HW-4

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14/10/2015

Problem 1

Problem 2

Problem 3

a

t_{pLH} for C_a should equals to t_{pLH} for C_L, hence,

$$\begin{aligned} R_n C_a ln(\frac{1}{1-\frac{\Delta V_a}{V_{DD}-V_{Tn}}}) &= R_n C_L ln(\frac{1}{1-\frac{\Delta V_{out}}{V_{DD}}}) \\ \frac{C_a}{C_L} &= \frac{ln(\frac{1}{1-\frac{\Delta V_{out}}{V_{DD}}})}{ln(\frac{1}{1-\frac{\Delta V_a}{V_{DD}-V_{Tn}}})} \\ &= ln(\frac{1}{1-\frac{\Delta V_{out}}{V_{DD}}} - \frac{1}{1-\frac{\Delta V_a}{V_{DD}-V_{Tn}}}) \end{aligned} \tag{1}$$

For $\Delta V_{out} = 0.6V$, $\Delta V_a = 1.4V$, thus $\frac{C_a}{C_L} =$.
For $\Delta V_{out} = 0.8V$, $\Delta V_a = 1.2V$, thus $\frac{C_a}{C_L} =$.
Thus, $\leq \frac{C_a}{C_L} \leq$.

b

For (i) A = 0, B = 0 to 1:
C_a is charged in precharge phase. Thus both C_L and C_a need to be discharged in evaluation phase.
For (ii) B = 1, A = 0 to 1:
Only C_L is charged in precharge phase. Thus only C_L needs to be discharged in evaluation phase.
Thus, case (ii) results in the lower high-to-low delay.