Chapter: Relations and Functions

Concepts and Formulae

Key Concepts

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

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 $R \subset A$ and Range of $R \subset B$ 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., $R = \phi \subset A \times A$.

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., $R = A \times A$.

6. A relation R in a set A is called

a. Reflexive, if $(a, a) \in R$, for every $a \in A$,

b. Symmetric, if $(a1, a2) \in R$ implies that $(a2, a1) \in R$, for all $a1, a2 \in A$.

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

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.

10. f f: A→B is a function then set A is the domain, set B is co-domain and set {f(x):x ∈ A } is the range of f. Range is a subset of codomain.

11 f: A → B is one-to-one if

For all x, y∈ A f(x) = f(y) ⇒ x = y or x ≠ y ⇒ f(x) ≠ f(y)

A one- one function is known as injection or an Injective Function. Otherwise, f is called many-one.

12. f: A → B is an onto function ,if for each b ∈ B there is atleast one a ∈ A such that f(a) = b

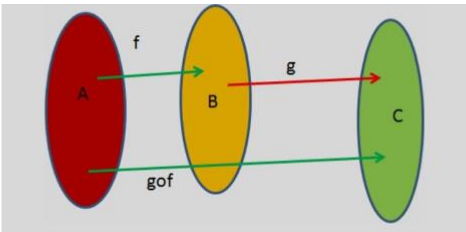
i.e if every element in B is the image of some element in A, f is onto.

13. A function which is both one-one and onto is called a bijective function Or a bijection.

14. A one – one function defined from a finite set to itself is always Onto but if the set is infinite then it is not the case.

15. Let f : A B → and g : B C → be two functions. Then the composition Of f and g, denoted by gof is defined as the function gof: A C → given By

gof(x): A → C defined by gof(x) = g(f(x)) ∀ x∈ A



16. Composition of functions is not commutative in general Fog(x) ≠ gof(x).Composition is associative If f: X→Y, g: Y→Z and h: Z→S are functions then

Ho(g o f)=(h o g)of

17. A function f: X → Y is defined to be invertible, if there exists a function g : Y → X such that gof = IX and fog = IY. The function g is called the inverse of f and is denoted by f –1 .

18. Let f: X → Y and g: Y → Z be two invertible functions. Then gof is also Invertible with (gof)–1 = f –1o g–1

19. If f: R→ R is invertible,

F(x)=y, then 1 F–(y)=x and (f-1)-1 is the function f itself.

20. A binary operation * on a set A is a function from A X A to A.

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