EE5811

MODULE-6. ADDERS

FULL ADDER:

	A	B	C_{in}	S	Cout	Cout
(DEL) KILL →	0	0	0	0	0	0
(DEL) KILL →	0	0	1	1	0	0
PROP →	0	1	0	1	0	C_{in}
PROP →	0	1	1	0	1	C_{in}
PROP →	1	0	0	1	0	C_{in}
PROP →	1	0	1	0	1	C_{in}
GEN →	1	1	0	0	1	1
GEN →	1	1	1	1	1	1

$D = \bar{A}\bar{B}$

$P = A \oplus B$

$G = AB$
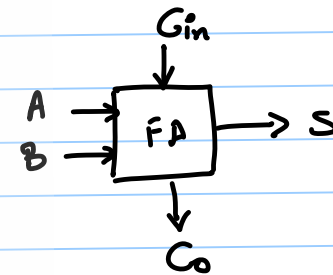
$\left.\right\}$ NOT A FUN OF C_{in}

$A \rightarrow A[0:N-1]$

$B \rightarrow B[0-N-1]$

$S = A + B;$

$A_{N-1} B_{N-1}$ $A_2 B_2$ $A_1 B_1$ $A_0 B_0$
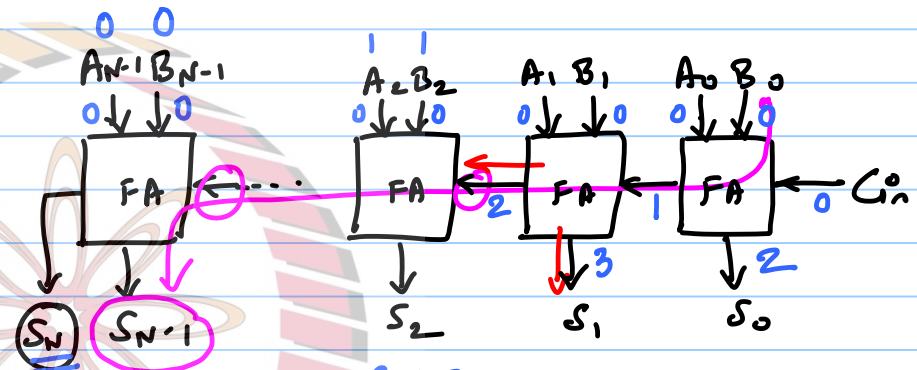
$G = A_2 B_2$

$P = A_2 \oplus B_2$

OK TO DELAY SUM GEN BUT OPTIMIZE COUT GEN

DELAY OF A RIPPLE ADDER

$$t_{ripple} = (N-1)\, t_{CARRY} + t_{SUM}$$

A	B	Cin	S	Cout
0	0	0	0	0
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

$$\overline{S} = \sum m(0, 3, 5, 6)$$
$$S = \sum m(1, 2, 4, 7)$$
$$C_{out} = \sum m(3, 5, 6, 7)$$
$$\overline{C_{out}} = \sum m(0, 1, 2, 4)$$

BOTH SUM & COUT ARE MIRROR CIRCUITS.

