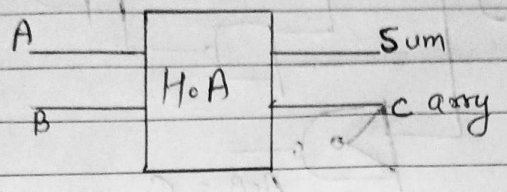
Half adder

Lecture 24

It is ~~used~~ a C.C which is used to add 2, 1 bit numbers.

S1



2 input / 2 output

T.T

S2

A	B	S	C
0	0	0	0
0	1	1	0
1	0	1	0
1	1	0	1

$S = \Sigma m(1, 2)$

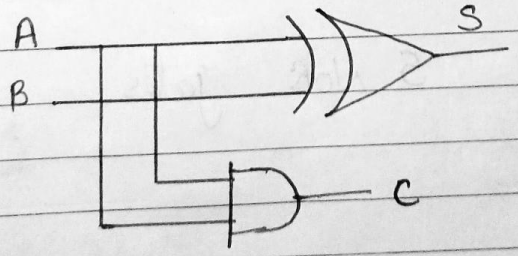
$C = \Sigma m(3)$

$S = A \oplus B$

$C = A \cdot B$

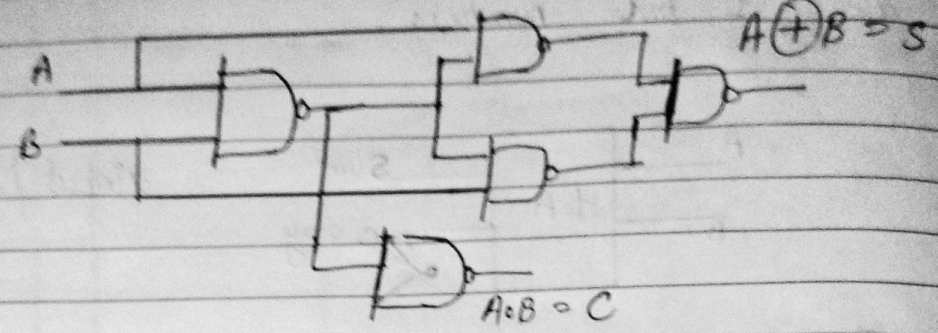
S3: Skip

S4 design



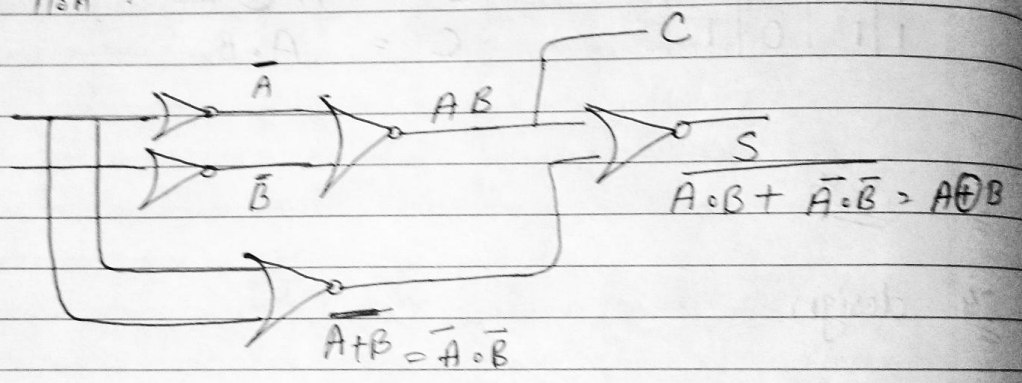
To design Half adder we need 1 XOR and 1 And gate

