Types of Relations

- **Empty Relation**
  An empty relation (or void relation) is one in which there is no relation between any elements of a set. For example, if set A = {1, 2, 3} then, one of the void relations can be R = {x, y} where, |x – y| = 8. For empty relation,

  $R = \varphi \subset A \times A$

- **Universal Relation**
  A universal (or full relation) is a type of relation in which every element of a set is related to each other. Consider set A = {a, b, c}. Now one of the universal relations will be R = {x, y} where, |x – y| ≥ 0. For universal relation,

  $R = A \times A$

- **Identity Relation**
  In an identity relation, every element of a set is related to itself only. For example, in a set A = {a, b, c}, the identity relation will be I = {a, a}, {b, b}, {c, c}. For identity relation,

  $I = \{(a, a), a \in A\}$

- **Inverse Relation**
  Inverse relation is seen when a set has elements which are inverse pairs of another set. For example, if set A = {(a, b), (c, d)}, then inverse relation will be R^{-1} = {(b, a), (d, c)}. So, for an inverse relation,

  $R^{-1} = \{(b, a): (a, b) \in R\}$

- **Reflexive Relation**
  In a reflexive relation, every element maps to itself. For example, consider a set A = {1, 2,}. Now an example of reflexive relation will be R = {(1, 1), (2, 2), (1, 2), (2, 1)}. The reflexive relation is given by-

  $(a, a) \in R$

- **Symmetric Relation**
  In a symmetric relation, if a=b is true then b=a is also true. In other words, a relation R is symmetric only if (b, a) ∈ R is true when (a,b) ∈ R. An example of symmetric relation will be R = {(1, 2), (2, 1)} for a set A = {1, 2}. So, for a symmetric relation,

  $aRb \Rightarrow bRa, \forall\ a, b \in A$

- **Transitive Relation**
  For transitive relation, if (x, y) ∈ R, (y, z) ∈ R, then (x, z) ∈ R. For a transitive relation,

  $aRb \text{ and } bRc \Rightarrow aRc\ \forall\ a, b, c \in A$

- **Equivalence Relation**
  If a relation is reflexive, symmetric and transitive at the same time it is known as an equivalence relation.