Assignment 3

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I.

1.

a) M functionally determines L. M and Y functionally determines P. L functionally determines C. Functionally means that there is a function that takes a value from the left-hand side to give a unique result for the right-hand side. That means, the value of L depends on the value of M. The value of P depends on the value of M and Y. The value of C depends on the value of L.

b) {M} is not a candidate key. Because the value of P,Y does not depend on M.
{MY} is a candidate key.
Proof:
Given M→L and L→C, then M→C by transitive.
Then MY→LY and MY→CY by argumentation.
Then MY→MYPLC by union.
{MC} is not a candidate key. Because The value of P,Y does not depend on MC.

c) The relation is in 3NF because all attribute can depend on MY, but there exists FD: L→C, which violate BCNF.

d) R1∩R2 = (M)
M→Y is not in F^+. But M→M, M→L and M→C are in F^+. Which means R1∩R2→R2 is in F^+.
Therefore, this is a lossless decomposition.

2.

a) Let F={A→BC, D→EF}. R1∩R2 = (D), Then D→R2 because D→D, D→E and D→F. Then the decomposition into R1 and R2 is lossless. It is also dependency preserving because the value of BC depends on the value of A which is in R1, and the value of EF only depends on the value of D.

b) Let F={A→BCD, E→F}. R1∩R2 = (D), Then neither R1 nor R2 depends on R1∩R2 because D only decides the value of itself. Then the decomposition into R1 and R2 is not lossless. It is also dependency preserving because the value of BCD depends on the value of A which is in R1, and the value of F only depends on the value of E which is in R2.

c) By letting F_2=AB→C, F_3=C→D. Then S with F1, F2 together is in BCNF, because A and AB are superkeys of S and they are on the LHS of DFs.

But S with F1, F2 and F3 together is in BCNF, because for F3, C is on the LHS, and C is not a superkey for S. Though, S is in 3NF in with F1, F2 and F3, because for F3, C is a member of A and AB, which means C is not prime.

d) (A,B,D) is a key for R, since there is no subset of (A,B,D) that is a key.

By doing the decompose recursively, we have BDNF relations:
R1=(ABC),R2=(BDEF),R3=(ADGH),R4=(AI),R5=(ABD)
DBNF relations satisfy 3NF.

3.

a) Let R be a relational schema such that, R=(A,B), where A and B are the only attributes. Then R is in BCNF because in this case, either one of A and B is a key of R, or (A,B) is a key for R, since every relation or table needs to have a uniquely identifier.
If A is a key of R, then there must exist a relation A→AB since A is the identifier of S. Then S is in BCNF. Similarly, for the case that B is a key of R, then S is also in BCNF.
If (A,B) is the key of R. Then R is in BCNF as well because AB→AB.
Therefore, any relational schema with 2 attributes is in BCNF.

b) First:

(A→B, A→C, CD→E, B→D, E→A)

Second:

A→B can't be removed. A^+=ABCDE.

A→C can't be removed. A^+=ABCDE.

CD→E can't be removed. CD^+=CDE.

B→D can't be removed. B^+=BD.

E→A can't be removed. E^+=ABCDE.

No other step needed because we didn't remove anything in second step. The F_{min} is (A→B, A→C, CD→E, B→D, E→A).

II.

4.

a) No, it is not serializable.

b) Yes, it is serializable.

T1	T2	T3
	R(X)	
		R(X)
		W(X)
R(X)		
W(X)		

5.

a) S_1 is strict, since there all value written by T1, T2 and T3 is not read or overwritten by each other. Therefore, S1 is also recoverable and ACA because strict schedules are recoverable and ACA.

b) S2 is not strict, since Y is written by T3 then read and overwritten by T2 before T3 commits. S2 is not recoverable because T2 read the value written by T3 but T2 commits before T3 commits. S2 is not ACA because it is not even recoverable.

c) S3 is not strict, since Y is written by T3 then overwritten by T2 before T3 commits. S3 is ACA because every Xact commits after all the Xact it read from commits(the original data). S3 is recoverable because it is ACA.

6.

3) The output is :

A:

USERNAME	NAME	BALANCE
mag	Magneto	25000.00
wolf	Wolverine	300.00
grey	Jean	15000.00
myst	Mystique	1000.00
prof	Xavier	12000.00
storm	Xmen	1000.00

B:

USERNAME	NAME	BALANCE
mag	Magneto	25000.00
wolf	Wolverine	300.00
grey	Jean	15000.00
myst	Mystique	1000.00
prof	Xavier	12000.00

storm Xmen 1000.00

rogue Rogue 800.00

The difference is that there is rogue in B. That is because the select for A is casted before inserting the ‘rogue’ in B. And the isolation lever is Read Committed, therefore, there exists a short duration read lock.

5)

B:

USERNAME NAME BALANCE

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mag Magneto 25000.00

wolf Wolverine 300.00

grey Jean 15000.00

myst Mystique 1000.00

prof Xavier 12000.00

storm Xmen 1000.00

rogue Rogue 800.00

8)

USERNAME NAME BALANCE

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mag Magneto 20000.00

wolf Wolverine 300.00

grey Jean 15000.00

myst Mystique 1000.00

prof Xavier 17000.00

storm Xmen 1000.00

rogue Rogue 800.00

The balance is already changed because of the change made on session A.