

CS M51A

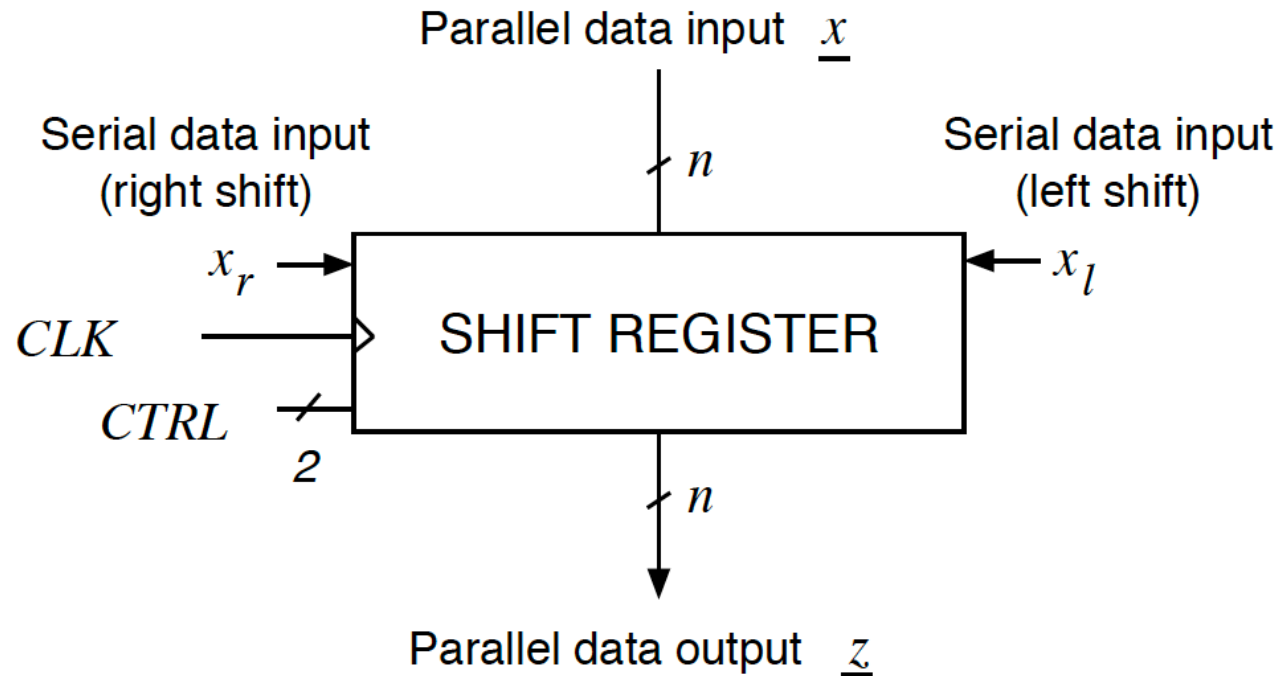
Logic Design of Digital Systems

Winter 2021

Some slides borrowed and modified from:

M.D. Ercegovic, T. Lang and J. Moreno, Introduction to Digital Systems.

