DnA: Homework 4

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Part One

1)

a) R = ABC

i) The functional dependencies are :

- AB -> C
- BC -> A
- AC -> B

This is a minimal cover already.

ii) Since AB, BC and AC are all candidate keys for R, it is in BCNF form. Hence the strongest normal form not violating these attributes is BCNF

iii) No conversion as it is already in BCNF.

b) R = ABCD

i) The functional dependencies are :

- B -> D
- AB -> C
- BC -> A
- AC -> B

This is a minimal cover already.

ii) R is not in BCNF, 3NF or 2NF as there exists a partial dependency B -> D since B is a subset of candidate key AB. Hence strongest normal not violating these attributes in 1NF.

iii) BCNF Decomposition - Decompose into 2 relations R1 and R2 :

- R1 = ABC
- R2 = BD

c) R = ABCEG

i) The functional dependencies are :

- E -> G
- AB -> C
- BC -> A
- AC -> B

This is a minimal cover already.

ii) R is not in BCNF, 3NF or 2NF as there exists a partial dependency E -> G since E is a subset of candidate key ABE. Hence strongest normal form not violating these attributes is 1NF.

iii) BCNF Decomposition - Decompose into 3 relations R1, R2 and R3 :

- R1 = ABC
- R2 = ABE
- R3 = EG

d) R = DCEGH

i) The functional dependencies are :

- E -> G

This is a minimal cover already.

ii) R is not in BCNF, 3NF or 2NF as there exists a partial dependency E -> G since E is a subset of candidate key DCEH. Hence the strongest normal form not violating these attributes is 1NF.

iii) BCNF Decomposition - Decompose into 2 relations R1 and R2 :

- R1 = DCEH
- R2 = EG

e) R = ACEH

i) The relation does not have any functional dependencies. This is a minimal cover already.

ii) Since there are no valid FDs, the only candidate key is ACEH itself and it is already in BCNF form. Hence the strongest normal form not violating these attributes is BCNF

iii) No conversion as it is already in BCNF form.

2)

a) The decomposition is not dependency preserving : The functional dependencies, AB -> C, AC -> B and BC -> A are not preserved.
The decomposition is not lossless join.

b) The decomposition is not dependency preserving : The functional dependencies, B -> D and E -> G are not preserved.

The decomposition is lossless join : If we first join ABC and ACDE it is lossless as their intersection AC is a key of ABCDE. Now if we join ABCDE with ADG it is lossless as their intersection is AD and AD -> ADG.

Part Two

Table : PURCHASES

Customer_ID	Order_ID	Product_ID	Cust_Name	Product_Name	Phn_Nos	Day	Discount

Convert the relational table to a) 1NF b) 2NF c) 3NF

Information about the table :

1. Composite Key is Customer_ID + Order_ID + Product_ID
2. Phn_Nos is a multi-valued attribute.
3. Day → Discount
4. Customer_ID → Cust_Name
5. Product_ID → Product_Name
6. Order_ID → Day

Table after 1NF:

Made a separate relation. The primary key of this is the customerID combined with Phones.
CustomerID is included because Phones is functionally dependent on it.

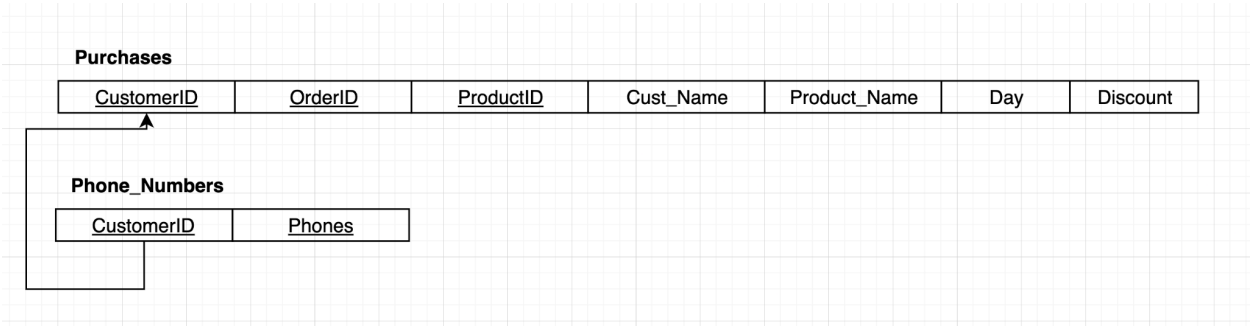


Table after 2NF:

Made three more relations CustomersName, Products, and Orders. These are formed since Cust_Name is dependent on CustomerID, Product Name is dependent on ProductID, and Day is dependent on OrderID while Discount is dependent on Day.

