Programmable ROMs (PROM)

It allows the user instead of the manufacturer to store the data. An instrument called a PROM programmer stores the words by "burning in."

All diodes are connected at the cross points. Each of these diodes has a fusible link (a small fuse). The PROM programmer sends destructively high currents through all diodes to be removed. In this way, only the desired diodes remain connected after programming a PROM. Programming like this is permanent because the data cannot be erased after it has been burned in.

One disadvantage of PROMs is the limit on number of input variables; typically, PROMs have 8 inputs or less.

Erasable PROM (EPROM)

It uses metal-oxide-semiconductor field-effect transistors (MOSFETs). Data is stored with an EPROM Programmer. Later, data can be erased. The EPROM is useful in project development. With an EPROM, the designer can modify the contents until the stored data is perfect. When the design is finalized, the data can be burned into PROMs or sent to an IC manufacturer who produces ROMs.

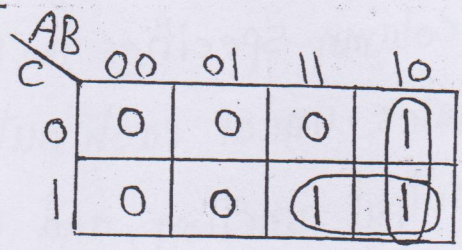
Programable Logic Array (PLA)

A PLA is similar to a ROM in concept; however, the PLA does not provide full decoding of the variables to generate all the minterms as in ROM. In PLA, the decoder is replaced by a group of AND gates called (Product Terms) and a group of OR gates called (Sum Terms) and links among them.

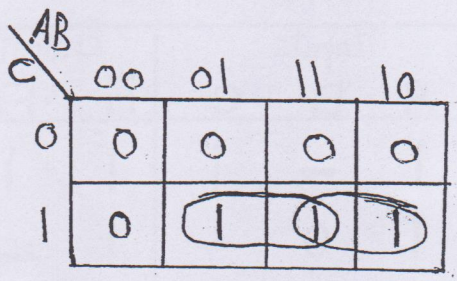
- PLA is used to implement functions that has large number of don't care-conditions (X).
- PLA implements the function in their Sum of Product (SOP) by fusing the links according to the PLA **Program table**.

Ex: Implement the following functions using PLA.

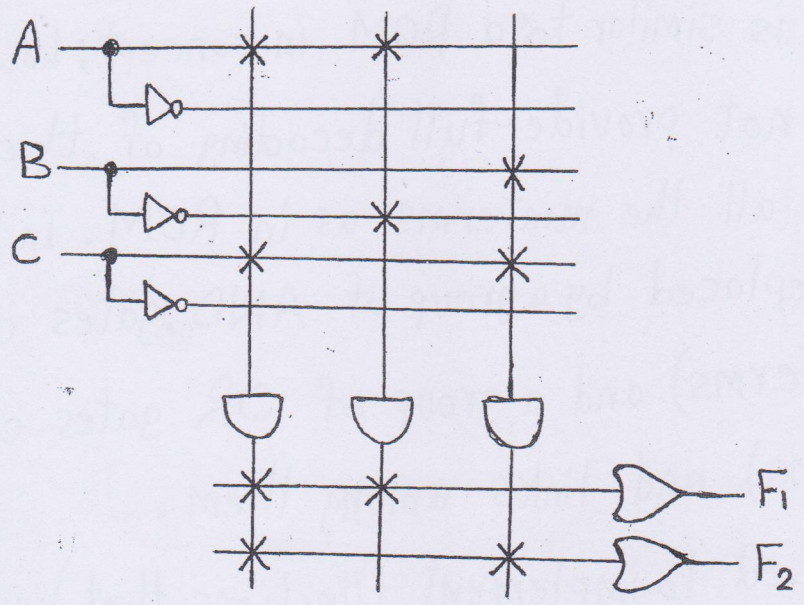
A	B	C	F_1	F_2
0	0	0	0	0
0	0	1	0	0
0	1	0	0	0
0	1	1	0	1
1	0	0	1	0
1	0	1	1	1
1	1	0	0	0
1	1	1	1	1



$F_1 = AC + A\bar{B}$



$F_2 = BC + AC$



PLA of 3 inputs 3-product terms and two sum terms (o/p)

PLA Program Table consists of three Columns:-

1- The first column lists the product terms numerically.

2- The second column specifies the required Path between inputs and AND gates (1 for normal, 0 for Complement, and - (dash) for no connection).

3- The third column specifies the path between AND gates and OR gates. under each output we write (T) for normal output function, and (C) for complement output function.

