National Chiao Tung University
Dept. of Computer & Information Science
Introduction to VLSI Design, Fall 2000

October 25, 2000
Handout #6
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Homework #2 (due November 8, 2000)

Problems 1–6 are taken from the text *Modern VLSI Design*.

1. Page 99, Problem 2-2 (b) and (c). You are requested to do only the cases for 1V, 3.3V, and 5V.
2. Pages 99-100, Problem 2-3. (**Hint:** For the question, you don't need to compute all related values from the scratch! Think about the effect of related parameters.)
3. Page 100, Problem 2-10 (b). Assume that $\lambda = 0.25\mu m$, respective bottomwall and sidewall capacitances equal 0.09 $fF/\mu m^2$ and 0.03 $fF/\mu m$, and unit resistance equals $4\Omega/\square$.
4. Page 157, Problem 3-7.
5. Pages 158-159, Problem 3-13.
6. Page 159, Problem 3-14. Assume $\lambda = 0.25\mu m$, the minimum gate size is $W = 6\lambda, L = 2\lambda$, and the minimum wire width is 2λ.
7. Refer to the circuit shown in Page 119 of the lecture note. Using (a) the Penfield-Rubenstein delay model and (b) the Elmore delay model, estimate the delay for F to go from 1 to 0, when the inputs x, y, and z take on values of 010.
    - Parameters: Output loads at F, G: 0.25 pF; transistor on-resistance: $5K\Omega$; gate capacitance: 0.01 pF; drain, source capacitance: 0.005 pF.
8. Refer to the parameters $\alpha, \beta, \alpha', \beta'$ listed in Page 115 of the lecture note. Assume that driver resistance $R_d = 100\Omega$, wire length $l = 1000\mu m$ with unit width, and capacitive load $C_L = 2pF$.
    (a) Compute the Elmore delay for the unbuffered wire.
    (b) If a unit-sized buffer is available, where should we insert the buffer to minimize the Elmore delay for the buffered wire? What is the resulting delay?
9. (DIY Problem) For this problem, you are asked to design a problem *set* related to the course content covered from last homework to Chapter 3.4 and give a sample solution to your problem set. Grading on this problem will be based upon the *quality* of the designed problem as well as the *correctness* of your sample solution.