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ON LINE LECTURE

NOTES FOR.

M. Sc. II sem physics.

Paper:- MPHYCC-7

Unit:- 4. Digital Electronics.

Topic:- Minterm and Maxterm
representation.

KB Singh,

* MINIMIZATION TECHNIQUE *

April 97

Friday

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* ~~MINIMIZATION TECHNIQUE~~ *

- 1) Boolean expression (logical-function or Boolean-function) of a logic circuit can be simplified by following methods:
- A i) Algebraic method
 - B ii) Karnaugh map technique or method.
 - C iii) Quine-McCluskey method.
 - D iv) Variable entered mapping (VEM) technique.

⇒ Minterms and Maxterm: - One of the important theorems of Boolean algebra states that any Boolean expression can be expressed as the sum (OR) of products (AND) of all the variables in the expression. However the variables can be represented either in direct form or in complement form. For example the term $A+B$ can be expressed as the sum of several products, each one of them containing letters A and B. These product terms are known as Minterm. In the above expression,

$$\begin{aligned}
 A+B &= A \cdot 1 + B \cdot 1 && \text{From Law.} \\
 &= A(B+\bar{B}) + B(A+\bar{A}) && \because A+\bar{A}=1 \\
 &= AB + A\bar{B} + AB + \bar{A}B \\
 &= AB + A\bar{B} + \bar{A}B
 \end{aligned}$$

In this case terms AB , $A\bar{B}$ and $\bar{A}B$ are known as minterm because all the terms contain both the variable A and B either in direct or in complement form. This process which is in fact expansion of the given expression is called as expansion.

In general for expanding a Boolean function into minterms the following systematic procedure should be followed:-

- i) write down all the terms of Boolean
- ii) By writing & convert each term into
- iii) generate all possible minterm by way

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all combinations of the x's in each term (use barred letters for 0 and unbarred letters for 1)
 iv) Omit all the redundant terms.

Example: - Find the minterm for $BC + A$.
Solution: - Step I: Write down all the terms of Boolean function i.e. $BC + A$.

Step II: Write X to convert each term to minterm at the places where letters are missing i.e. XBC AXX .

Step III: Use all combinations of x's in each term for generating all possible minterms i.e. vary all the x's in XBC as follows

$$\rightarrow \bar{A}BC, ABC$$

$$\text{and in } AXX \rightarrow A\bar{B}\bar{C}, A\bar{B}C, AB\bar{C}, ABC$$

Hence,

$$BC + A = \bar{A}BC + ABC + A\bar{B}\bar{C} + A\bar{B}C + AB\bar{C} + ABC$$

Step IV: Omit all redundant terms i.e.
 $BC + A = \bar{A}BC + ABC + A\bar{B}\bar{C} + A\bar{B}C + AB\bar{C}$

The fact that the R.H.S. of the above equation is same as L.H.S. can be confirmed by reducing R.H.S. using Boolean algebra i.e.

$$\bar{A}BC + ABC + A\bar{B}\bar{C} + A\bar{B}C + AB\bar{C}$$

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

$$= BC + A\bar{B} + AB\bar{C}$$

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

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

$$= A\bar{B} + BA + BC$$

$$= A(\bar{B} + B) + BC$$

$$= A + BC$$

$$= BC + A \quad \text{L.H.S.}$$

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