HW Buffer

(1) $N_{opt} = \ln\left(\frac{C_l}{C_0}\right) \Rightarrow \ln\left(\frac{40pF}{50fF}\right) \approx 6$

$\beta_{opt} = \left(\frac{40pF}{50fF}\right)^{\frac{1}{6}} = (800)^{\frac{1}{6}} = 3.047$

Relatives sizes of inverters are 1, 3.05, 9.28, 28.3, 86.2, 263

delay of $3.05\tau_0$

Total delay = N (delay of each) $\Rightarrow$ $6(3.05\tau_0) = 18.3\tau_0$

for $N = 7$

$\beta = (800)^{\frac{1}{7}} = 2.60$

Total delay = $7(2.60\tau_0) = 18.2\tau_0$

Close $18.3\tau_0$ is total delay

(2) $N_{opt} = \ln\left(\frac{80pF}{20fF}\right) \approx 1.6$

$\beta_{opt} = \left(\frac{80}{20}\right)^{\frac{1}{6}} = 2.82$

delay of $2.82\tau_0$

Total delay = $8(2.82\tau_0) = 22.56\tau_0$