HOMEWORK – 4

PART 1

ANS 1)

A minimal cover of a set of functional dependencies (FD) E is a minimal set of dependencies F that is equivalent to E. it must satisfy the below conditions:

• Every dependency in F has a single attribute for its right-hand side.

• We cannot replace any dependency X->A in F with a dependency Y->A, where Y is a proper subset of X, and still have a set of dependencies that is equivalent to F.

• We cannot remove any dependency from F and still have a set of dependencies that are equivalent to F.

a. **ABC**

i. The FD's are :
   AB → C
   BC → A
   AC → B
   This satisfies requirements of minimal cover as is.
ii. Its in BCNF.
iii. No changes required.

b. **ABCD**

i. The FD's are
   AB → C
   BC → A
   B → D
   AC → B
   This satisfies requirements of minimal cover as is.
ii. It is in 1 NF. Keys are: AB, AC, BC. The FD B → D violates 2NF(since B is proper subset of keys AB and BC.
iii. We decompose ABCD to ABC, BD. This results in BCNF, as required.

c**. ABCEG**

i. The FD's are
   AB → C
   AC → B
   BC → A
   E → G
   This satisfies requirements of minimal cover as is.
ii. It is in 1NF. Since the keys are ABE, ACE, and BCE and E is a proper subset of the keys and we have a FD {E → G} which violates 2NF.

iii. We decompose ABCEG to ABE, ABC, EG. This decomposition gives us BCNF.

d. **DCEGH**

i. The FD is E → G. This is in minimal cover already.
ii. It is in 1NF. The key in this case is DCEH. E is a subset of the key and so FD {E → G} violates 2NF.
iii. Decompose DCEGH to DCEH, EG to make it into BCNF.

e. **ACEH**

i. No FDs exist. So no minimal cover.
ii. It is in BCNF form
iii. No changes required.

ANS2)

The decompositions R1, R2, R2…Rn for a relation schema R are said to be Lossless if their natural join results the original relation R. Otherwise, if there natural join results into addition of extraneous tuples with the original relation R, then they are lossy. If the intersections of the decomposition forms a superkey of the relation then the join is a lossless join, else it is a lossy join.

(a) {AB, BC, ABDE, EG }

a) AB → C , AC → B and BC → A do not get preserved since ABC does appear together in a single decomposed relation. Hence it is not dependency preserving.

b) Since the intersections of the decompositions do not form a superkey of the relations, hence it is a lossy join.

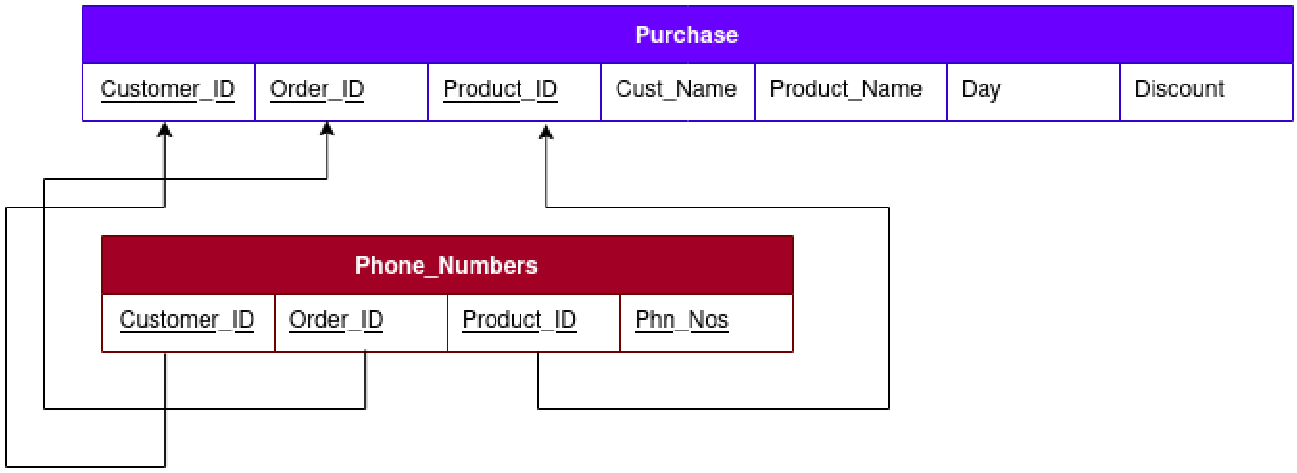
b) {ABC, ACDE, ADG }

a) Since BD and EG do not appear together in any decomposed relation, hence E → G ans B → D do not get preserved. Hence the decomposition is not dependency preserving.

