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COE 360, Principles of VLSI Design, Term 981
Quiz# 4

Date: Saturday, May 8

- (I) A depletion-load inverter has an output low voltage V_{OL} of 0.2V when $\beta_{load}/\beta_{driver}=1/6$. Assuming $(W/L)_{load}=1/3$, determine $(W/L)_A$, $(W/L)_B$, $(W/L)_C$, $(W/L)_D$, and $(W/L)_E$ for the circuit shown below such that the worst case $V_{OL}=0.2V$.

(II) Given a CMOS inverter with $\beta_n=2.5\beta_p$, $V_{tn} = 1.0 \text{ V}$, $V_{tp} = -0.8\text{V}$, and $V_{DD}=5\text{V}$.

1. Show that

$$V_{th} = \frac{V_{tn} + \sqrt{\frac{\beta_p}{\beta_n}}(V_{DD} + V_{tp})}{\left(1 + \sqrt{\frac{\beta_p}{\beta_n}}\right)}$$

2. Compute the value of the inverter threshold, V_{th}

3. For what ratio of β_n/β_p the inverter threshold voltage, $V_{th}=2.5 \text{ Volts}$.