Q. How many Min NAND gates are needed to realise H.A ?



5 NAND gates

Q. How many Min NOR gates are needed to realize H.A ?



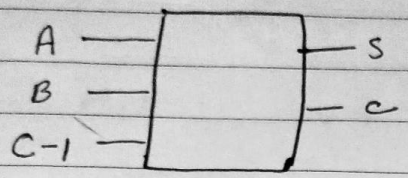
5 NOR gates

* Full adder

Full adder is a C.C which is used to add 2, 1 bit number & previous carry

design

S1



3 I/P and 2 O/P Lines

S2 Truth Table

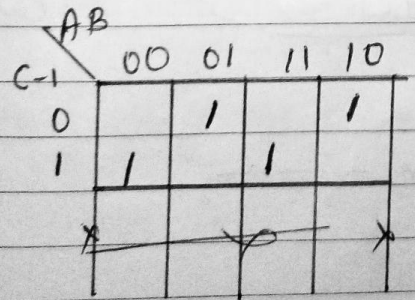
A	B	C-1	S	C
0	0	1	1	0
0	1	0	1	0
0	1	1	0	1
1	0	0	1	0
1	0	1	0	1
1	1	0	0	1
1	1	1	1	1
0	0	0	0	0

$S = f(A, B, C_{-1}) = \Sigma m(1, 2, 4, 7)$

$C = f(A, B, C_{-1}) = \Sigma m(3, 5, 6, 7)$

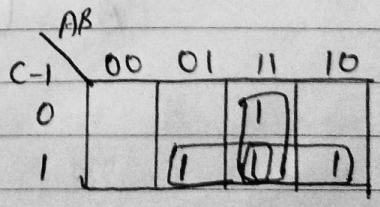
S3

S

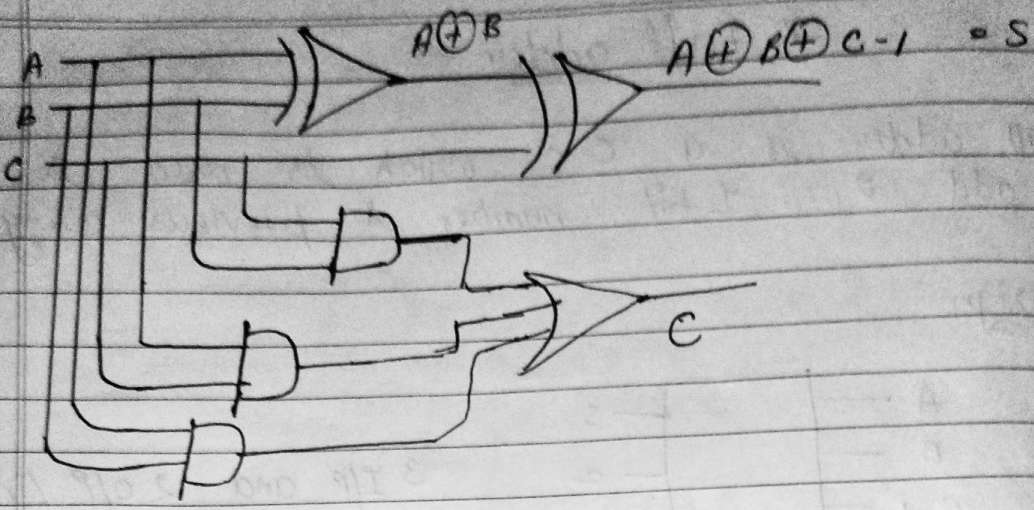


$S = A \oplus B \oplus C_{-1}$

C



$BC_{-1} + AC_{-1} + AB$



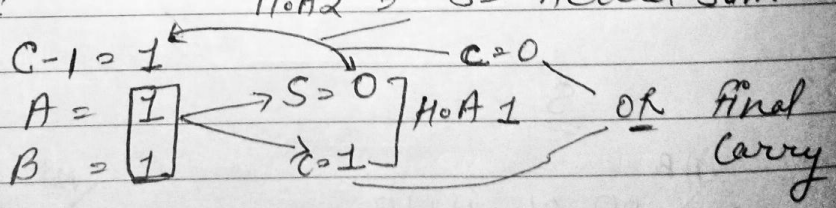
To realize full adder we need 3 AND, 1 OR (3 I/P) 2 XOR gate (or we can use 1 XOR gate, 3 I/P)