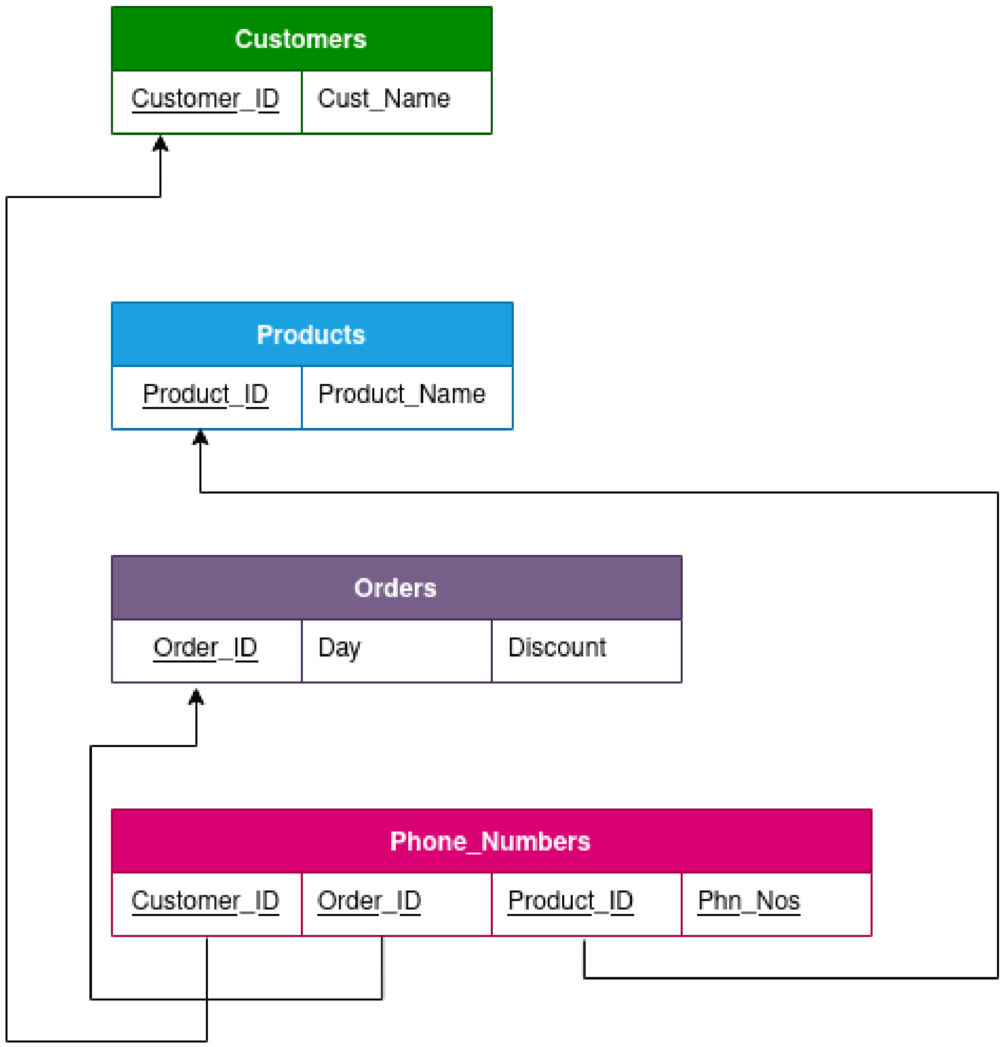
b) If we first join ABC and ACDE, their intersection forms AC which is a key of R. If we now join this with ADG, the intersection is AD and AD is a key since AD → E and E → G, hence ADG → G. Since the intersections form the keys of the relation, hence the join will be a lossless join.

