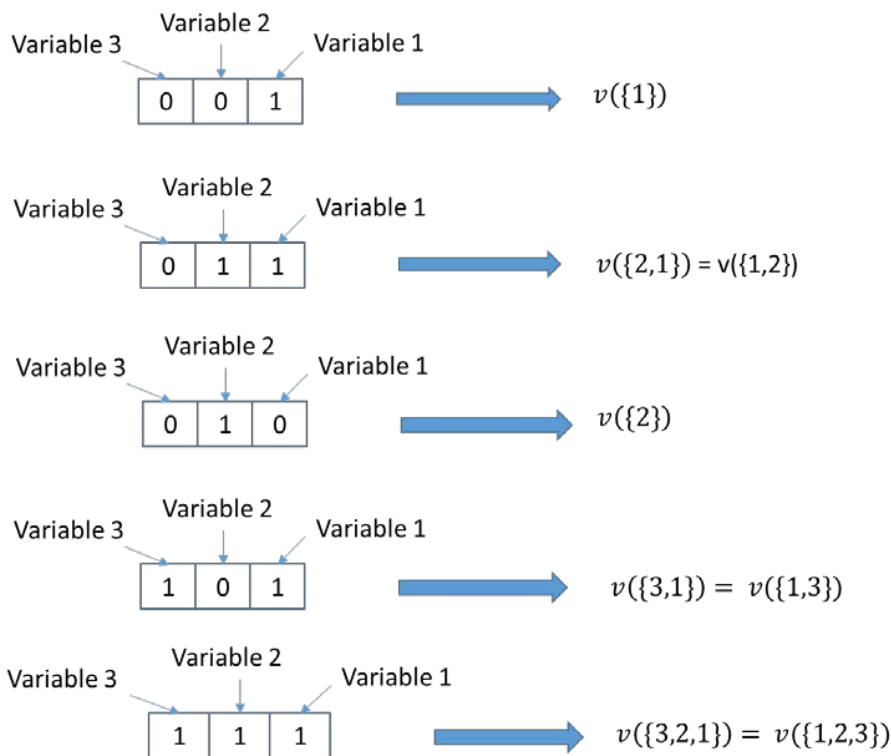# Binary representation of the fuzzy measures (Choquet integrals)

- In order to represent the fuzzy measures, Binary ordering can be used.

- Binary ordering uses the form of a binary number to decide which elements are in the set at a given position.

- For example, let us consider that we want to represent the following 8 fuzzy measures (with three variables 1, 2, and 3).

  - $v(\emptyset)$, $v(\{1\})$, $v(\{2\}), v(\{3\}), v(\{1,2\}), v(\{1,3\}), v(\{2,3\}), v(\{1,2,3\})$

    - In order to represent these 8 fuzzy measures, we need three digit binary number (hence it has 8 possibilities). The binary numbers are:

  - 000, 001, 010, 011, 100, 101, 110, 111.

- We look at where the "1'' occurs from the far "right" in order to decide which element/variable is included in the set. See the diagrams below

- The below table shows the full binary representation of the 8 fuzzy measures.

Remember that we look at where the "1'' occurs from the far "right" in the binary representation

Number	Binary number	Fuzzy measures
0	000	$v(\emptyset)$
1	001	$v(\{1\})$
2	010	$v(\{2\})$
3	011	$v(\{1,2\})$
4	100	$v(\{3\})$
5	101	$v(\{1,3\})$
6	110	$v(\{2,3\})$
7	111	$v(\{1,2,3\})$