

Name: _____

Student ID #: _____

EECS 170A
Homework #8

Please do not turn your HW in **anywhere else**.

Due: Monday, December 5, 2011 at 5pm

Location: Dropbox right outside of **EH 1121**.

Please *staple* this sheet to the front of your homework.

1	2	3	4	Total
/25	/25	/25	/25	/100

- 1) Design a 3-input NAND gate and a 3-input NOR gate similar to (Fig 5.9 of the CMOS circuit pdf located in the password protected section of our website).
- 2) Draw the Band Diagram of an n-channel MOSFET with n^+ polysilicon gate in the ON and OFF state.
- 3) Oxide charges: Assume $\langle Q_{ox} \rangle = q10^{12} \text{ cm}^{-2}$ and thickness (t) = 100 nm . Also assume $\delta_{Q_{ox}} = 0.1 \langle Q_{ox} \rangle$ and a Gaussian statistical distribution. On a wafer with 10^9 devices, how many move a threshold shift $> 1V$?
- 4) DRAM: Assume $I_{leak} = 10\text{fA}$, $V_{dd} = 1V$, and $C = 10\text{pF}$. How often (roughly) must the memory be refreshed?