Database Principles Definitions regarding Normalization

functionally dependent (→ , *fd*)
A and B are non-empty sets of attributes in relation R.

A→ B iff each value of A has associated with it exactly one value of B.

fully functionally dependent (*ffd*)
A and B are non-empty sets of attributes in R.

B is fully functionally dependent on A if
A → B, but
B is not functionally dependent on any proper subset of A

transitively dependent
A, B and C are non-empty attributes of R such that A → B and B → C
then C is transitively dependent on A via B (provided A is not functionally dependent on B or C)

2NF – simple definition
A relation that is in 1NF and
every non-primary key attribute is fully functional dependent on the primary key

2NF – general definition
A relation that is in 1NF, and
every non-candidate key attribute is ffd on any candidate key.

3NF – simple definition
A relation that is in 2NF and
no non-primary key attribute is transitively dependent on the primary key.

3NF – general definition
A relation that is in 2NF and in which no non-candidate key attribute is transitively dependent on any candidate key.

BCNF
A relation R is in BCNF if whenever a non-trivial X → A exists, then X is a superkey.

BCNF – alternate definition
A relation R is in BCNF if and only every determinant is a candidate key.

Decomposition of relation R is a set {R1, R2, …, Rn} such that
each Ri ⊆ R, and
union over all Ri equals R.
(i.e., same as "attribute preserving decomposition")

Attribute preserving decomposition of universal table R = {R1, R2, …, Rn}
Every attribute of R appears in at least one of the relations Ri
That is,
R1 ∪ R2 ∪ … ∪ Rn = R

Dependency preserving decomposition of universal table R = { R1, R2, … Rn }
All the functional dependencies in R can be inferred from the function dependencies obtained from the natural join (pair-wise) over all the Ri.

Lossless join
A decomposition is lossless join if a natural join of R1, R2, … Rn = R with no spurious tuples.

Alternatively, a decomposition is lossless join if it is attribute preserving and dependency preserving.

Rules for inferring functional dependencies from a set of functional dependencies:
A, B, C are non-empty subsets of attributes of relation R

(Armstrong's axioms)
(1) Reflexitivity if B <= A, then A → B

(2) Augmentation if A → B, then A C → B C

(3) Transitivity if A → B and B → C, then A → C

(Additional rules -- derivable from Armstrong's axioms)
(4) Self determination A → A

(5) Decomposition if A → B C, then A → B and A → C

(6) Union if A → B and A → C, then A → B C

(7) Composition if A → B and C → D then A C → B D