UNIVERSIDADE FEDERAL DE MINAS GERAIS
INSTITUTO DE CIÊNCIAS EXATAS
DEPARTAMENTO DE CIÊNCIA DA COMPUTAÇÃO

Curso: Bacharelado em Ciência da Computação
Disciplina: Introdução aos Sistemas Lógicos
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Lista de Exercícios 4

Exercícios Katz

- Exercícios 7.16, 7.20 e 7.28 do katz segunda edição

7.16 *(Parity Checker)* Redesign the odd parity checker FSM of Section 7.2.1 to make it check for even parity (that is, assert the output whenever the input contains an even number of 1s). Show your state diagram and implement the machine using either a *D* flip-flop.

7.20 *(Reverse Engineering)* What is the counter state diagram implied by the flip-flop implementation of Figure Ex. 7.20? Note that there are two inputs to this counter. *C* is asserted to enable counting. *D* is used to change count direction, that is, go through the sequence in reverse order.

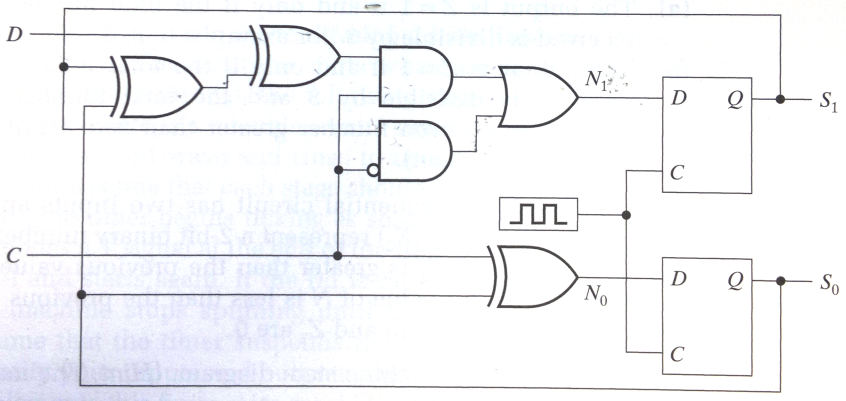

Figure Ex. 7.20 **Counter implementation to reverse engineer in Exercise 7.20.**

7.28 *(Word Problem)* Two two-way streets meet at an intersection controlled by a four-way traffic light. In the east and west directions, the lights cycle from green to yellow to red. The south-facing lights do the same thing, except that they are red when the east-west lights are green or yellow, and vice versa. However, the north-facing lights are augmented with a green left-turn arrow. They cycle red–green arrow–yellow arrow–green–yellow–red. Consider the following additional problem specifications:

(a) When the green or yellow left-turn arrows are illuminated, the lights in the other three directions are red.

(b) The timings for the north-facing lights are as follows: red, 60 seconds; green arrow, 20 seconds; yellow arrow, 10 seconds; green, 45 seconds; and yellow, 15 seconds.

(c) The timings for the other lights can be derived from specifications (a) and (b). Assume you have as many programmable timers as you need. These can be loaded with a time constant (in seconds) and assert an output when they count down to zero.

Construct a chart that shows the timing behavior of the lights in each of the four directions (*Y*-axis). List the illuminated lights for east, west, south, and north along the *Y*-axis. The *X*-axis is calibrated in the elapsed time in seconds. Show what happens in one complete cycle of the lights. How many unique configurations of the lights are there? Derive a chart, explicitly listing all input and output control signals needed to implement the traffic light system.

Exercício 4

Problem Specification Consider the following finite state machine specification: "A finite state recognizer has one input (X) and one output (Z). The output is asserted whenever the input sequence ...110... has been observed, as long as the sequence 001 has never been seen."

Implement this problem using D, T, $R-S$ and $J-K$ flip-flops. Show the state diagram, the state transition table and the implementation for each type of flip-flops.