

Name: SOLUTIONID: _____ Section: L2

Instructions: Answer these questions as clearly as possible.

Q. 2: [3 + 3 + 1 = 7 marks] Consider the following 1-table database representing a bus service:

Passenger ID	Name	Bus ID	Bus Route	Ticket Price	Class	Service
10345	Asif	A123	KHI-HYD	10000	Superior	Meals
71892	Saima	A245	KHI-LHE	15000	Superior	Meals
10572	Bilal	A123	KHI-HYD	5000	Regular	Snacks
21567	Hameed	A245	KHI-LHE	3000	Budget	Drinks
78902	Eliza	A299	ISB-PEW	9000	Regular	Snacks
10572	Bilal	A299	ISB-PEW	11000	Superior	Meals
21198	Rameez	A299	ISB-PEW	6000	Regular	Snacks

This is a 1-table schema for bus routes on a particular day/date with the following schema:

- BusTravel (PassengerID, Name, BusID, Bus Route, Ticket Price, Class, Service).

The following rules are applicable:

- Passenger Name depends on PassengerID
- Bus Route depends on BusID
- Ticket Price depends on PassengerID (preference) and BusID/Route (Availability)
- Class depends on Ticket Price Range as shown in the table below
- Service Type depends on Class as shown in the table below

Ticket Price	Class	Service
Price \geq 10000	Superior	Meals
Price \geq 5000 & Price $<$ 10000	Regular	Snacks
Price $<$ 5000	Budget	Drinks

Answer the following questions related to this database:

- (a) Is this database in the second normal form? If yes, give reasons for your answer. If no, then write the equivalent set of relations (schema) that are in 2NF:

No because of attribute dependencies on partial keys such as $\text{Bus ID} \rightarrow \text{Bus Route}$. The relation can be transformed to 2NF using the following schema:

1) Passenger (PassengerID, Name)

2) Bus (BusID, Bus Route)

3) Ticket (PassengerID, BusID, TicketPrice, Class, Service)

(b) Is the resulting database above in the third normal form? If yes, give reasons for your answer. If no, then write the equivalent set of relations that are in 3NF.

In the previous solution there are transitive dependencies in the relation Ticket. In 3NF this is:-

- Passenger (Passenger ID, Name)
- Bus (Bus ID, Bus Route)
- Ticket (Passenger ID, Bus ID, Ticket Price)
- Class (Ticket Price, Class)
- Service (Class, Service)

(c) Is this database given in Table 1 in First Normal Form? Give reasons for your answer.

Yes it is because domain of all attributes is atomic.

Q. 1: ³ [2 marks] Explain (using an example) what kind of functional dependency is there in a relation that is in 3NF but not in BCNF.

The relation TEACH (Student, Course, Instructor) where the key pair is {Student, Course} is in 3NF but not in BCNF because of the dependency Instructor \rightarrow Course.

As 'Instructor' is not a candidate key, but it is a determinant, hence the relation is not in BCNF.

Name: _____

TOTAL:

/ 10

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