PART 2

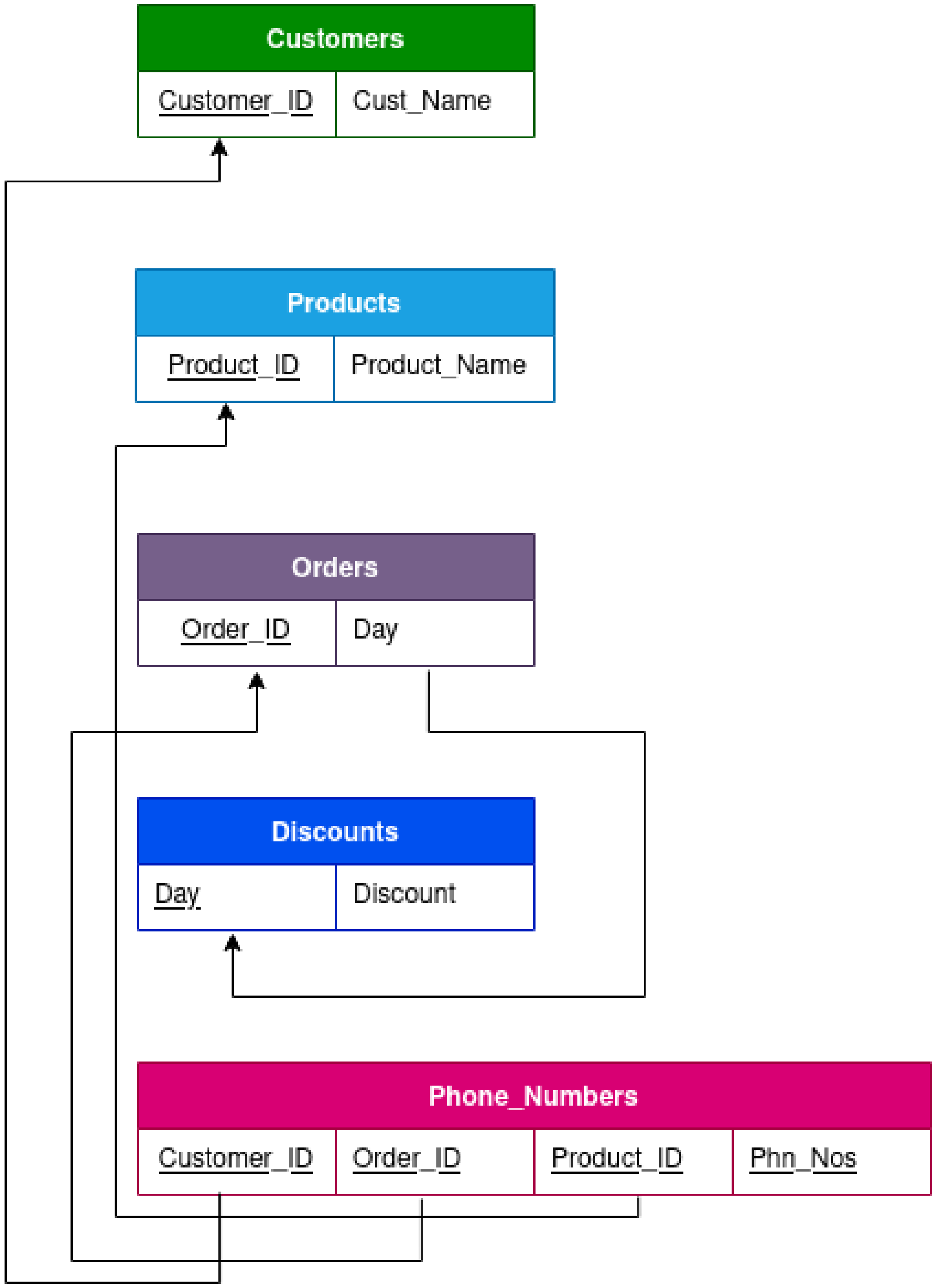
- 1NF



- 2NF



- 3 NF



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Products
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Product_Name
Orders
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