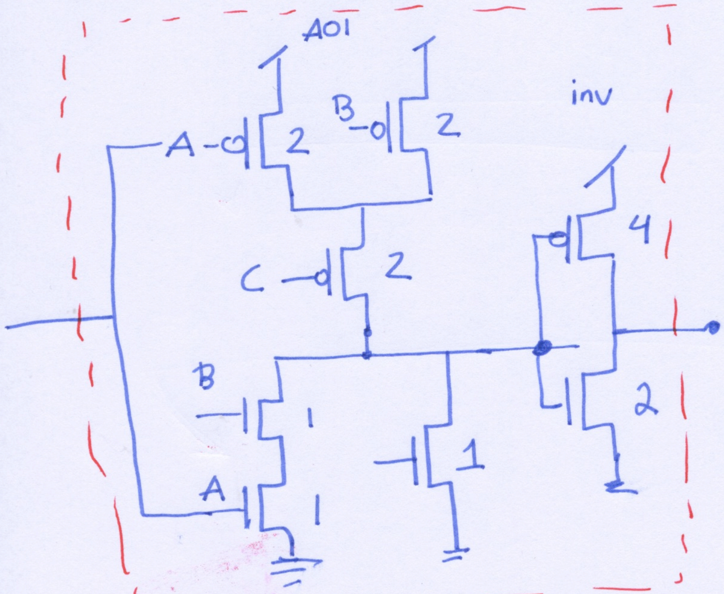
Exam 131021

Regarding problem 6 g & p for AO gate

How to derive p & g for AO gate



AO gate

inverter:

$g_{inv} = 1$

$p_{inv} = p_{inv}$

$g_{AOI_A} = \frac{3RC}{\frac{3}{2} \cdot RC} = \frac{6}{3} = 2$

$p_{AOI} = \frac{4 \cdot RC}{\frac{3}{2} RC} \cdot p_{inv} = \frac{8}{3} \, p_{inv}$

We should now view the two cells together as one cell

Step one: write down the normalized delay for entire AO gate $d_{AO} = \underbrace{p_{AOI} + g_{AOI_A} \cdot h_{AOI} + p_{inv}}_{\text{constant part } = p_{AO}} + \underbrace{g_{inv} \cdot h_{inv}}_{C_{LOAD} \text{ dependent part should give } g_{AO} \cdot h_{AO}}$

constant part: does not depend on C_{LOAD}

$p_{AO} = \frac{8}{3} p_{inv} + 2 \cdot \frac{6C}{3C} + p_{inv} =$

$\frac{13}{3} \cdot p_{inv} + 4$

load dependent part: $g_{inv} \cdot h_{inv} = g_{inv} \cdot \underbrace{\frac{C_{LOAD}}{C_{IN\,inv}}}_{= h_{inv}}$

but for the AO gate we have $h_{AO} = \frac{C_{LOAD}}{C_{IN\,AO}}$

so we use $g_{inv} \cdot \frac{C_{LOAD}}{C_{IN\,inv}} = \underbrace{g_{inv} \cdot \frac{C_{IN\,AO}}{C_{IN\,inv}}}_{\text{gives } g_{AO}} \cdot \underbrace{\frac{C_{LOAD}}{C_{IN\,AO}}}_{\equiv h_{AO}}$

model for AO gate $\underbrace{\frac{13}{3} \cdot p_{inv} + 4}_{p_{AO}} \approx 8$

$g_{AO} = \frac{3C}{6C} = \frac{1}{2}$

Note! In such a case it is possible to have $g < 1$!