CS 261: Database Management Systems
Assignment-2

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Due date of submission is April 11, 2021 before 11:59 PM

Please read the following:

1. Write your name and roll number on the first page of your answer script.
2. Answer all the questions
3. Submit a single PDF file containing scanned copies of your answer scripts. Make sure that all the scanned copies are in order.
4. Answer scripts submitted after the deadline will not be considered and any reason will not be entertained.
5. Do not copy from others and do not discuss with others.
6. Do not waste your time digging the internet for solutions.
7. Good luck!

Question 1

1. **True or False:** If R is a relation with only three attributes, namely A, B, and C, such that $AB \rightarrow A$, $C \rightarrow A$ and $C \rightarrow B$, then R is in BCNF. Justify your answer.
2. Let $R(A_1, A_2, \ldots, A_n, B_1, B_2, \ldots, B_n)$ be a relation with the set of functional dependencies $F = \{A_i \rightarrow B_i \mid i \in \{1, 2, \ldots, n\}\} \bigcup \{B_i \rightarrow A_i \mid i \in \{1, 2, \ldots, n\}\}$ defined on R. List all the candidate keys.

Question 2

Consider the relation $R(A, B, C, D)$ with the set of FDs $F = \{B \rightarrow A, D \rightarrow A, AB \rightarrow D\}$ defined on R. Determine whether the decomposition $E = \{R_1, R_2, R_3\}$, where $R_1 = \{B, D\}$, $R_2 = \{D, A\}$, and $R_3 = \{A, B, C\}$, has the nonadditive property.

Question 3

Suppose you are asked to provide a simple logical design of a database for a Hospital. The database should keep track information of doctors, patients, and tests with test reports.

1. Construct an ER diagram that should clearly specify (i). Entities, attributes including their type, (ii). Cardinality constraints, (iii). Relationships among various entities. Also, please clearly specify your assumptions.

2. Convert your ER diagram to a relation schema by clearly specifying primary keys and referential integrity constraints.

Question 4

Let $R(Ssn, Pnumber, Pname, Phours)$ be a relation with the set of FDs $F = \{Ssn \rightarrow \{Pnumber, Pname\}, \{Ssn, Pnumber\} \rightarrow Phours, Pnumber \rightarrow Pname\}$.

1. Find a minimal cover E of F using the algorithm discussed in class.

2. Prove that $F \subseteq E^+$ using the rules of inference.