Worksheet 8: Normalization

Submission Instructions: Submit a text file or a pdf file with your answers. Name your file as last- nameFirstnameW4.fileExtension (e.g., chaturvediRituW48.txt). Hand-written answers will not be accepted.

Question 1: Match the following. Statements on the left-hand side may match more than one statements on the right-hand side. (Hint: Nov 1st Monday's lecture has the solutions).

1	Anomaly	a	A is the dependent, B is the determinant
2	Functional Dependency	b	A is the determinant, B is the dependant
3	A -> B	c	is one that is part of any primary key
4	Prime attribute	d	does not have any repeating groups such as composite or multi-valued attributes
5	Non-loss decomposition {R1, R2, ...Rn} of a relation R	e	is an inconsistent, incompatible or contradictory state of the database
6	Full FD	f	is a many-to-one relationship between attribute set A and attribute set B
7	Transitive	g	if 2 tuples in a relational instance agree on their X-value, then they must agree on their Y-value.
8	Relation in 2NF	h	each value of A has associated with it exactly one value of B
9	Relation in 3NF	i	does not have any tranistive depencies
10	Relation in 1NF	j	is a FD of an attribute S on attribute R such that S does not depend on any proper subset of R
		k	does not have any non-full dependencies
		l	if there exists a FD of X -> Y and Y -> Z, then it implies that X -> Z also exists
		m	natural join of R1, R2, ...Rn produces exactly the relation R
		n	Rissanen's rules

Question 2: A relation called Emp must store the following attributes for every employee in this company: (Name, Address, Phone numbers, BeersLiked). Each employee has an address, may have 1 or more phone numbers and may like 1 or more beer.

a. Create an instance for Emp using the following information:

Name: Harry
Address: 50 Stone Wall
Phone numbers: {519 999 8888, 647 999 2233}
BeersLiked: {Brahma, Heineken, Coors Light}

Name: Ansh
Address: 3550 Mississauga Road
Phone numbers: {647 000 1111, 416 321 4133}
BeersLiked: {Brahma}

Name	Address	Phone Number	BeersLiked
Harry	50 Stone Wall	519 999 8888	Brahma
Harry	50 Stone Wall	647 999 223	Brahma
Harry	50 Stone Wall	519 999 8888	Coors Light
Harry	50 Stone Wall	647 999 223	Coors Light
Harry	50 Stone Wall	519 999 8888	Heineken
Harry	50 Stone Wall	647 999 223	Heineken
Ansh	3550 Mississauga Road	647 000 1111	Brahma
Ansh	3551 Mississauga Road	416 321 4133	Brahma

b. What is the result of:

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SELECT COUNT(*)
FROM   Emp;
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c. find all multivalued and functional dependencies of Emp, if any. Assume that the key is (name, PhoneNumbers, BeersLiked).

FDs
(Name, PhoneNumbers, BeersLiked) -> Address
Name -> Address
MVD
Name ->-> PhoneNumbers | BeersLiked

d. Decompose Emp to smaller relations such that there are no more MVDs in any of the smaller relations and all smaller relations are now in 3Nf and 4NF. Prove that the decomposition is non-loss.

2d: Part 1 (3NF)
Step1: Relation is not in 3NF because it is not in 2NF
Relation is not in 2NF because it has a non-full FD on the key
(Name, PhoneNumbers, BeersLiked) -> Address
Name -> Address

Step 2: Decompose
R1 (Name, PhoneNumbers, BeersLiked)
R2 (Name, Address)

Is R1 in 2NF - Yes
Is R1 in 3NF - Yes
Is R2 in 2NF - Yes
Is R2 in 3NF - Yes

Step3: Justify that the decomposition is non-loss
Common attribute of R1 and R2 = Name, Name is the PK of R2, therefore the decompositio nis non-loss.

2d: Part 2 (4NF)
Is R2 in 4NF
Is R1 in 4NF - no

R1 is not in 4NF due to the MVD Name ->-> PhoneNumbers | BeersLiked

Decompose

R11 (Name, PhoneNumbers)
R12 (Name, BeersLiked)

Is R11 in 4NF - yes
Is R12 in 4NF - Yes

Justify that the decomposition is non-loss

Non-loss because name is part of the primary key

Question 3: CAR_SALE(Car#, Date_sold, Salesman#, Commision%, Discount_amt)

Assume that a car may be sold by multiple salesmen and hence {CAR#, SALESMAN#} is the primary key. Additional dependencies are:

Date_sold ->Discount_amt

and

Salesman# ->commission%

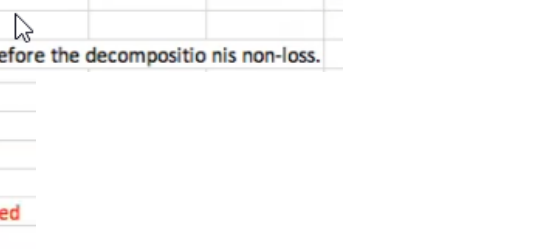
Based on the given primary key, is this relation in BCNF? Why or why not? How would you successively normalize it completely?

Q 3

	Determinants	Candidate Key
1	Car#, Salesman#	Car#, Salesman#
2	Salesman#	
3	Date_Sold	

A relation is in BCNF iff every determinant is a candidate key

The given is not in BCNF
Because it has 2 determinants Salesman# and Date_sold that are not candidate keys



Decompose

R1 (Car#, Salesman#, Date_Sold)
R2 (Salesman#, Commission%)
R3 (Date_Sold, Discount_amt)

Is the decomposition non-loss?

Common attribute of R1 and R2 = Salesman#, Salesman# is the PK of R2 Non-loss
Common attribute of R1 and R3 = Date_Sold, Date_sold is a PK of R3 Non-loss

Are R1, R2 and R3 in BCNF - Yes