CSM151B Hw3

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Fan-in	Delay
1	T
2	2T
3	3T
4	5T
5	7T
6	10T
7+	2T×fan-in

$G_0 = A_0 \cdot B_0 = \boxed{2T}$

$P_0 = A_0 \oplus B_0 = \boxed{2T}$

$G_{\alpha} = G_0 \cdot P_1 \cdot P_2 + G_1 \cdot P_2 \cdot P_3 + G_2 \cdot P_3 + G_3 = 2T + 5T + 5T = \boxed{12T}$

$P_{\alpha} = P_0 \cdot P_1 \cdot P_2 \cdot P_3 = 2T + 5T = \boxed{7T}$

$C_{12} = G_{\delta} + G_{\beta} \cdot P_{\gamma} + \underbrace{G_{\alpha} P_{\beta} P_{\delta}}_{12T+3T} + \underbrace{C_0 \cdot P_{\alpha} \cdot P_{\beta} \cdot P_{\gamma}}_{7T+5T}$

$= (12T + 3T) + 5T = \boxed{20T}$

$C_{15} = G_{14} + G_{13} \cdot P_{14} + G_{12} \cdot P_{13} \cdot P_{14} + C_{12} \cdot P_{12} \cdot P_{13} \cdot P_{14} \quad = 20T + 5T + 5T = \boxed{30T}$ (20T)

$C_{16} = G_{\delta} + G_{\gamma} \cdot P_{\delta} + G_{\beta} P_{\delta} P_{\delta} + \underbrace{G_{\alpha} \cdot P_{\beta} \cdot P_{\delta} \cdot P_{\delta}}_{12T+5T} + \underbrace{C_0 P_{\alpha} \cdot P_{\beta} \cdot P_{\gamma} \cdot P_{\delta}}_{7T+7T}$

$= 17T + 7T = \boxed{24T}$

$S_{15} = (A_{15} \oplus B_{15}) \oplus C_{15} = 30T + 2T = \boxed{32T}$

$C_{20} = G_{19} + G_{18} P_{19} + G_{17} \cdot P_{18} \cdot P_{19} + G_{16} \cdot P_{17} \cdot P_{18} \cdot P_{19} + C_{16} \cdot P_{16} \cdot P_{17} \cdot P_{18} \cdot P_{19}$

$= 2T + 7T + 7T = \boxed{16T}$

* Note that $C_{16} = 0T$

$S_{14} = (A_{14} \oplus B_{14}) \oplus C_{14}$

$C_{14} = G_{18} + G_{17} \cdot P_{18} + G_{16} \cdot P_{17} \cdot P_{18} + C_{16} \cdot P_{16} \cdot P_{17} \cdot P_{18}$

$= 2T + 5T + 5T = \boxed{12T}$

$S_{14} = 12T + 2T = \boxed{14T}$

$C_{24} = G_{23} + G_{22}P_{23} + G_{21}\cdot P_{22}\cdot P_{23} + G_{20}\cdot P_{21}\cdot P_{22}\cdot P_{23} + \underbrace{G_{19}\cdot P_{20}\cdot P_{21}\cdot P_{22}\cdot P_{23}}_{16T+7T}$

$= 10T + 7T + 7T = \boxed{30T}$

$C_{31} = G_{30} + G_{29}P_{30} + G_{28}\cdot P_{29}\cdot P_{30} + G_{28}\cdot P_{28}\cdot P_{29}\cdot P_{30}$

$C_{28} =$ delay $[C_{24}] + 7T + 7T = \boxed{44T}$

$C_{31} = 44T + 5T + 5T = \boxed{54T}$

$C_{32} = [G_{31} + G_{30}P_{31} + G_{29}P_{30}P_{31} + G_{28}P_{29}P_{30}P_{31} + C_{28}P_{28}P_{29}P_{30}P_{31}] +$ delay [MUX]

$= 44T + 7T + 7T + 4T = \boxed{62T}$

$S_{31} = (A_{31} \oplus B_{31}) \oplus C_{31} + MUX = 54T + 2T + 4T = \boxed{60T}$

Therefore, the maximum delay is $\boxed{62T}$