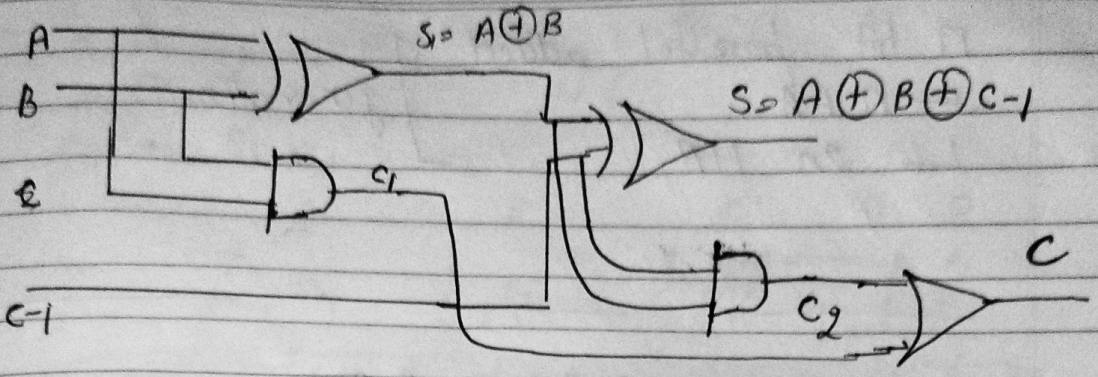
Q: How many gates req. when on 2 input gates are avaliable?

A: 2 XOR, 3 AND, 2 OR

Q: how many half adder are needed to realize full adder ? and what else do we need?

Ans: worst Case:

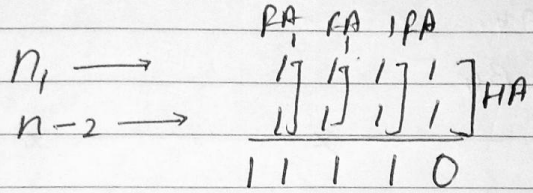




2 H.A & 1 OR gate

Q To add 2, 4 bit numbers How many HA & FA are needed

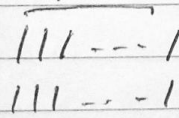
Worst case



1 HA & 3FA or 4FA or 7HA

Q: To add 2, nbit number How many HA & FA are needed?

A



1 HA & (n-1) FA or n FA or ~~4A 2n HA~~

1 + 2(n-1) → 1 + 2n - 2

2n - 1 HA

Q How many HA & FA are needed to design 4 bit parallel adder (Ripple carry adder)

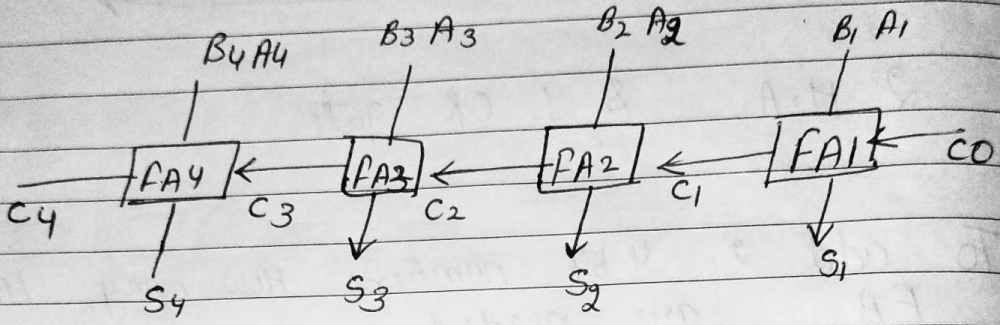
↓

2, 4bit No. and previous carry

A 4 FA or 8 HA

n bit parallel added
- n FA
- 2n HA

] generalized



$n_1 \longrightarrow A_1\ A_2\ A_3\ A_4$

$n_2 \longrightarrow B_1\ B_2\ B_3\ B_4$

BCD adder

Lecture 25

A Combinational circuit which is used to add 2, BCD no. & previous carry

(BCD no. — 4 bit)

valid BCD 0–9

0111	— 7	
1000	— 8	
1111	— 15 invalid BCD	
0110		
10101	—	
(15)10		

1000	— 8
Carry 1000	— 8
10000	
0110	
1 0110	
(16)10	