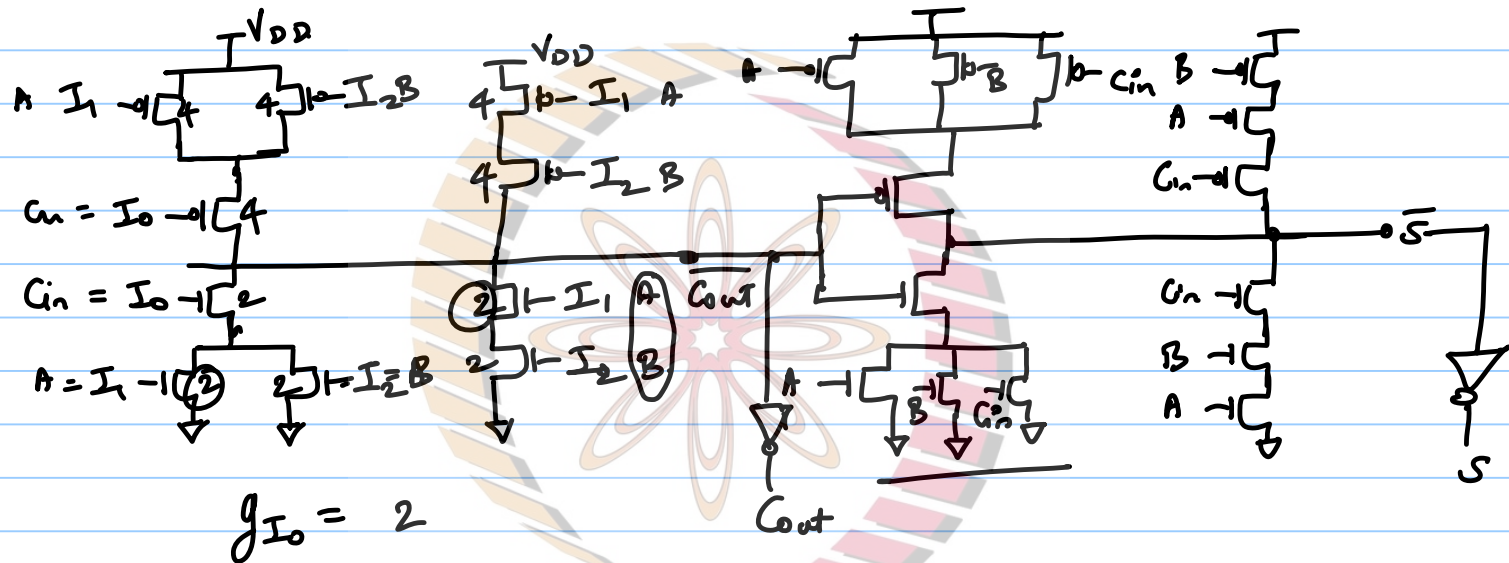$$S = \sum m(1, 2, 4, 7)$$
$$\overline{C_{out}} = \sum m(0, 1, 2, 4)$$

$$C_{out} = AB + BC_{in} + C_{in}A$$
$$S = A \oplus B \oplus C_{in}$$
$$= A(\overline{B \oplus C_{in}}) + \overline{A}(B \oplus C_{in})$$
MIRROR $\longrightarrow$ $\quad = A(BC_{in} + \overline{B}\,\overline{C_n}) + \overline{A}(B\overline{C_n} + \overline{B}C_n) \quad \leftarrow$ NEED $A/\overline{A}, B/\overline{B}$

$C/\overline{C}$

$\underbrace{m(7)}$

$$\longrightarrow S = \overbrace{ABC_{in}} + \overline{C_{out}}(A + B + C_{in})$$

$\underbrace{\phantom{(A+B+C_{in})}}_{= 0 \ (A = B = C_{in} = 0)}$

STACK IS HUGE

$$g_{I_0} = 2$$

$$g_{I_1} = g_{I_2} = 4$$

Cin Connected to least LE & Tr closest to o/p.

$$S = ABC_{in} + \overline{C_{out}}\,(A+B+C^0_{in})$$

$$S = ABC_{in} + \overline{C_{out}} \; (\overline{\overline{A}\,\overline{B}\,\overline{C_{in}}})$$

$$= ABC_{in} + \overline{C_{out}} \; (A + B + C_{in})$$
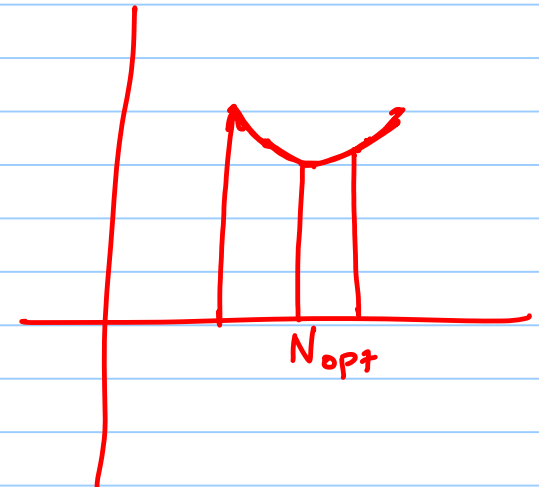
Quiz - II

$$F = 3^4 = 81$$
$$f = F^{1/4} = 3$$

$$\text{delay} = 20 = 4 \times 3 + 8$$

$$d = 5 \times (81)^{1/5} + 8 + 1$$

$$\sin(2\pi t) \longrightarrow 1 \, Hz$$