



Computer Architecture II – WS 05/06

(due: Monday, 28.11.2005)

Exercise 1: (Shifter)

(10 + 10 points)

Let:

$$n = 2^m \quad a, c \in \{0, 1\}^n \quad b \in \{0, 1\}^m \quad x \in [0 : n - 1]$$

For a given a and a given x the function cls is defined as:

$$cls(a, x) = (a[n - 1 - x : 0] a[n - 1 : n - x])$$

A n -bit cyclic left shifter (n -CLS) is a circuit with two inputs a, b and an output c satisfying:

$$c = cls(a, \langle b \rangle)$$

1. Construct an n -CLS for an arbitrary n and an m , i.e. $m = \lceil \log_2(n) \rceil$.
2. Prove the correctness of your construction.

Exercise 2: (Leading Zero Counter)

(10 + 10 points)

Let:

$$n = 2^m \quad a \in \{0, 1\}^n \quad c \in \{0, 1\}^m$$

For a string x , we denote the number of leading zeros of x by $lz(x)$. An n -bit leading zero counter (n -LZC) is a circuit with an input a and an output c satisfying:

$$\langle c \rangle = lz(a)$$

1. Construct an n -LZC for an arbitrary n and an m , i.e. $m = \lceil \log_2(n) \rceil$.
2. Prove the correctness of your construction.