What is Programmable Array Logic (PAL)?

Programmable Array Logic (PAL) is a type of device which comes from the class of programmable logic devices (PLDs) and is used to implement combinational circuits. The basic configuration of a PAL consists of a programmable AND array and followed by a fixed OR gate. It differs from PLA in a manner, that PAL consists of an AND array followed by a fixed OR array whereas in case of PLA it has an AND array followed by a programmable OR gate. In PAL, since only AND array is programmable it is easier to use but it is not that flexible.

A schematic diagram of the basic configuration of PAL can be drawn as:

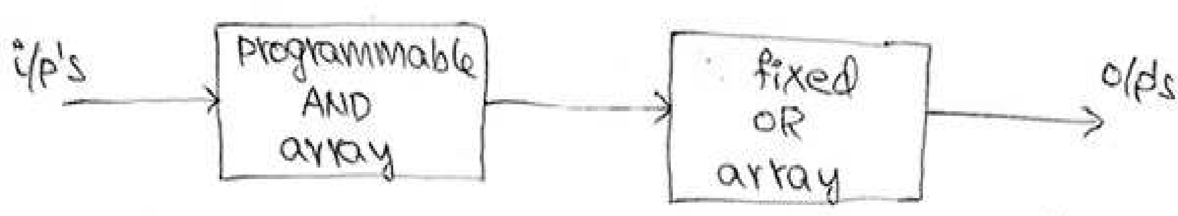


fig: Basic configuration of PAL.

Programmable Array Logic (PAL) Examples

Example 1

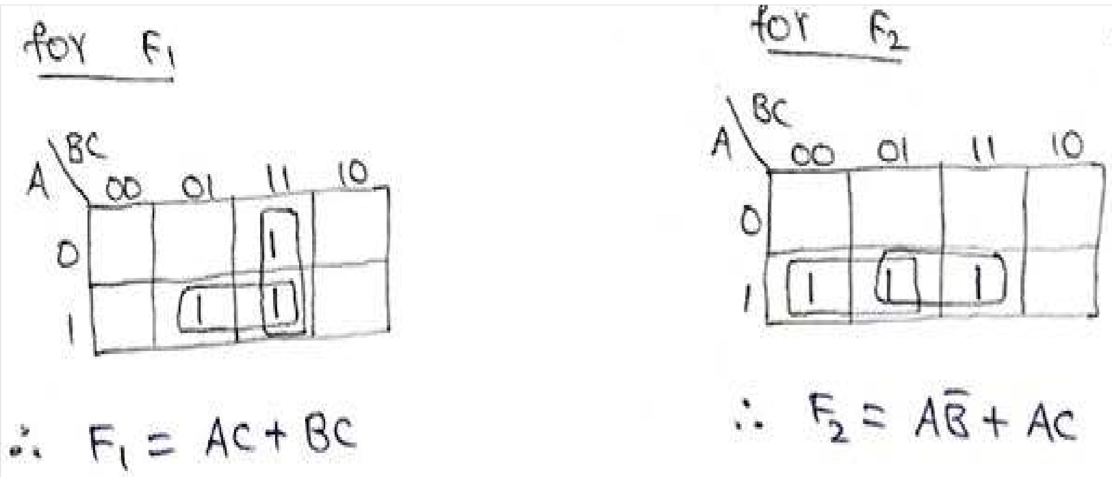
Implement the following Boolean expression using PAL,
F1= ∑ m (3,5,7) and F2 = ∑ m (4,5,7).

Solution

Since, F1= ∑ m (3,5,7) and F2 = ∑ m (4,5,7). Truth table for Boolean functions F1 and F2 can be drawn as:

Inputs			Outputs	
A	B	C	F1	F2
0	0	0	0	0
0	0	1	0	0
0	1	0	0	0
0	1	1	1	0
1	0	0	0	1
1	0	1	1	1
1	1	0	0	0
1	1	1	1	1

