Quiz5 – Solutions

1.

Customer N.	Model	Shipping Address	Producer	Phone	Price(x100$)
Alan Smith	Golf	35 Palm St, Miami	Volkswagen AG	(090) 555 6688	250
Roger Banks	Fiesta	47 Camp. Road, Boston	Ford MC	(090) 600 9090	300
Evan Wilson	Golf, Focus	28 Rock Av, Denver	Volkswagen AG, Ford MC	*Both*	450
Alan Smith	Fiesta	47 Camp. Road, Boston	Ford MC	(090) 600 9090	300

The relation above records the info of car producer company and the sale operations.

Considering that relation perform:

a) 1NF decomposition

- Each cell should be atomic
- Entries in an attribute should be same type
- Rows should at least one attribute that uniquely identifies it.

Cust ID*	Customer N.	Model	Shipping Address	Producer	Phone	Price(x100$)
1	Alan Smith	Golf	35 Palm St, Miami	Volkswagen AG	(090) 555 6688	250
2	Roger Banks	Fiesta	47 Camp. Road, Boston	Ford MC	(090) 600 9090	300
3	Evan Wilson	Golf	28 Rock Av, Denver	Volkswagen AG	(090) 555 6688	250
3	Evan Wilson	Focus	28 Rock Av, Denver	Ford MC	(090) 600 9090	200
4	Alan Smith	Fiesta	47 Camp. Road, Boston	Ford MC	(090) 600 9090	300

b) 2NF (but not 3NF) decomposition

To be in 2NF, each attribute (except non-key attributes) in the relation has to be dependent on only keys not any subset of keys.

Here attributes, *Cust ID* and *Model* can be a super key. In this case, attribute *Producer* is dependent on *Model*, which breaks the 2NF rule.

Cust ID*	Customer N.	Model	Shipping Address
1	Alan Smith	Golf	35 Palm St, Miami
2	Roger Banks	Fiesta	47 Camp. Road, Boston
3	Evan Wilson	Golf	28 Rock Av, Denver
3	Evan Wilson	Focus	28 Rock Av, Denver
4	Alan Smith	Fiesta	47 Camp. Road, Boston

Model*	Producer	Phone	Price(x100$)
Golf	Volkswagen AG	(090) 555 6688	250
Fiesta	Ford MC	(090) 600 9090	300
Focus	Ford MC	(090) 600 9090	200

Cust ID*	Model*
1	Golf
2	Fiesta
3	Golf
3	Focus
4	Fiesta

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c) 3NF decomposition

All attributes can be dependent on only key not other attribute.

Here there is a dependency between *Producer* and *Phone* so those should be placed in another table and referred in the table of interest.

Cust ID*	Customer N.	Model	Shipping Address
1	Alan Smith	Golf	35 Palm St, Miami
2	Roger Banks	Fiesta	47 Camp. Road, Boston
3	Evan Wilson	Golf	28 Rock Av, Denver
3	Evan Wilson	Focus	28 Rock Av, Denver
4	Alan Smith	Fiesta	47 Camp. Road, Boston

Model*	Producer -FK	Price(x100$)
Golf	Volkswagen AG	250
Fiesta	Ford MC	300
Focus	Ford MC	200

Producer*	Phone
Volkswagen AG	(090) 555 6688
Ford MC	(090) 600 9090

Cust ID*	Model*
1	Golf
2	Fiesta
3	Golf
3	Focus
4	Fiesta

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2. Suppose that we decompose the schema *r (A, B, C, D, E)* into *r1 (D, A, E)* and *r2 (D, B, C)*

a) Show that this decomposition is a lossless decomposition if the following set *F* of functional dependencies holds:

F: D → AE
EB → C
A → B
C → D

A decomposition {R1, R2} is a lossless-join decomposition if R1 ∩ R2 → R1 or R1 ∩ R2 → R2. Let R1 = (D, A, E), R2 = (D, B, C), and R1 ∩ R2 = D. Since D is a candidate key, therefore R1 ∩ R2 → R1.

b) Give a lossless-join decomposition into BCNF of schema R.

result : = {R};

F^+ = {D → ABCDE, A → B, AE → ABCDE, EB → ABCDE, C → ABCDE, …}.

R is not in BCNF. A → B is a non-trivial f.d. that holds on R, A ∩ B = ∅, and A → ABCDE is not in F^+ .

Therefore, result := (result – R) ∪ (R – B) ∪ (A, B), i.e.

(D, A, B, C) ∪ (A, B).

(D, A, E, C) and (A,B) are in BCNF. So this is a decomposition of R into BCNF.