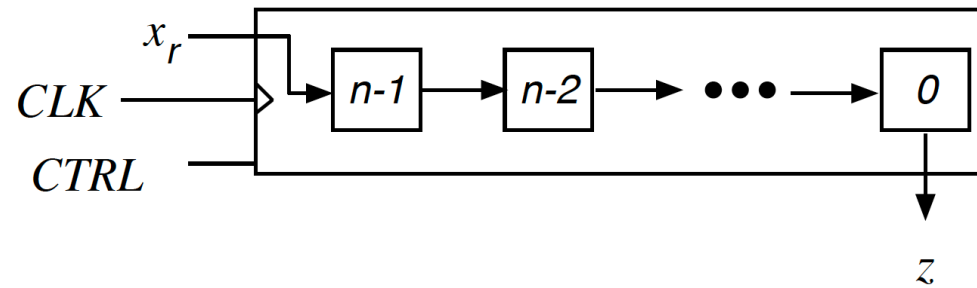
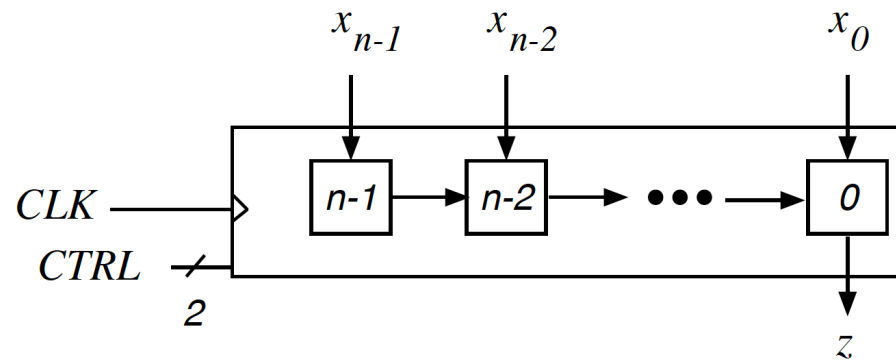
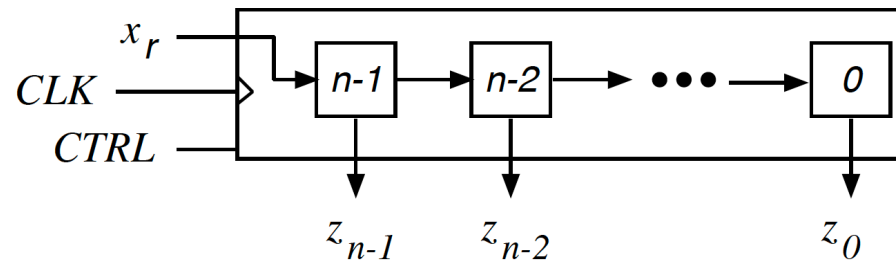
SHIFT REGISTERS



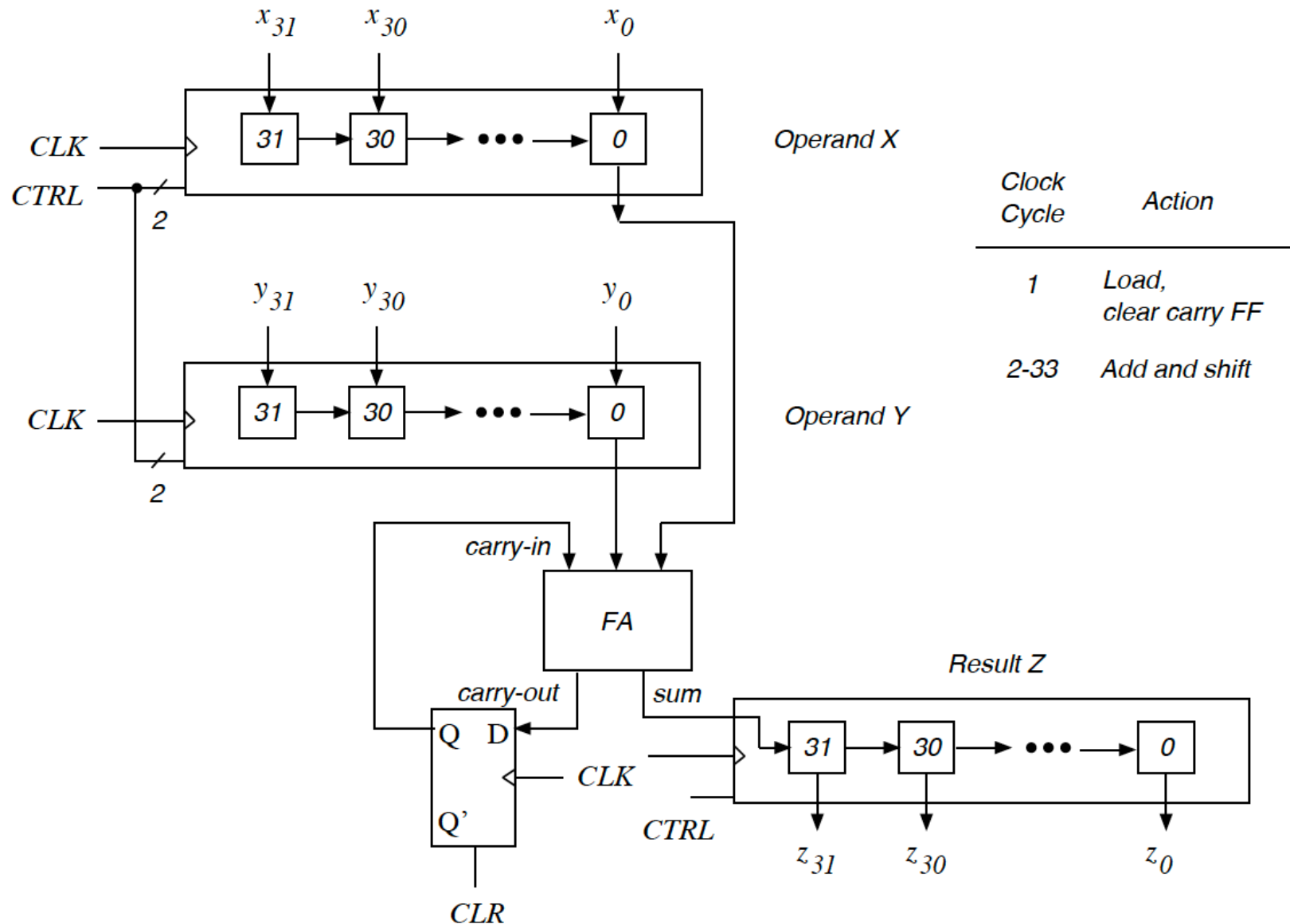
$$\underline{s}(t+1) = \begin{cases} \underline{s}(t) & \text{if } CTRL = NONE \\ \underline{x}(t) & \text{if } CTRL = LOAD \\ (s_{n-2}, \dots, s_0, x_l) & \text{if } CTRL = LEFT \\ (x_r, s_{n-1}, \dots, s_1) & \text{if } CTRL = RIGHT \end{cases}$$

