ECN 104 Spring 2023

Sample practice problems for Sequential Circuit

5.3 Show that the characteristic equation for the complement output of a *JK* flip-flop is

$$Q'(t + 1) = J'Q' + KQ$$

5.4 A *PN* flip-flop has four operations: clear to 0, no change, complement, and set to 1, when inputs *P* and *N* are 00, 01, 10, and 11, respectively.

(a) Tabulate the characteristic table.
(b)* Derive the characteristic equation.
(c) Tabulate the excitation table.
(d) Show how the *PN* flip-flop can be converted to a *D* flip-flop.

5.6 A sequential circuit with two *D* flip-flops *A* and *B*, two inputs, *x* and *y*; and one output *z* is specified by the following next-state and output equations (HDL—see Problem 5.35):

$$A(t + 1) = xy' + xB$$
$$B(t + 1) = xA + xB'$$
$$z = A$$

(a) Draw the logic diagram of the circuit.
(b) List the state table for the sequential circuit.
(c) Draw the corresponding state diagram.

5.12 For the following state table

	Next State		Output	
Present State	$x = 0$	$x = 1$	$x = 0$	$x = 1$
a	*f*	*b*	0	0
b	*d*	*c*	0	0
c	*f*	*e*	0	0
d	*g*	*a*	1	0
e	*d*	*c*	0	0
f	*f*	*b*	1	1
g	*g*	*h*	0	1
h	*g*	*a*	1	0

(a) Draw the corresponding state diagram.
(b)* Tabulate the reduced state table.
(c) Draw the state diagram corresponding to the reduced state table.

5.16 Design a sequential circuit with two *D* flip-flops *A* and *B*, and one input *x_in*.

(a)* When *x_in* = 0, the state of the circuit remains the same. When *x_in* = 1, the circuit goes through the state transitions from 00 to 01, to 11, to 10, back to 00, and repeats.

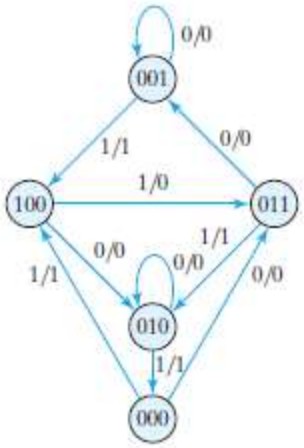

FIGURE P5.19

5.20 Design the sequential circuit specified by the state diagram of Fig. 5.19, using *T* flip-flops.