S

Second Normal Form (2NF)

Marcelo Arenas
Pontifical Catholic University of Chile, Santiago, Chile

Synonyms

2NF

Definition

Let $R(A_1,..., A_n)$ be a relation schema and Σ a set of functional dependencies over $R(A_1,..., A_n)$. An attribute A_i ($i \in\{1,...,n\}$) is a *prime* attribute if A_i is an element of some key of $R(A_1,..., A_n)$. Then specification (R, Σ) is said to be in second normal form (2NF) if for every nontrivial functional dependency $X \rightarrow A$ implied by Σ, it holds that A is a prime attribute or X is not a proper subset of any (candidate) key for R [1].

Key Points

In order to avoid update anomalies in database schemas containing functional dependencies, 2NF was introduced by Codd in [1]. This normal form is defined in terms of the notions of prime attribute and key as shown above. For example, given a relation schema $R(A, B, C)$ and a set of functional dependencies $\Sigma = \{A \rightarrow B\}$, it does not hold that $(R(A, B, C), \Sigma)$ is in 2NF since B is not a prime attribute and A is a proper subset of the key AC. On the other hand, $(S(A, B, C), \Gamma)$ is in 2NF if $\Gamma = \{A \rightarrow B, B \rightarrow C\}$, since A is a key (and thus it is not a proper subset of any candidate key) and B is not contained in any (candidate) key for S.

It should be noticed that relation schema $S(A, B, C)$ above is in 2NF if $\Gamma = \{A \rightarrow B, B \rightarrow C\}$, although this schema is not in 3NF. In fact, 3NF is strictly stronger than 2NF; every schema in 3NF is in 2NF, but there exist schemas (as the one shown above) that are in 2NF but not in 3NF.

Cross-References

▸ Boyce-Codd Normal Form
▸ Fourth Normal Form
▸ Normal Forms and Normalization
▸ Third Normal Form

Recommended Reading

1. Further CEF. Normalization of the data base relational model. In: Data base systems. Englewood Cliffs: Prentice-Hall; 1972. p. 33–64.

L. Liu, M.T. Özsu (eds.), *Encyclopedia of Database Systems*,
DOI 10.1007/978-1-4899-7993-3_1263-2