

SOP and POS

SOP (Sum of Products) Form

The SOP or Sum of Products form is a form of expressing a logical or Boolean expression. In SOP, different product terms of input variables are logically ORed together. Therefore, in the case of SOP form, we first

logically AND the input variables, and then all these product terms are summed together with the help of logical OR operation.

For example –

$$f(A, B, C) = ABC + \bar{A}BC + AB\bar{C}$$

This is a logical expression in three variables. Here, ABC, A'BC, and ABC' are the three product terms which are summed together to get the expression in SOP form.

POS (Product of Sum) Form

The POS or Product of Sum form is another form used to represent a logical expression. In POS form, different sum terms of input variables are logically ANDed together. Hence, if we want to express a logical expression in POS form, for that we first logically OR all the input variables and then these sum terms are ANDed using AND operation.

For example –

$$f(A, B, C) = (A + B + C)(\bar{A} + B + C)(A + B + \bar{C})$$

Here, f is a logical expression in three variables. From this example, it can be seen that there are three sum terms which are ANDed together to obtain the POS form of the given expression.

Applications of SOP

- **Digital Circuit Design:** The SOP form is utilized very often in the implementation of combinational circuits like multiplexers, encoders and decoders among others.
- **Logic Minimization:** Most of the logic minimization approaches ranging from Karnaugh mapping to Quine-McCluskey uses the

standard sum of product for better construction of digital circuits.

- **Programmable Logic Arrays (PLAs):** In PLAs, which is a configurable device, the logic is defined with the help of SOP expressions.
- **Design Finite State Machine:** When designing finite state machine, the transition logic between the different states is expressed in the form of SOP.