$$\underline{z} = \underline{s}$$

SHIFT REGISTERS

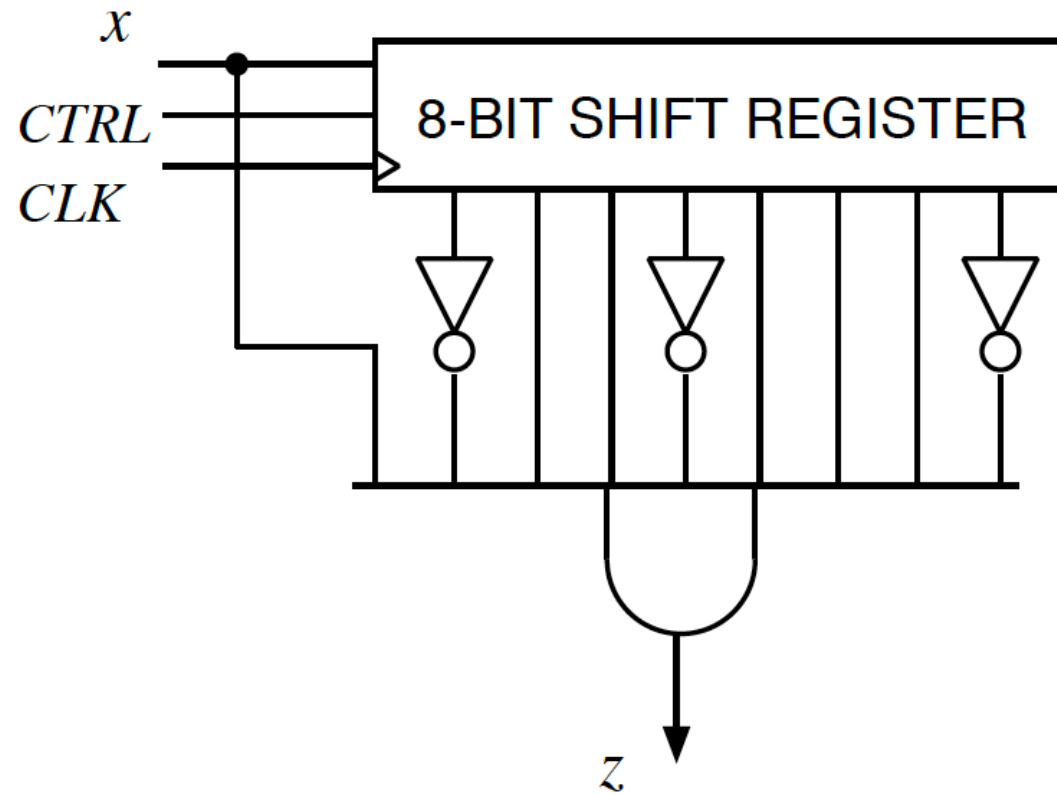


Example: Serial Adder



Example

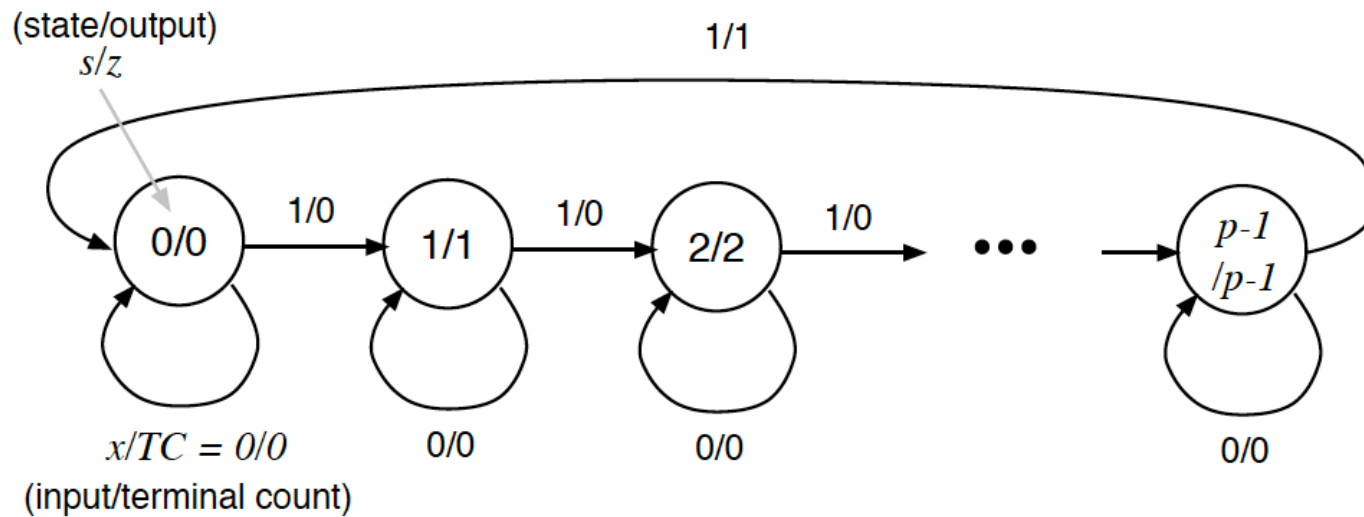
$$z(t) = \begin{cases} 1 & \text{if } \underline{s}(t) = 