
Course: *Databases and Data Warehousing*

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Homework Assignment IV

Assigned : *12:30 PM, 22nd September*

Deadline : *11:55 PM, 28th September*

1. Explain the following terms briefly along with an **example**: Trivial functional dependency, Non-Trivial functional dependency, Transitive functional dependency, 1-NF, 2-NF, 3-NF, and BCNF. **(8 Points)**

2. Given the relation $R = \{P, Q, R, S, T, U, V, W, X, Y, Z\}$ and the set of functional dependencies $F = \{ \{P, R\} \rightarrow \{Q\}, \{P\} \rightarrow \{S, T\}, \{R\} \rightarrow \{U\}, \{U\} \rightarrow \{V, W\}, \{S\} \rightarrow \{X, Y\}, \{U\} \rightarrow \{Z\} \}$. Find the key for R? Decompose R into 2NF and then 3NF relations and then to BCNF (show the steps of decomposition steps clearly). **(8 Points)**

3. JIO institute AI & DS frequent travelers have been complaining to the state's transport authority about the poor organization at the bus station in Vashi. As a result, the officials have decided that all information related to the station should be organized using a DBMS, and you've been hired to design the database. Your first task is to organize the information about all the buses that are stationed and maintained at the station. The relevant information is as follows: **(14 Points)**
 - Every bus has a registration number, and each bus is of a specific model. The station accommodates a number of bus models, and each model is identified by a model number and has a capacity.
 - A number of technicians work at the bus station. You need to store the name, aadhar number, address, phone number, and salary of each technician.
 - Each technician is an expert on one or more bus model(s), and his or her expertise may overlap with that of other technicians. This information about technicians must also be recorded.

- All the station employees (including technicians) belong to a union. You must store the union membership number of each employee. You can assume that each employee is uniquely identified by the aadhar number.
 - The bus station has a number of tests that are used periodically to ensure that the buses are in a good condition. Each test has a test number, a name, and a maximum possible score.
 - The Road Transport Authority (RTA) requires the station to keep track of each time that a given bus is tested with a given test by a given technician. For each testing event, the information needed is the date, the number of hours the technician spent doing the test, and the score that the bus received on the test.
1. Design a relational database schema for this database application. First show all the functional dependencies that should hold among the attributes. Then design relation schemas for the database that are each in 3NF or BCNF. Specify the key attributes of each relation. Note any unspecified requirements, and make appropriate assumptions to render the specification complete.