

## Smarandache's codification used in computer programming

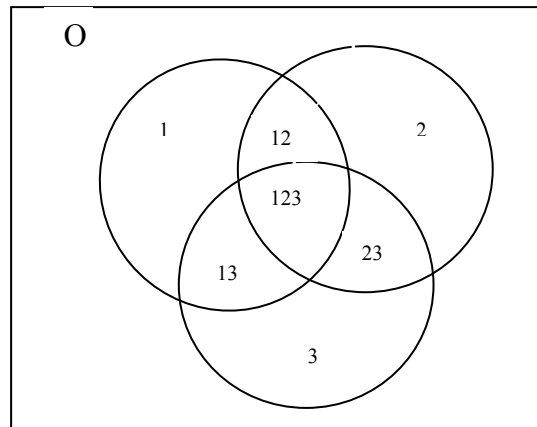
Since Venn diagram is very hard to draw and to read for the cases when the number of sets becomes big (say  $n = 8, 9, 10, 11, \dots$ ), Smarandache has proposed a generalization of Venn diagram through an *algebraic representation* for the intersection of sets.

Let  $n \geq 1$  be the number of sets  $S_1, S_2, \dots, S_n$ , that are to be intersected in all possible ways in a Venn diagram. Let  $1 \leq k \leq n$  be an integer.

He noted by:  $i_1 i_2 \dots i_k$  the Venn diagram region that belongs to the sets  $S_{i_1}$  and  $S_{i_2}$  and  $\dots$  and  $S_{i_k}$  only, for all  $k$  and all  $n$ .

The part which is outside of all sets (i.e. the complement of the union of all sets) is noted by 0 (zero).

Each Venn diagram will have  $2^n$  disjoint parts, and each such disjoint part (except the above part 0) will be formed by combinations of  $k$  numbers from the numbers: 1 2 3  $\dots$   $n$ . Let see an example of **Smarandache's codification**, for  $n = 3$ , for sets  $S_1, S_2$ , and  $S_3$ .



Therefore, part 12 means that part which belongs to  $S_1$  and  $S_2$  only; part 3 means that part which belongs to  $S_3$  only.

This helps to the construction of a base formed by all these disjoint parts, and implementation in a computer program of each set from the power set  $\mathcal{P}(S_1 \cup S_2 \cup \dots \cup S_n)$  by a unique combination of numbers 1, 2,  $\dots$ ,  $n$ .

When  $n \geq 10$ , one uses one space in between numbers: for example, if we want to represent the disjoint part which is the intersection of  $S_3, S_{10}$ , and  $S_{27}$  only, he used the notation [3 10 27], with blanks in between set indexes.

Smarandache's codification is user friendly in algebraically doing unions and intersections in a simple way. Union of sets  $S_a, S_b, \dots, S_v$  is formed by all disjoint parts that have in their index either the number  $a$ , or the number  $b$ ,  $\dots$ , or the number  $v$ .

While intersection of  $S_a, S_b, \dots, S_v$  is formed by all disjoint parts that have in their index all numbers  $a, b, \dots, v$ .

For  $n = 3$  and the diagram above:

$S_1 \cup S_{23} = \{1, 12, 13, 23, 123\}$ , i.e. all disjoint parts that include in their indexes either the number 1, or the number 23.

$S_1 \cap S_2 = \{12, 123\}$ , i.e. all disjoint parts that have in their index the numbers 12.