01101110 \text{ and } x(t) = 1 \\ 0 & \text{otherwise} \end{cases}$$



COUNTERS

- MODULO- p COUNTER

$$s(t+1) = (s(t) + x) \bmod p$$

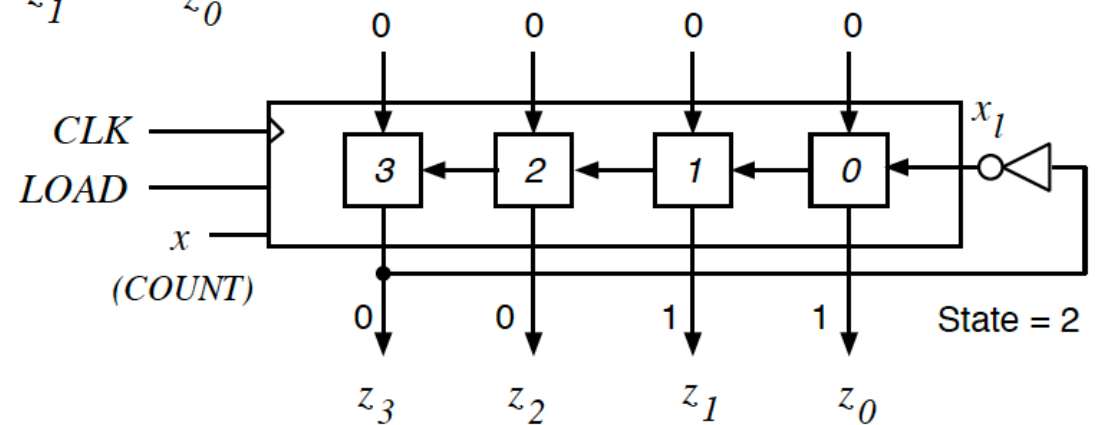
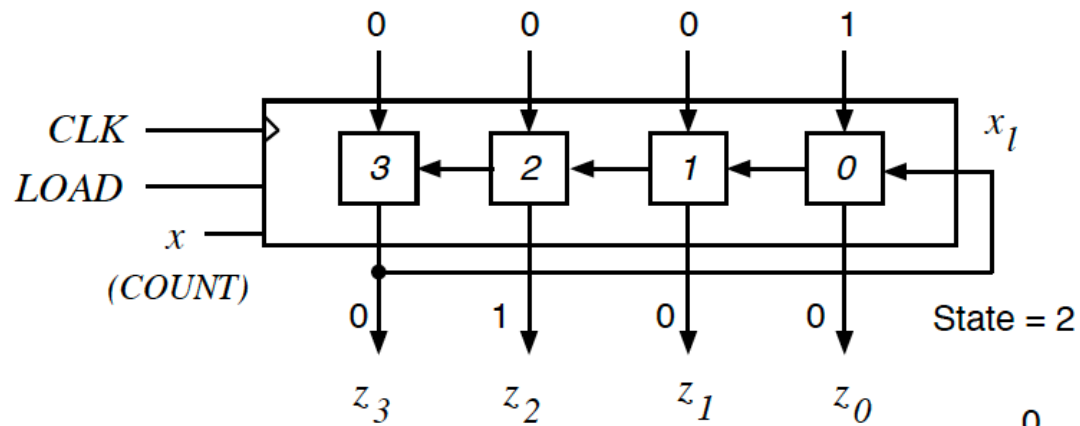


