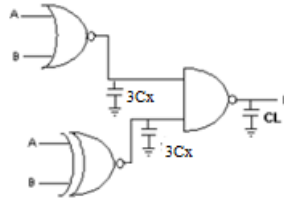


CSE 493/593 FALL 2023 – HOMEWORK 4

1. Consider the circuit in Fig. 1. Assume that all input combinations are equally likely. Let  $C_x=0.8fF$ , and  $C_L=12fF$ .
  - a. Calculate the activity factor for the output (F).
  - b. Calculate the dynamic power consumption if the inputs are switching at rate of 200MHz at a supply voltage of 2.5V

(Hint 1: If input probabilities are not given, consider them to be 0.5)

(Hint 2: For total dynamic power consumption, calculate and add dynamic power consumption for all gates)



2. For the circuit shown in Fig. 2, derive the transitional probability  $P_{0 \rightarrow 1}$ , given  $P_A = 0.3$ ,  $P_B = 0.5$ ,  $P_C = 0.8$ ,  $P_D = 0.4$ .  $P_A$ ,  $P_B$ ,  $P_C$  and  $P_D$  indicate the probabilities that A, B, C and D are 1 respectively.

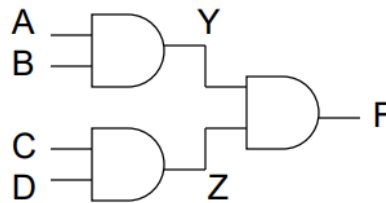


Fig. 2

3. Compute the switching probability of the output node F for both the chain and tree implementations of the circuit.  $P(A=1) = P(B=1) = P(C=1) = P(D=1) = 0.3$ . Which is better with regard to dynamic power?

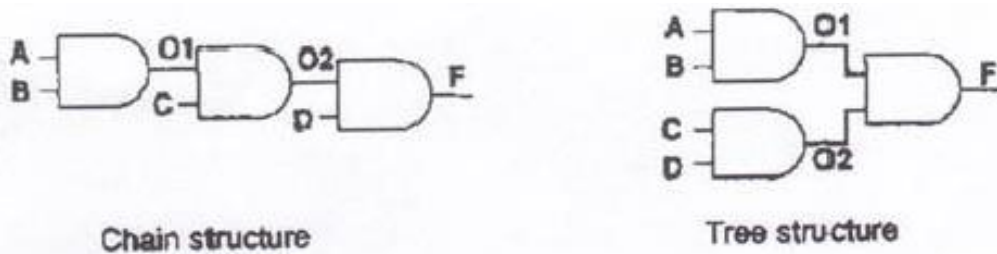


Fig. 3

4. Considering the logic circuit in Fig. 3, identify the critical path. Describe how you can achieve low power using
  - a. Multi- $V_{DD}$  technique
  - b. Multi- $V_T$  technique.
 Justify your answer.

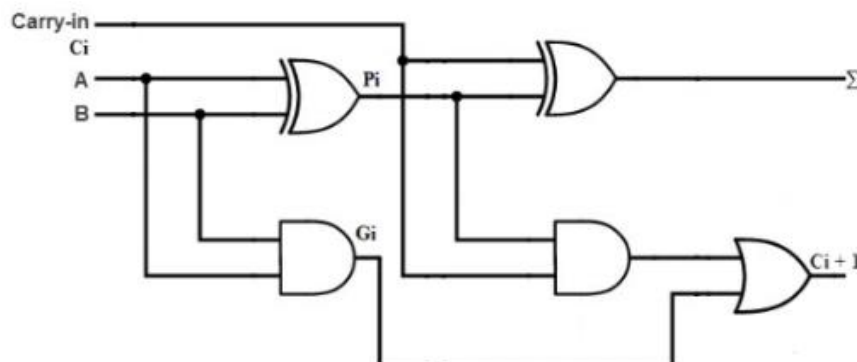


Fig. 4