

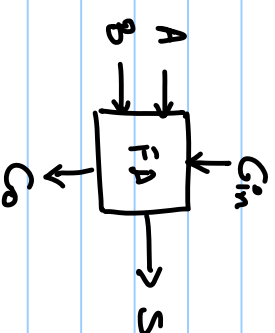
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EE5811

Module-6 - Adders

Full Adder:

	A	B	C <sub>in</sub>	S	C <sub>out</sub>	C <sub>out</sub>
(DEL) KILL →	0	0	0	0	0	0
(DEL) KILL →	0	0	1	1	0	0
PROP →	0	1	0	1	0	C <sub>in</sub>
PROP →	0	1	1	0	1	C <sub>in</sub>
PROP →	1	0	0	1	0	C <sub>in</sub>
PROP →	1	0	1	0	1	C <sub>in</sub> .
Gen →	1	1	0	0	1	1
Gen →	1	1	1	1	1	1



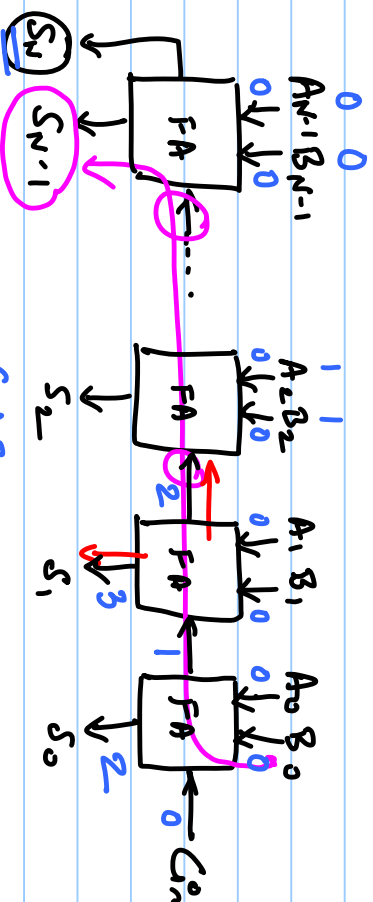
$$\left. \begin{array}{l} D = \bar{A}B \\ P = A \oplus B \\ G = AB \end{array} \right\} \text{Not A Full}$$

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

$$S = A + B;$$

OK TO DELAY SUM GEN BUT OPTIMIZE CARRY GEN

DELAY OF A RIPPLE ADDER



$$G = A_2 B_2$$

$$P = A_2 \oplus B_2$$

$$t_{\text{ripple}} = (N-1) t_{\text{carry}} + t_{\text{sum}}$$

A	B	C <sub>in</sub>	S	C <sub>out</sub>
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

$$S = \sum m(0, 3, 5, 6)$$

$$S = \sum m(1, 2, 4, 7)$$

$$C_{out} = \sum m(3, 5, 6, 7)$$

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

BOTH SUM & C<sub>out</sub> ARE  
MIRROR CIRCUITS.

$$S = \sum m(1, 2, 4, 7)$$

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

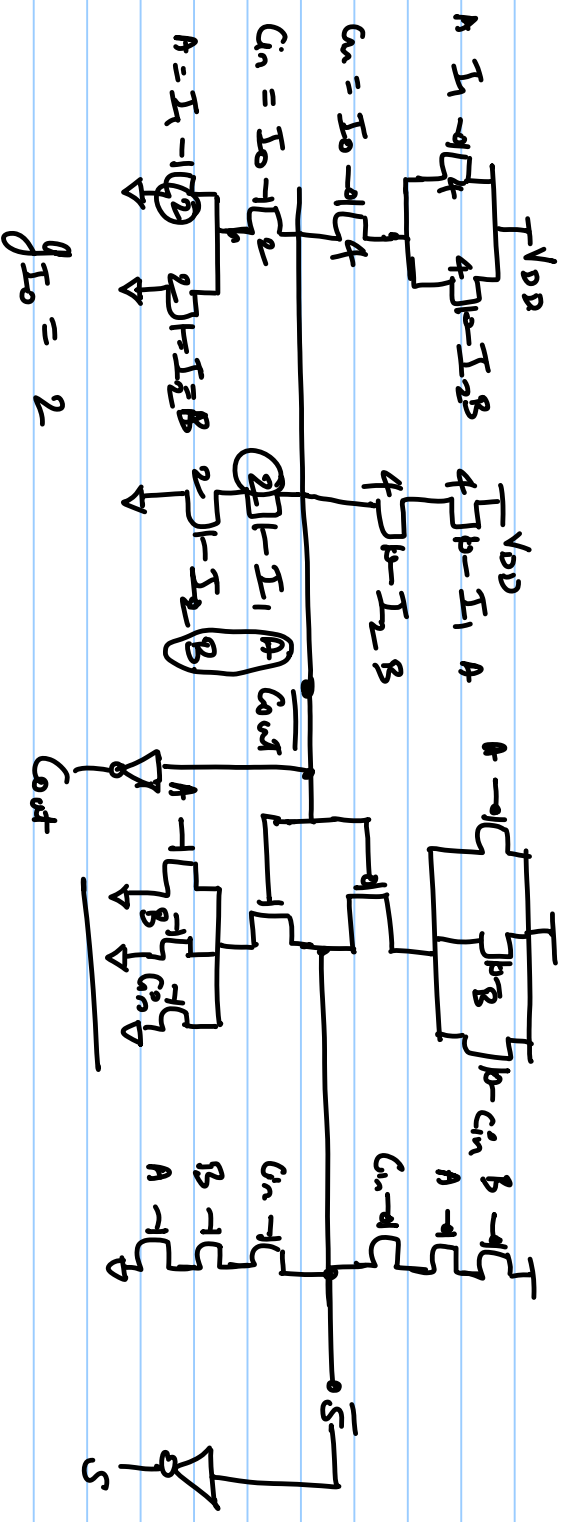
$$C_{out} = AB + BC_{in} + C_{in}A$$

$$S = A \oplus B \oplus C_{in}$$

$$= A(B \oplus C_{in}) + \bar{A}(B \oplus C_{in})$$

$$MIRROR \rightarrow = A(BC_{in} + \bar{B}\bar{C}_{in}) + \bar{A}(BC_{in} + \bar{B}C_{in}) \leftarrow \text{NEED } A/\bar{A}, B/\bar{B} \text{ OF } C/\bar{C}$$

$$\rightarrow S = \underbrace{ABC_{in} + \overline{C_{out}}}_{\text{STACK IS HUGE}} (A + B + C_{in}) = 0 \text{ (A=B=C}_{in}=0)$$



$$g_{I_0} = 2$$

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

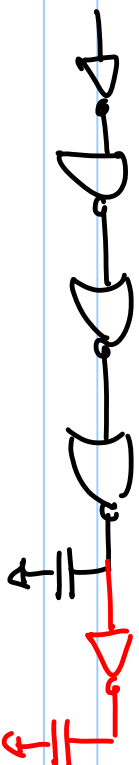
$C_{in}$  Connected to least LE & Tr closest to o/p.

$$S = A B C_{in} + \overline{C_{out}} (A + B + C_{in}^2)$$

$$S = AB C_n + \overline{C_n} (\overline{A B C_n})$$

$$= \underline{AB C_n + \overline{C_n} (A + B + C_n)}$$

## Quiz - II



$$F = 3^4 = 81$$

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

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

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

$$\sin(2\pi t) \rightarrow 1 \text{ Hz}$$