TYPES OF COUNTERS

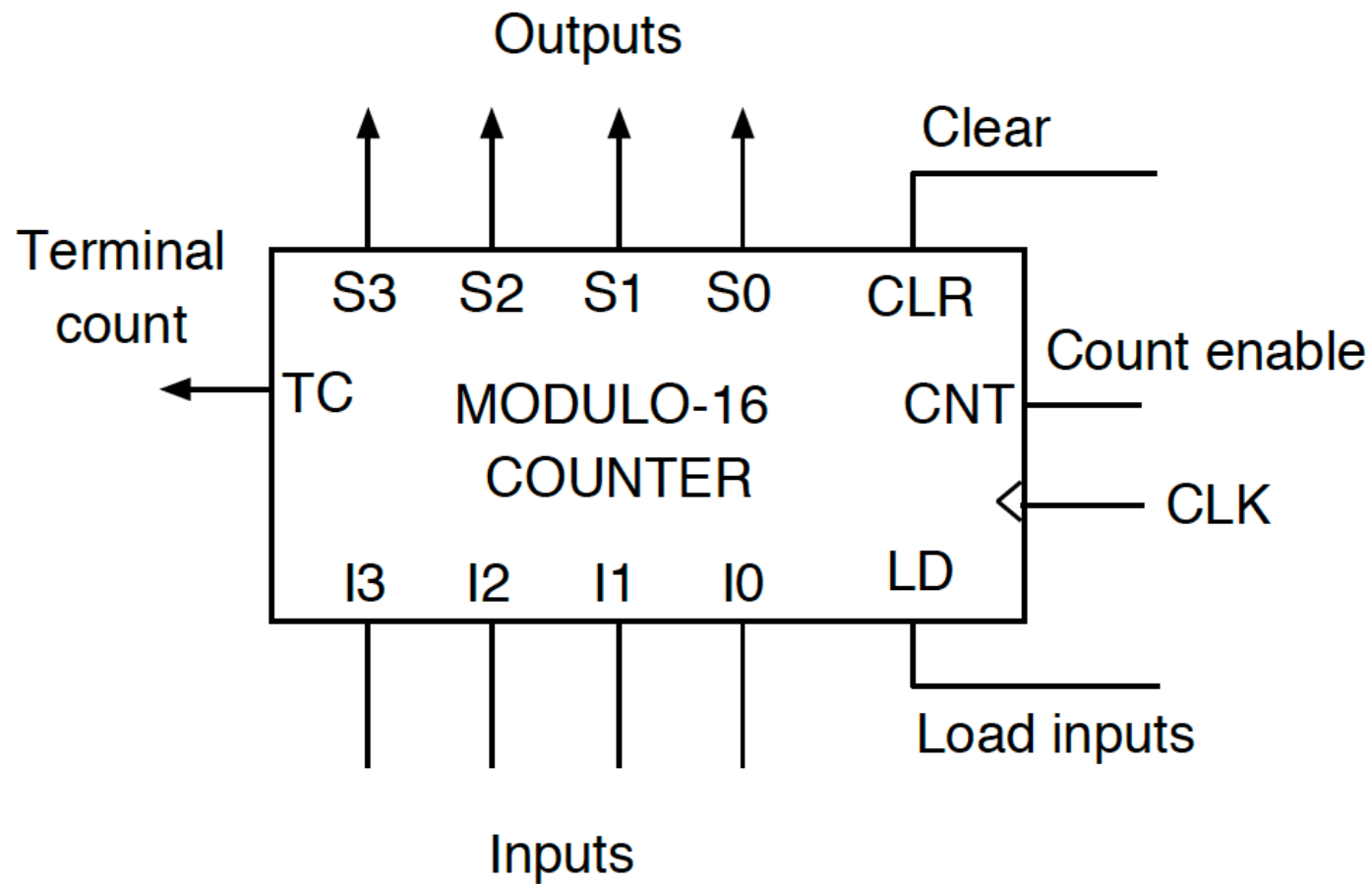
- UP or DOWN COUNTERS

State	Binary	Ring	Twisted Tail
0	000	00000001	0000
1	001	00000010	0001
2	010	00000100	0011
3	011	00001000	0111
4	100	00010000	1111
5	101	00100000	1110
6	110	01000000	1100
7	111	10000000	1000
8			
9			