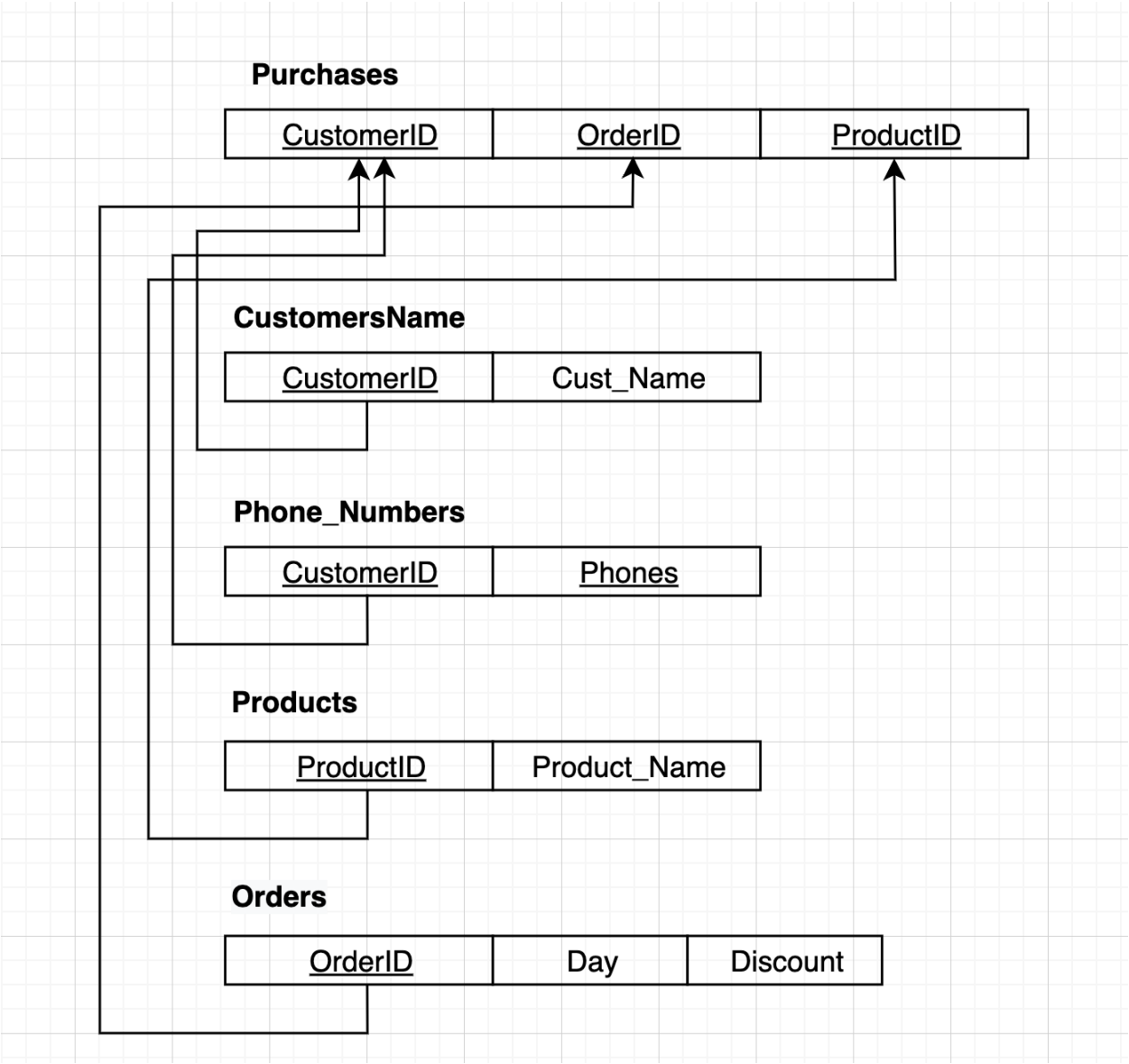
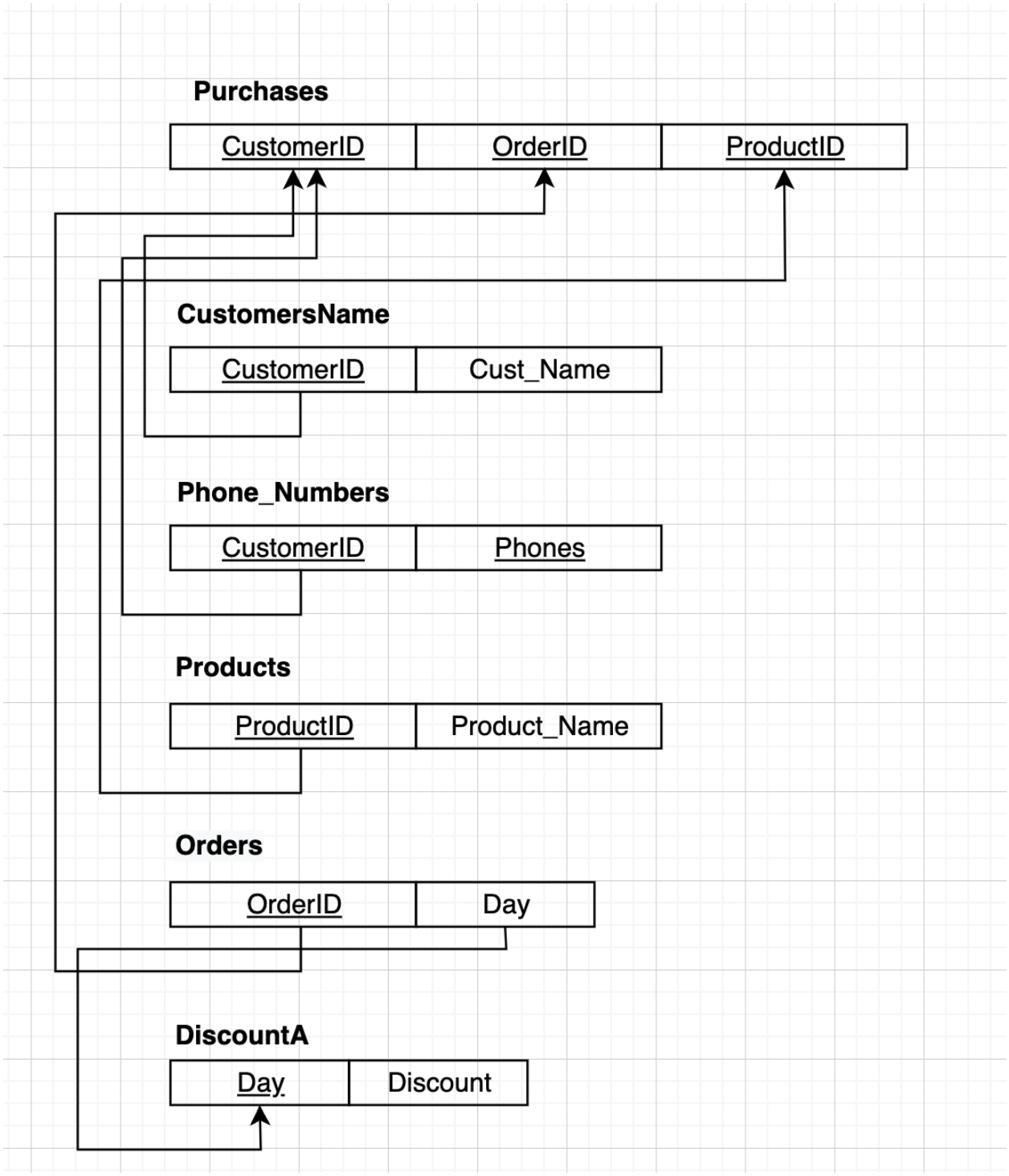


Table after 3NF:

Made one more relation DiscountA since Orders showed transitive behaviour. Day is dependent on OrderID while Discount is dependent on Day. Orders was also modified.


Purchases
CustomerID
OrderID
ProductID
CustomersName
CustomerID
Cust_Name
Phone_Numbers
CustomerID
Phones
Products
ProductID
Product_Name
Orders
OrderID
Day
DiscountA
Day
Discount