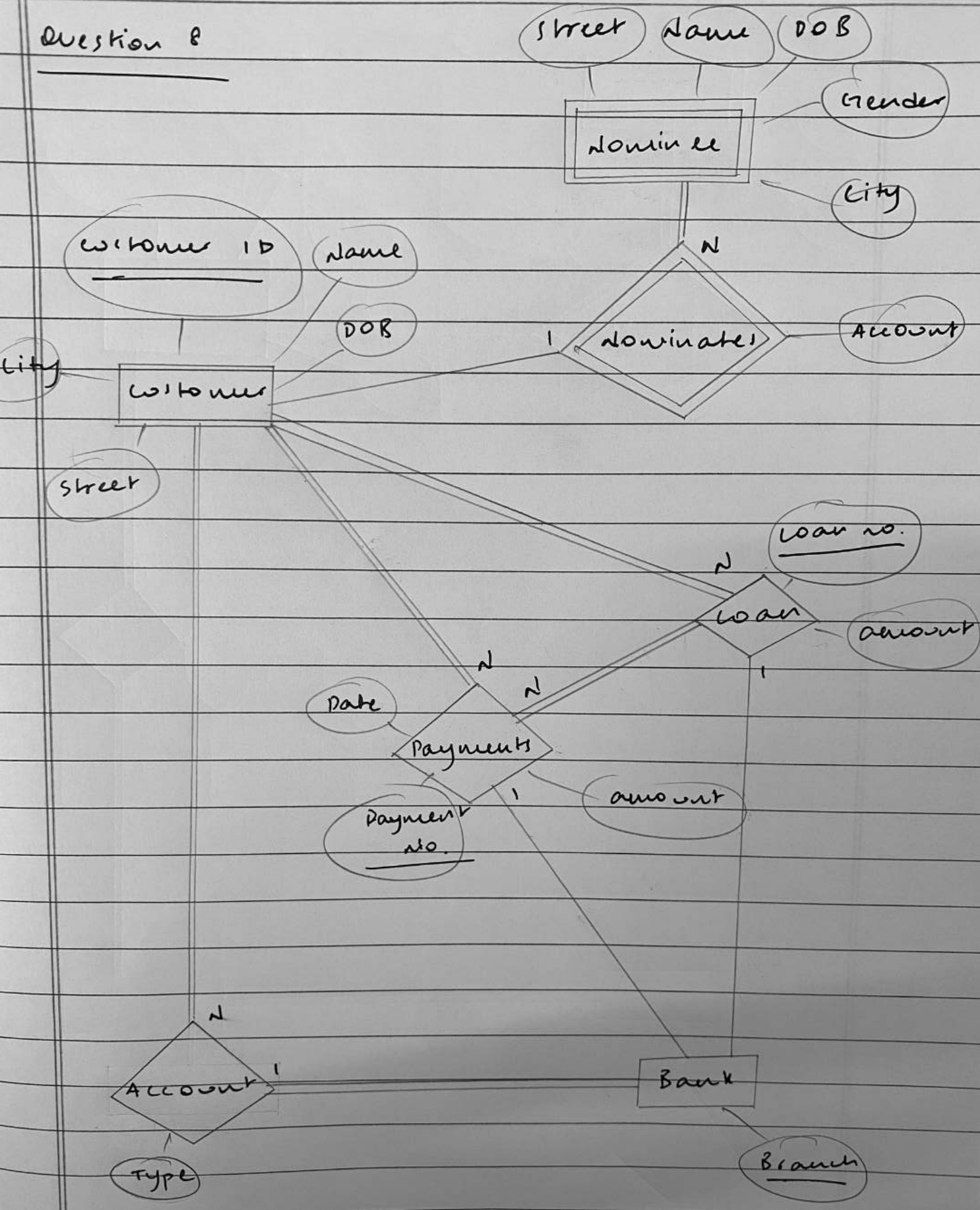
S#	J#
S1	J1
S2	J1

iii. The three tables SP, PJ, SJ are lossless

Question 7



Question 8


Street
Name
DOB
Gender
Nominee
City
N
Nominated
1
Account
Borrower ID
Name
DOB
City
Borrower
Street
Loan no.
N
Loan
amount
1
N
N
Date
Payments
1
amount
Payment no.
N
Account
1
Type
Bank
Branch

Question 9

Non additive join property:

If R_1 and R_2 exist
if $X \in R_1$ and $X \in R_2$
Then $R_1 \subseteq R_2$ or $R_2 \subseteq R_1$

comparing relation pairs:

1. R1(AD), R2(AB) - R1(AD), R2(ABCD) - $R1 \subseteq R2$

2. R1(AD), R3(BE) - trivial

3. R1(AD), R4(CDE) - $CE \rightarrow A$ - $R1 \subseteq R4$

4. R1(AD), R5(AE) - not satisfied

∴ we can decide that the relations do not satisfy the non-additive join decomposition losslessly.