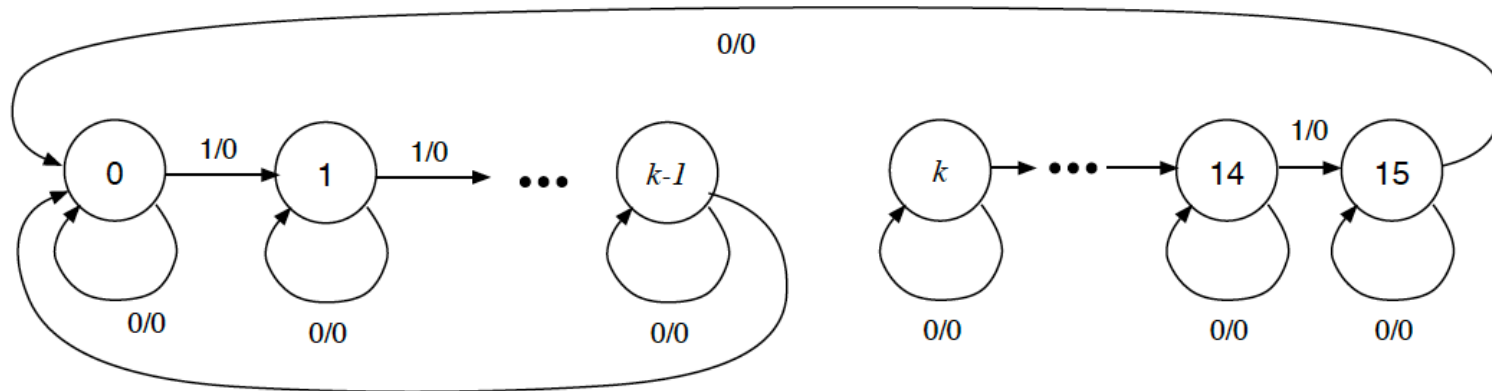
RING and TWISTED-TAIL COUNTERS



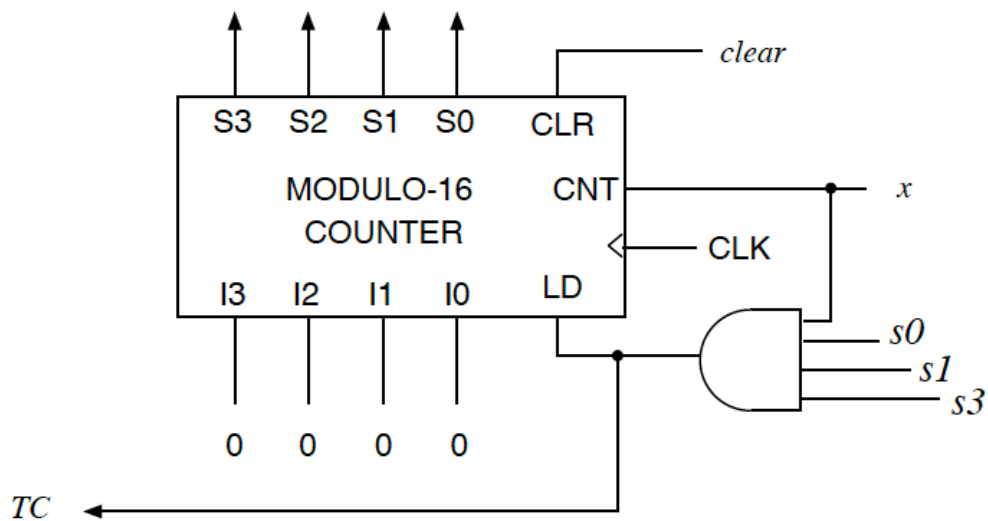
MODULO-16 COUNTER



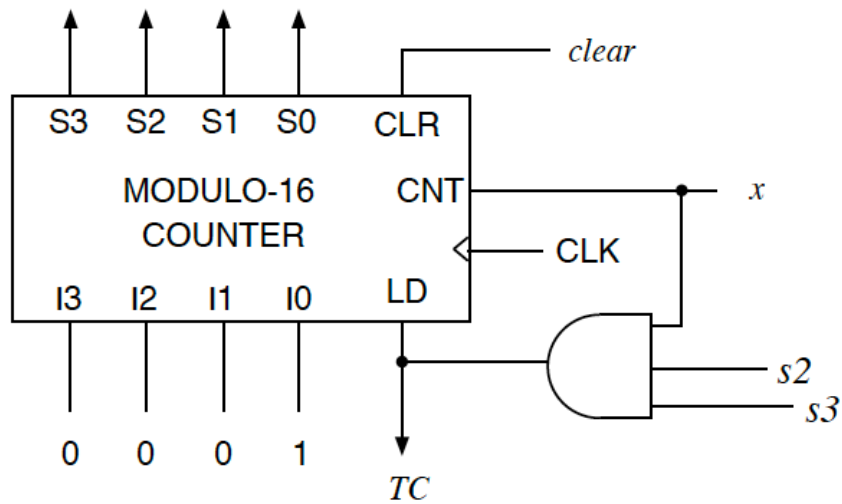
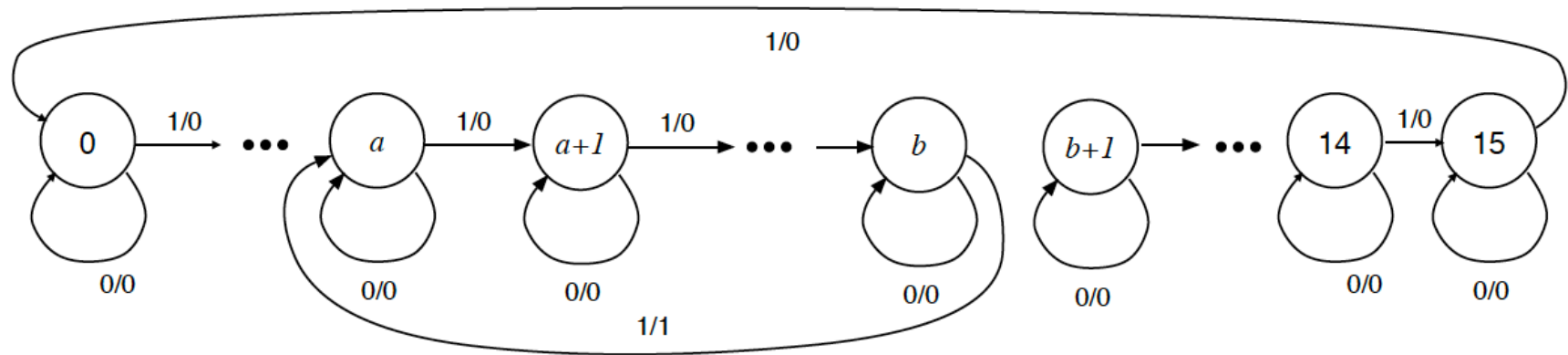
MODULO- k COUNTER ($1 \leq k \leq 16$)(cont.)



