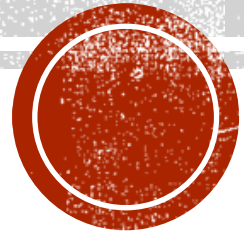
BCD ADDER



Presented by Nabanita Das

BCD ADDER

- BCD stand for binary coded decimal. Suppose, we have two 4-bit numbers A and B. The value of A and B can varies from 0(0000 in binary) to 9(1001 in binary) because we are considering decimal numbers.
- The output will varies from 0 to 18, if we are not considering the carry from the previous sum. But if we are considering the carry, then the maximum value of output will be 19 (i.e. 9+9+1 = 19).
- When we are simply adding A and B, then we get the binary sum. Here, to get the output in BCD form, we will use BCD Adder.

EXAMPLE

Input :
A = 0111 B = 1000
Output :
Y = 0001 0101
Explanation:
We are adding A(=7) and B(=8).
The value of binary sum will be 1111(=15).
But, the BCD sum will be 0001 0101,
where 1 is 0001 in binary and 5 is 0101 in binary.

RESULT OF BCD ADDITION

- We are adding "0110" (=6) only to the second half of the table.

- The conditions are:

1. If C3 = 1 (Satisfies 16-19)
2. If S3.S2 = 1 (Satisfies 12-15)
3. If S3.S1= 1 (Satisfies 10 and 11)

- So, our logic is

C3 + S3.S2 + S3.S1 = 1

Decimal digit	Uncorrected BCD sum C_3	S_3	S_2	S_1	S_0	Corrected BCD sum C_{out}	S_3	S_2	S_1	S_0	
0		0	0	0	0		0	0	0	0	
1		0	0	0	1		0	0	0	1	
2		0	0	1	0		0	0	1	0	
3		0	0	1	1		0	0	1	1	No correction required
4		0	1	0	0		0	1	0	0	
5		0	1	0	1		0	1	0	1	
6		0	1	1	0		0	1	1	0	
7		0	1	1	1		0	1	1	1	
8		1	0	0	0		1	0	0	0	
9		1	0	0	1		1	0	0	1	
10		1	0	1	0	1	0	0	0	0	
11		1	0	1	1	1	0	0	0	1	
12		1	1	0	0	1	0	0	1	0	
13		1	1	0	1	1	0	0	1	1	
14		1	1	1	0	1	0	1	0	0	Correction required
15		1	1	1	1	1	0	1	0	1	
16	1	0	0	0	0	1	0	1	1	0	
17	1	0	0	0	1	1	0	1	1	1	
18	1	0	0	1	0	1	1	0	0	0	
19	1	0	0	1	1	1	1	0	0	1	

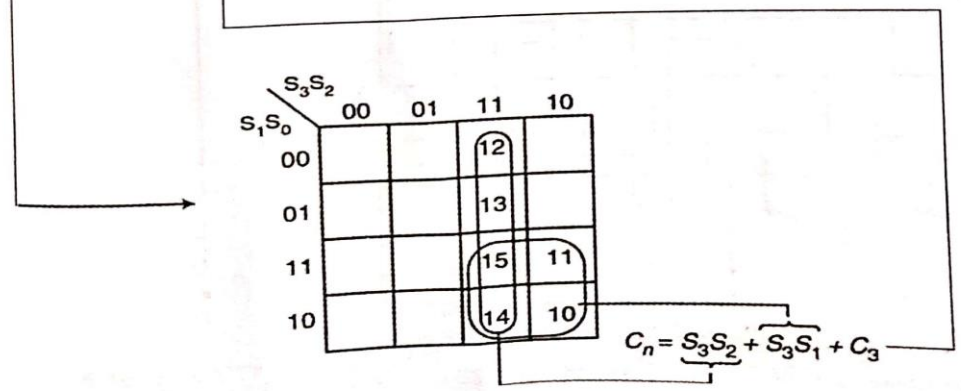


Fig. 5.21 K-map simplification

BCD ADDER CIRCUIT

When the sum output (S3S2S1S0) is greater than 9 when $C_3=1$ OR $S_3.S_2=1$ OR $S_3.S_1=1$

$C_3 + S_3.S_2 + S_3.S_1 = 1$