**Product -of- sum representation of logic function :**

A PS is a sum term or several sum terms logically multiplied together e.g. :

F = (A+B)(A+B+C)(A+D)…..

**Derivation of PS :**

1-construct the T.T.

2-construct a sum column of sum of all inputs ( 0=uncomplement , 1=complement)

3-The desired output exp. Is the product of the sum of all terms in which the output

is zero.

***EX:*** For the following T.T. , write the logic function using PS method :

Z S. treams Max terms AB

00 1 (A+B) M0

01 0 (A+B) M1

10 0 (A+B) M2

11 0 (A+B) M3

Z= M1 . M2 . M3

= (A+B)(A+B)(A+B)

***EX***: Simplify the following function using SP and PS methods :

F(A,B,C) = π( M2 , M3 , M6 )

Sol:

ABC Z

000 1 m0

001 1 m1

010 0 M2

011 0 M3

100 1 m4

101 1 m5

110 0 M6

111 1 m7

**1-By SP method :**

Z = m0 + m1 + m4 + m5 + m7

= ABC + ABC + ABC +ABC + ABC

= AB(C+C) + AB(C+C) + ABC  A

= AB + AB + ABC C

= B(A+A) + ABC B Z

= B + BAC

Z = B + AC

**2- By PS method :**

Z = M2.M3.M6

=(A+B+C)(A+B+C)(A+B+C)

=(A+B+C)(A+B+C)(A+B+C)(A+B+C)

=(AA+BA+CA+AB+BB+CB+AC+BC+CC)

=(A+BA+CA+AB+B+CB+AC+BC).(

=(A(1+B+C+B+C)+B(1+C+C)).(

=(A+B)(AA+BA+CA+AB+BB+CB+AC+BC+CC)

=(A+B)(BA+CA+AB+B+CB+AC+BC+C)

=(A+B)(B(A+A+1+C+C)+C(A+A+1))

=(A+B)(B+C)

A

B

z

C

PS method require one more gate than SP .

**Logic circuit design using NAND and NOR gates only :**

There are many reasons for using NAND and NOR gates only to implement any logic function :

1-NAND and NOR gates are simpler, cheaper and have a faster response time to input changes , and consume less power .

2-The ability to implement any logic function using NAND or NOR gates only is easier than implement three different logic gates .

By using De morgan's theorem we can apply any logic circuit using NAND or NOR gates only.

**Using NAND gates :**

***EX***: Simplify the following function and implement the final equation using NAND gates only :

H(A,B,C) = Σ (0,1,4,6,7)

H= ABC + ABC + ABC + ABC + ABC

= AB(C+C) + ABC + AB(C+C)

= AB + ABC + AB

= B(A+AC) + AB

= B(A+C) + AB

= BA + BC +AB