Problem Set 4

Due: In class on Wednesday, March 3. Starred problems are optional.

Problem 4-1. Design a linear systolic array to recognize strings of the form ww in real time.

Problem 4-2. A ***punctuated palindrome*** is a string which, when spaces and punctuation marks are removed, is a palindrome. For example, "`A MAN, A PLAN, A CANAL: PANAMA!`" is a punctuated palindrome. Describe how to construct a linear systolic array that recognizes punctuated palindromes in real time. (*Hint:* At first glance, this problem seems resistant to efficient systolic conversion, because it requires both broadcast and accumulation, but think again.)

Problem 4-3. Show that the following two properties are equivalent for any semisystolic circuit G and integer constant $c > 0$:

- The constraint graph $cG - 1$ contains no negative-weight cycles.
- There exists a retiming of G whose clock period is at most c.

Problem 4-4. * Describe how to build a real-time modulo-m up-down counter as an $O(\lg m)$-processor linear systolic array. The counter should support the operations INCREMENT and DECREMENT, and it should output a 0 whenever the counter is $0 \bmod m$, and 1 otherwise. (*Hint:* First, solve the problem for when m is an exact power of 2.)