Assignment #4 FDs and Normal Forms Spring Semester 2023 Database Systems

Due Date: Before the start of the class (5th April 2022)

Instructions:

- Use proper assignment papers for solving your assignment questions. Assignments done on diary pages, register pages, and rough pages will not be credited.
- Do not copy the work of your peers. In case cheating is detected, then your case will be referred to DC.

Question 1:

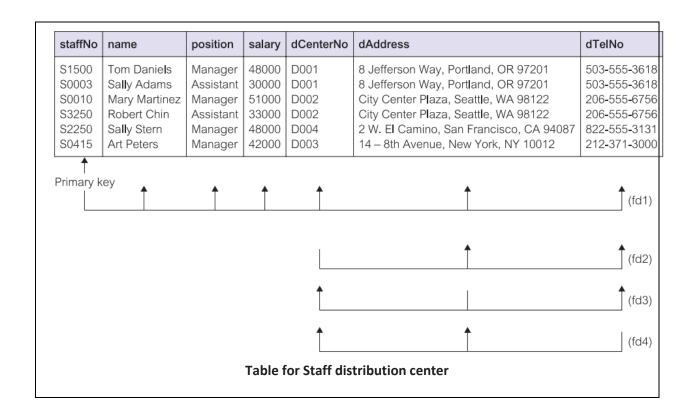
The relation given below shows five sample records that represent members of staff who have been allocated a car parking space. Each car park space provided by the organization is uniquely identified using a space number (space). (Note in this example, we do not include the extension number and vehicle license number data associated with staff.)

- (a) The relation is susceptible to update anomalies. Provide examples of insertion, deletion, and modification anomalies.
- (b) Identify the functional dependencies represented by the data shown in the table. State any assumptions you make about the data shown in this table.
- (c) Describe and illustrate the process of normalizing the relation to 3NF. Identify the primary key and, where appropriate, alternate and foreign keys in each table.
- (d) Demonstrate that the functional dependencies identified in part (b) are present in the 3NF tables described in part (c).

staffNo	name	carParkName	location	capacity	noOfFloors	spaceNo
S1156	Jane Jones	Yellow	Block E	120	3	123
S2311	Karen Gilmore	Yellow	Block E	120	3	145
S1167	Richard Blight	Yellow	Block E	120	3	156
S2345	Guy Ritchie	Green	Block D	45	2	26
S3434	Stephen Williams	Green	Block D	45	2	34

Question 2: The table given below shows staff distribution center details

- a) The table is susceptible to update anomalies. Provide examples of insertion, deletion, and modification anomalies.
- b) Specify all the keys of the given relation for the staff distribution center.
- c) Check if the relation is in BCNF. If not, then indicate all the BCNF violations.
- d) Decompose the relation into collections of relations that are in BCNF.
- e) Indicate all the 3NF violations.
- f) Decompose the relations, as necessary, into collections of relations in 3NF.

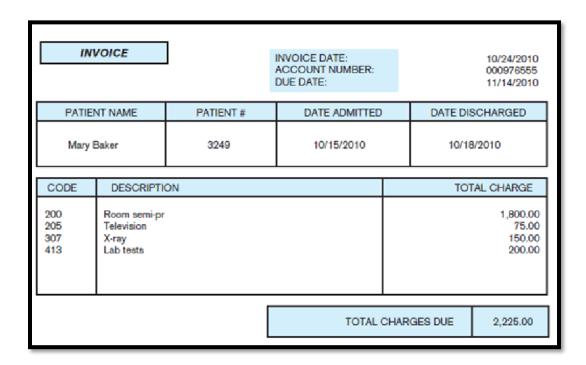


Question 3:

The following statement is presented to the patient (or patient representative) when the patient is discharged. Assume that each item on the bill has a unique description and that the charge for a particular item may vary from one patient to another.

Using the normalization, develop a set of BCNF relations for the patient billing system shown below.

Draw a relational schema for the BCNF relations you developed. Be sure to show the functional dependencies and referential integrity constraints.



Question 4: SuperX Theater produces a series of short dramas and shows them in different nationwide theaters. This summer, they are presenting 4-opera mini-series. This series has a huge cast. The owner wants a database to keep track of the characters. They hired an intern, and he built a table named Opera. It lists the characters and information about them, such as their voice part, what they have power over (fire, love, the magic sword, etc.), the name of their residence, and its address.

Character	Voice	Power	Residence	Address
Wotan	Baritone	Light	Valhalla	Rainbow Bridge
Wotan	Baritone	Air	Valhalla	Rainbow Bridge
Erda	Alto	Wisdom	Middle of Universe	Fremont
Erda	Alto	Fate	Middle of Universe	Fremont
Siegfried	Tenor	Sword	Forest	Hurricane Ridge
Brunnhilde	Soprano	Horse	Rock	Enchanted Fire Ring
Freia	Soprano	Love	Valhalla	Rainbow Bridge
Loge	Tenor	Fire	Valhalla	Rainbow Bridge
Hagen	Bass	Drink	Hut	Seward Park
Getrune	Soprano	Drink	House	Wallingford

Your assignment is as follows:

- a) This table is not in BCNF. Based only on the data given above, identify the functional dependencies that violate BCNF
- a) Using the functional dependencies you identified in part a), decompose the table into BCNF. Indicate which attributes are the key(s) of the various relations, and also indicate any foreign key relationships between the tables. Show the steps in your decomposition that clearly show which functional dependencies you are using at each step.