VLSI Design, Fall 2017

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Homework No. 8

Assigned November 6, 2017, due November 13, 2016

1. You have a balance scale (which will be balanced if the two sides have equal weights in them) and 12 coins. Exactly one of the coins is counterfeit and is lighter. Find the counterfeit with the minimum number of tries.
Can you find a solution for n coins? What about the case where the odd coin can be lighter or heavier?

2. An array has 100 numbers, uniquely from $0 - 100$, stored in random locations (i.e., one of the numbers is missing). How would you find the missing number?

3. Problem 5.1 from the Exercises for Chapter 5 (page 209).

4. Problem 5.2 from the Exercises for Chapter 5 (page 209).

5. Problem 5.4 from the Exercises for Chapter 5 (page 209).

6. Problem 5.5 from the Exercises for Chapter 5 (page 209).

7. Problem 5.6 from the Exercises for Chapter 5 (page 209).

8. An embedded hardware accelerator in a system-on-chip is designed in a 1 V, 90 nm process, and has 1 million logic transistors with an average width of 12λ. The gate capacitance, $C_g = 2$ fF/μm. The gates have an activity factor of 0.2.

(a) What is the maximum clock frequency if the dynamic power should not exceed 20 mW?

(b) If the subthreshold leakage is 20 nA/μm and the gate leakage is 2 nA/μm, and if half the transistors are off (on average), what is the leakage power?