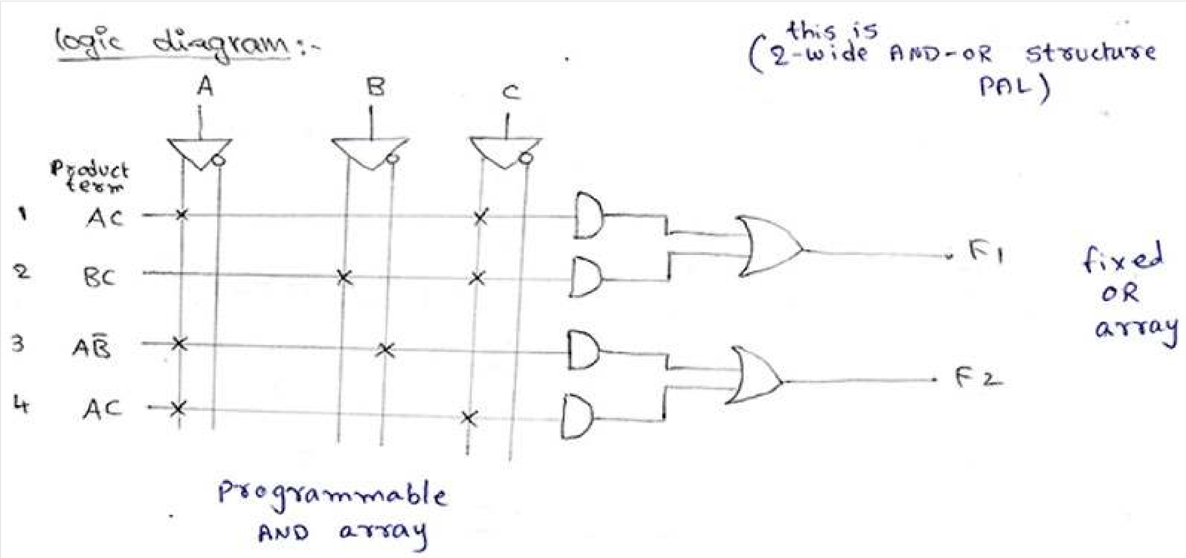
Now, for these Boolean functions, using the K-Map we can find the simplified Boolean expressions as:



A PAL program table can be also drawn representing the terms in the Boolean expression as:

	Product Term	AND i/p's A	B	C	o/p's
1	AC	1	–	1	$F_1 = AC + BC$
2	BC	–	1	1	
3	$A\bar{B}$	1	0	–	$F_2 = AC + A\bar{B}$
4	AC	1	–	1	

The logic diagram of the combinational circuit implemented using PAL can be drawn as:



Example 2

Implement the following Boolean expressions using a suitable PLA.

A (x,y,z) = ∑ m (1,2,4,6)

B (x,y,z) = ∑ m (0,1,6,7)

C (x,y,z) = ∑ m (2,6)

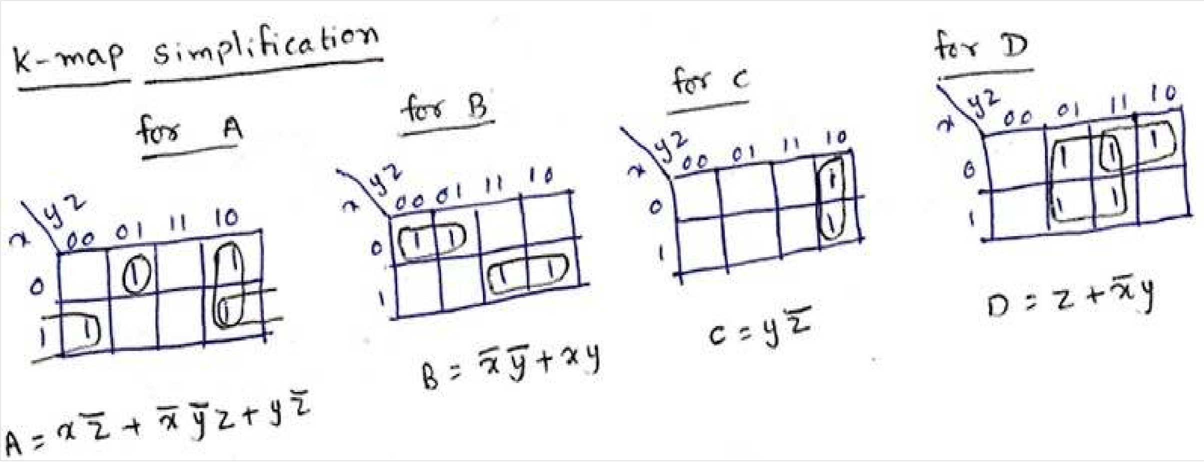
D (x,y,z) = ∑ m (1,2,3,5,7)

Solution

Truth table for Boolean functions A, B, C and D can be drawn as:

Input			Output			
x	Y	z	A	B	C	D
0	0	0	0	1	0	0
0	0	1	1	1	0	1
0	1	0	1	0	1	1
0	1	1	0	0	0	1
1	0	0	1	0	0	0
1	0	1	0	0	0	1
1	1	0	1	1	1	0
1	1	1	0	1	0	1

Solving K-Map to get the required Boolean expressions:



A PLA program table can be also drawn representing the terms in the Boolean expression as:

PAL program Table

	Product terms	AND inputs x	y	z	outputs
1	$x\bar{z}$	1	—	0	$A = x\bar{z} + \bar{x}\bar{y}z + y\bar{z}$
2	$\bar{x}\bar{y}z$	0	0	1	
3	$y\bar{z}$	—	1	0	
4	$\bar{x}\bar{y}$	0	0	—	$B = \bar{x}\bar{y} + xy$
5	xy	1	1	—	
6					
7 8 9	$y\bar{z}$	—	1	0	$C = y\bar{z}$
10	z	—	—	1	$D = z + \bar{x}y$
11	$\bar{x}y$	0	1	—	
12					

The logic diagram of the combinational circuit implemented using PLA can be drawn as:

Logic Diagram :-