	Product Terms	Inputs A	B	C	Output F_1	F_2
AC	1	1	-	1	1	1
$A\bar{B}$	2	1	0	-	1	-
BC	3	-	1	1	-	1
					T	T

PLA Program Table

Notes :-

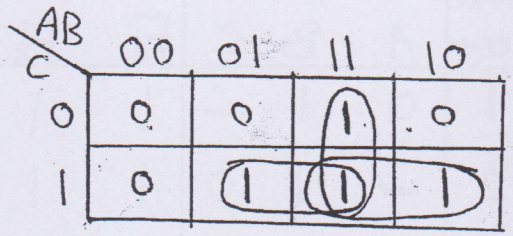
* Designing a circuit with PLA, there is no need to show the internal connection, only the PLA program table is enough.

* The functions implemented with PLA should be simplified to have minimum number of terms (Product terms) therefore both the normal and complemented of the function is obtained (SOP, POS) to see which one provides fewer and common Product terms.

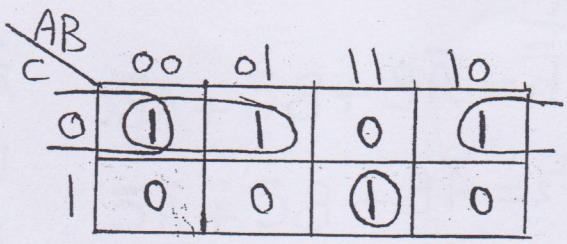
Ex: Implement the following two functions using PLA with 3 inputs, 4- product terms and two outputs, then derive the PLA Program table.

$F_1(A,B,C) = \sum(3,5,6,7)$, $F_2 = \sum(0,2,4,7)$

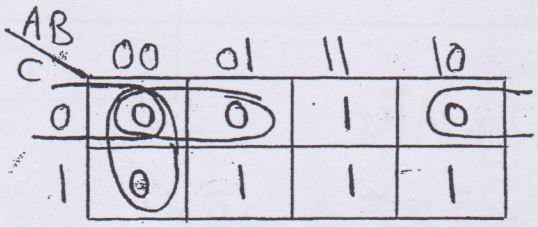
Soln



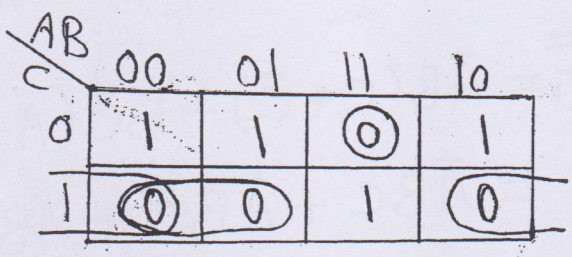
SOP ⇒ $F_1 = AB + BC + AC$



$F_2 = \bar{A}\bar{C} + \bar{B}\bar{C} + ABC$



POS ⇒ $\bar{F}_1 = \bar{A}\bar{C} + \bar{A}\bar{B} + \bar{B}\bar{C}$



$\bar{F}_2 = \bar{A}C + \bar{B}C + AB\bar{C}$

The combination that gives four product terms are:-

$\bar{F}_1 = \bar{A}\bar{C} + \bar{B}\bar{C} + \bar{A}\bar{B}$, $F_2 = \bar{A}\bar{C} + \bar{B}\bar{C} + ABC$

	Product Terms	Inputs A	B	C	Outputs F_1	F_2
$\bar{A}\bar{C}$	1	0	–	0	1	1
$\bar{B}\bar{C}$	2	–	0	0	1	1
$\bar{A}\bar{B}$	3	0	0	–	1	–
ABC	4	1	1	1	–	1
					C	T

T/C

Ex: Find the Boolean expression of the function implemented with a PLA which has the following PLA program table shown below, then implement the functions using 3x8 decoder.

	Product terms	Inputs A	B	C	outputs F_1	F_2
$\bar{A}B$	1	0	1	–	1	1
$B\bar{C}$	2	–	1	0	1	1
$\bar{A}\bar{C}$	3	0	–	0	–	1
$A\bar{B}C$	4	1	0	1	1	–
					C	T

Soln

$\bar{F}_1 = \bar{A}B + B\bar{C} + A\bar{B}C$

$F_2 = \bar{A}B + B\bar{C} + \bar{A}\bar{C}$

$\bar{F}_1 = \bar{A}B(C+\bar{C}) + B\bar{C}(A+\bar{A}) + A\bar{B}C$

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

$\therefore F_1 = (A+\bar{B}+\bar{C})(A+\bar{B}+C)(\bar{A}+\bar{B}+C)(\bar{A}+B+\bar{C}) = \Pi(2,3,5,6$

$$F_2 = \bar{A}B(C+\bar{C}) + B\bar{C}(A+\bar{A}) + \bar{A}\bar{C}(B+\bar{B})$$

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

$$F_2 = \Sigma(0,2,3,6)$$

$$F_1 = \Pi(2,3,5,6) = \Sigma(0,1,4,7)$$