Scribed Notes-19

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COMPOSITION OF FUNCTIONS AND PERMUTATIONS

Compositions of Functions

Function composition is an operation that takes two functions f and g and produces a function h such that h(x) = g(f(x)). In this operation, the function g is applied to the result of applying the function f to x. That is, the functions f : X → Y and g : Y → Z are composed to yield a function that maps x in X to g(f(x)) in Z.

Function composition is an associative. If f(x)=y then, y=f(x)

Range of the function is subset of second function's domain.

Intuitively, if z is a function of y, and y is a function of x, then z is a function of x. The resulting composite function is denoted g ∘ f : X → Z, defined by (g ∘ f)(x) = g(f(x)) for all x in X.

- ➔ The composition of two permutations is also a permutation.

  Composition of operation on set of permutations from a group.

  Set of all permutation under function composition operation form a non-abelian group.

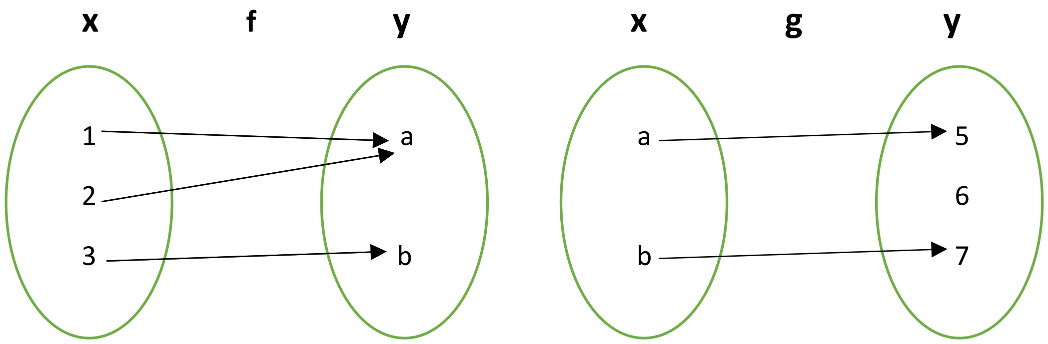
For example,

f(x)=2x+3 and g(x)=2x on domain=codomain= All positive integers, then, for f(g(2)) firstly we will evaluate g(2) = 4 and then replace value of g(2) in f(g(2))

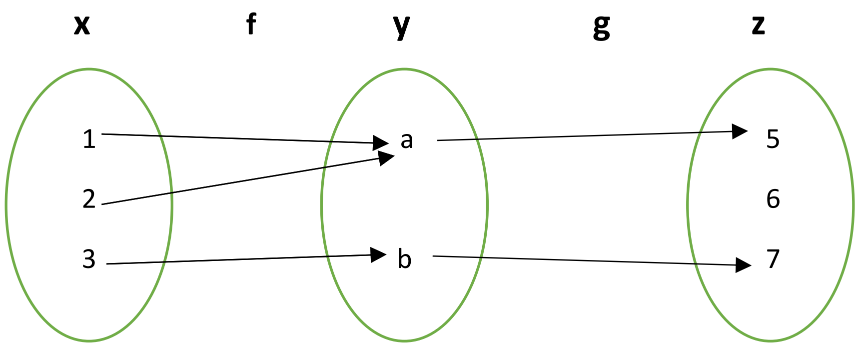
Consider functions, f: A → B and g: B → C. The composition of f with g is a function from A into C defined by (gof) (x) = g [f(x)] and is defined by gof.

To find the composition of f and g, first find the image of x under f and then find the image of f (x) under g.

Eg: Consider the function f = {(1, a), (2, a), (3, b)} and g = {(a, 5), (b, 7)} as in figure. Find the composition of gof.



Solution: The composition function gof is :



➔ Order of permutation

Order of permutation is to reach the identity permutation

$$\begin{pmatrix} 1 & 2 & 3 & 4 & 5 & 6 & 7 \\ 3 & 2 & 5 & 4 & 1 & 6 & 7 \end{pmatrix}$$

$$\begin{pmatrix} 1 & 2 & 3 & 4 & 5 & 6 & 7 \\ 1 & 4 & 3 & 6 & 5 & 2 & 7 \end{pmatrix}$$

Permutation is called cycle if there is only one non trivial orbit.

- **Cycle of Permutation: 3**

3-> 5	2-> 4
5-> 1	4-> 6
1-> 3	6-> 2

- Every group can be linked to a permutation group
- Not all cyclic group are abelian group but all abelian group are cyclic group.

x 10	1	3	7	9
1	1	3	7	9
3	3	9	1	7
7	7	1	9	3
9	9	7	3	7