Chapter: Relations

Concepts and Formulae

Key Concepts

1. A relation R between two non empty sets A and B is a subset of their Cartesian Product A × B. If A = B then relation R on A is a subset of A × A

2. If (a, b) belongs to R, then a is related to b, and written as a R b If (a,b) does not belongs to R then a R b.

3. Let R be a relation from A to B.

Then Domain of R⊂ A and Range of R⊂ B co domain is either set B or any of its superset or subset containing range of R

4. A relation R in a set A is called empty relation, if no element of A is related to any element of A, i.e., R = ϕ ⊂ A × A.

5. A relation R in a set A is called universal relation, if each element of A is related to every element of A, i.e., R = A × A.

6. A relation R in a set A is called

a. Reflexive, if (a, a) ∈ R, for every a ∈ A,

b. Symmetric, if (a1, a2) ∈ R implies that (a2, a1) ∈ R, for all a1, a2 ∈ A.

c. Transitive, if (a1, a2) ∈ R and (a2, a3) ∈ R implies that (a1, a3) ∈ R, or all a1, a2, a3 ∈ A.

7. A relation R in a set A is said to be an equivalence relation if R is reflexive, symmetric and transitive.

8. The empty relation R on a non-empty set X (i.e. a R b is never true) is not an equivalence relation, because although it is vacuously symmetric and transitive, it is not reflexive (except when X is also empty)

9. Given an arbitrary equivalence relation R in a set X, R divides X into mutually disjoint subsets Si called partitions or subdivisions of X satisfying:

- **No element of**

S_j ,if $i \neq j$

- **All elements of Si are related to each other, for all i**

$\bigcup_{i=1}^{n} S_j = X$ and $S_i \cap S_j = \phi$, if $i \neq j$

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- **The subsets Sj Are called Equivalence classes.**

Go through this following link for the following topic to understand more better.

Link for NPTEL course :- https://nptel.ac.in/courses/111/106/111106086/

1) **Intro of relation:-**
   https://youtu.be/gs0dQF3pGqM https://youtu.be/mS81mT8Qs9c
2) **Type of relation https://youtu.be/MxT-NpCPqcY https://youtu.be/lOD8ZxhqTbw**
   https://youtu.be/L05UUw8Bxc8
   https://youtu.be/U_cmOYldnY0
   https://youtu.be/xW92ngEA-YU
   https://youtu.be/F31g1VwtvZ4
3) **Practise Question**
   https://youtu.be/qvsTMxUx-CA
   https://youtu.be/RE5-IBhwjgw
4) **Partial order relation**
   https://youtu.be/LUjb0tgE_uo
5) **Closure relation https://youtu.be/Hu4pEt-TGJo**
   https://youtu.be/qvsTMxUx-CA