# Disjoint-set Datastructures

* **Set:** A collection of distinct and well-defined elements.

$S_1 = \{1, 2, 3, 4, 5\}$
$S_2 = \{a, b, c, d\}$ (Sets)

* **Disjoint-set:** (Partitioned-set)

$DS_1 = \{\{1\}, \{2\}, \{3\}, \{4\}, \{5\}\}$
$DS_2 = \{\{1, 2, 3\}, \{4, 5\}\}$
$DS_3 = \{\{a, b, c\}, \{d\}\}$ (Disjoint sets)

No elements are in common in the subsets of $DS_1$, $DS_2$ and $DS_3$.

* **Disjoint-set as a Datastructure:**

A datastructure which can be viewed as a collection of sets, wherein no element appears in more than one set.

So, DS1, DS2 and DS3 are disjoint-sets as shown earlier.

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## * Operations supported by Disjoint-set datastructure:

I) MAKE-SET(a) :- makes singleton sets, containing each element of a set exactly once.

Ex:- $S = \{1, 2, 3, 4, 5\}$

MAKE-SET(1) → {1}
MAK-SET(2) → {2}
MAKE-SET(3) → {3}

Elements of a set are "isolated".

II) FIND-SET(a) :- finds representative (owner) of a set containing a.

Ex:- $S = \{1, 2, 3, 4, 5\}$

(2 is the representative of S)

So, FIND-SET(3) = 2
FIND-SET(5) = 2
(∵ 2 is representative of S)

Ex: $S_1 = \{\{1,2\}, \{3,4\}, \{5\}\}$

FIND-SET(3) = 3
FIND-SET(1) = 2
FIND-SET(5) = 5
FIND-SET(4) = 3

II) UNION(a,b) : combines sets containing a and b and collects them into a new set. It means that if a is present in set $S_a$ and b is present in set $S_b$; then this operation merges a and b into a single set (either $S_a$ or $S_b$ or may be new set) Generally $S_a$ or $S_b$ are taken and new set is not created.

Since FIND-SET and UNION operations are critical in disjoint-set datastructures, these structures are famously known as "Union-Find" datastructures.