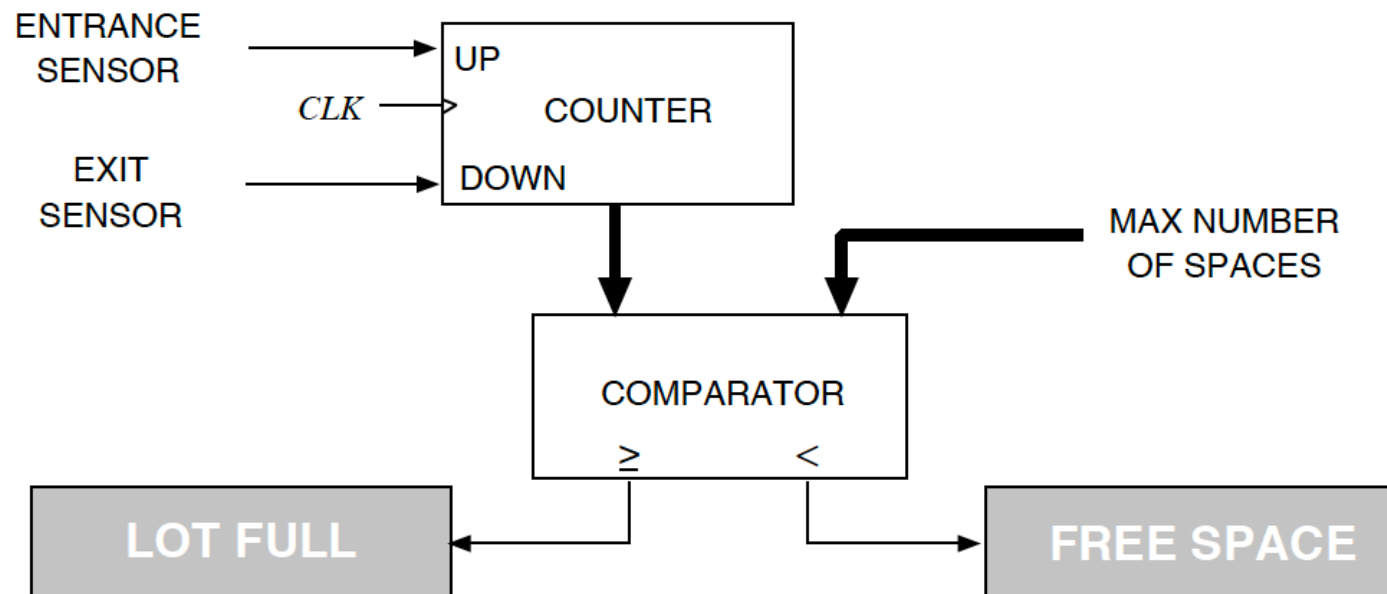
1/1

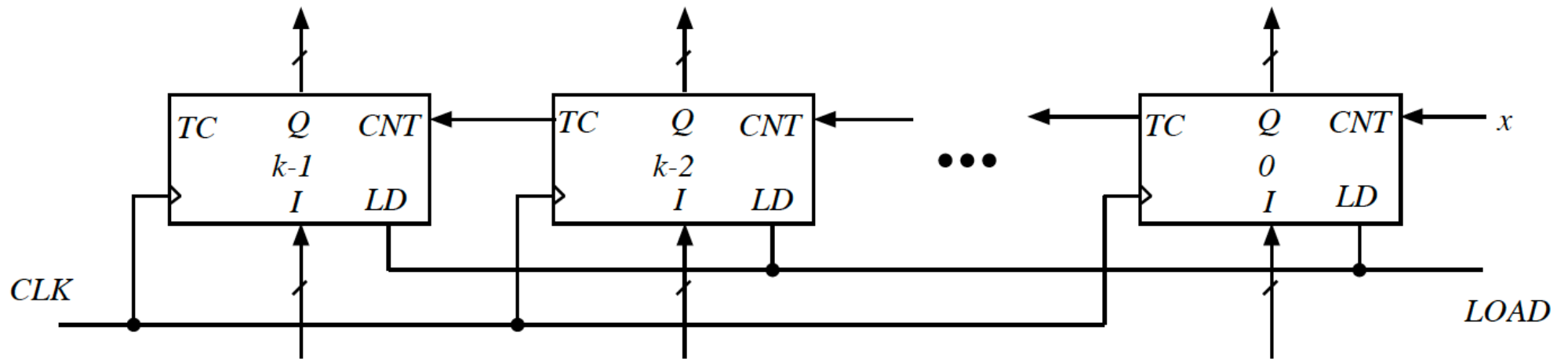


Counting a to b



USES OF COUNTERS





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