VLSI I

Spring 2009 (Prof. David Pan)

Homework #3: Assigned Feb. 6, due Feb 13

- 1. Problem 4.3 from the Exercises for Chapter 4.
- 2. Problem 4.4 from the Exercises for Chapter 4.
- 3. Problem 4.10 from the Exercises for Chapter 4.
- 4. Problem 4.11 from the Exercises for Chapter 4.
- Problem 4.13 from the Exercises for Chapter 4.
 (Hint: Try a design with 4 stages; 2-bit XNOR gates to check for bitwise equality, a 16-input AND function to check equality of the input words (using 4-input gates, for example), and an AND gate to choose between Y or 0).
- 6. Size the following gate so that it has the same drive strength as an inverter that has a pMOS transistor of width 3 and an nMOS transistor of width 2.



7. The n-channel transistors in the following portion of a CMOS circuit have an on-resistance of 5 KOhms. The total source and drain (diffusion) capacitances of an n-channel transistor are 5 fF each. The parasitic (wiring, etc.) capacitances are

shown lumped at the internal nodes. The output load capacitance shown (50 fF) includes the diffusion capacitance of the P-Network, wiring capacitances, and the driven gate capacitances.



(a) Assume that all load and internal capacitances have been charged to V_{DD} . Which input input vector will result in the longest t_{pdf} ? Explain your answer.

(b) Assuming all the capacitors are initially charged to V_{DD} , use the Elmore delay approximation to find the value of t_{pdf} for the input vector ABCDE = 10111.