Databases

(a) Present two advantages and two disadvantages of eliminating logical redundancy in database schema design. [4 marks]

(b) What are NULL values in SQL, and with what problems are they associated? [2 marks]

(c) We are given a schema $R(X)$ with key $K \in X$. Suppose that $A, B, C \in X$ are non-key attributes and we want to verify that the functional dependency $A, B \rightarrow C$ is not violated in our database. Consider the SQL query,

$$\text{select } S.K, T.K \text{ as } K1, K2 \quad \text{from } R \text{ as } S, R \text{ as } T \quad \text{where } S.A = T.A \text{ and } S.B = T.B \text{ and } S.C <> T.C$$

Does this query return all key pairs of records that violate the functional dependency

(i) when $C$ is not allowed to be NULL? [3 marks]

(ii) when $C$ is allowed to be NULL? [3 marks]

(d) Suppose that $R(X, Y, Z)$ is a relational schema where $X, Y$, and $Z$ are disjoint attribute sets. Prove that the following mixed transitivity rule holds:

If $X \rightarrow Y$ and $Y \rightarrow Z$, then $X \rightarrow Z$. [8 marks]