DBMS – ASSIGNMENT 2

M.Tech. (CS), First Year, 2019–2020

Deadline: March 31, 2020

Total: 10 marks

SUBMISSION INSTRUCTIONS

1. Submit all the solutions in a single file.
2. Naming convention for your submission file (assuming CS19xx is your roll number): `CS19xx-assign2` (.rtf, .docx, .doc, .pdf, .tex, etc.).
3. To submit a solution file (say `CS19xx-assign2.pdf`), ensure that it is not password protected and mail to `<assignisik@gmail.com>` with the subject line as follows: `DBMS M.Tech. (CS) 2019-21 CS19xx Assignment 2`.

NOTE: All the solutions must be self-sufficient and to the point.

Q1. Suppose a relation R, with an associated set of functional dependencies, is decomposed into 3NF. Prove that the functional dependency based redundancy will still remain in the 3NF decomposition but will be less than that of an equivalent 2NF decomposition.

Q2. Given the relational schema $R = (V, W, X, Y, Z)$ with atomic attributes, for which the set of functional dependencies $\{WX \rightarrow VYZ, Y \rightarrow W\}$ hold, answer the following questions:

(i) Find the candidate keys for R.

(ii) Identify the highest normal form that R satisfies.

(iii) If R is not in BCNF, decompose it until it becomes. During decomposition, re-compute the keys and normal forms the emerging relations satisfy.

Q3. Cite an example of a non-trivial relation, which has at least three attributes and some functional dependencies therein, that does not satisfy 5NF. Justify your answer.

Q4. Given a pair of relations R_1 and R_2, with N_{R_1} and N_{R_2} tuples, respectively, estimate the sizes of the following query expressions:

(i) $R_1 \rtimes R_2$, given no attribute is common between R_1 and R_2

(ii) $R_1 \ltimes R_2$, given no attribute is common between R_1 and R_2

(iii) $R_1 \rtimes\!\ltimes R_2$, given the attributes common between R_1 and R_2 forms a key for R_2

Q5. Prove that the expression $((R_1 \bowtie R_2) \bowtie R_3)$ is equivalent to $(R_1 \bowtie (R_2 \bowtie R_3))$, but not necessarily have the same size.