Introduction to Digital circuits (CSE3015-01)

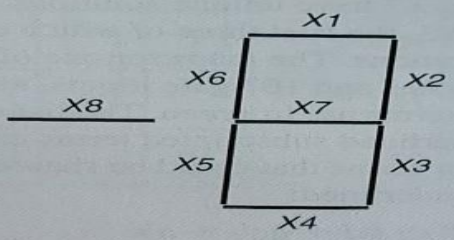
Homework # 03

Due Date: 2020-12-10 18:00

Chapter 4

Problem 14 (d)

14. You are to design a driver for an eight-segment display as described below. It has four inputs, *a, b, c, d* and eight outputs, $X1, \ldots, X8$.



This is to display the decimal equivalent of a 4-bit binary number that is in one's complement format. In one's complement, the following values are coded:

0000	0	1000	−7
0001	1	1001	−6
0010	2	1010	−5
0011	3	1011	−4
0100	4	1100	−3
0101	5	1101	−2
0110	6	1110	−1
0111	7	1111	0

(Note that the minus sign ($X8$) is lit for −1 to −7, but not for either 0 or for 1 to 7.) Segment $X1$ may or may not be lit for the digit 6; segment $X6$ is not lit for digit 7. All inputs are available both complemented and uncomplemented.

d. Implement these functions using a PLA with as few terms as possible. Show a PLA diagram.

Chapter 5

Problem 1 (d)

5.6 EXERCISES

1. For each of the following state tables, show a state diagram and complete the timing trace as far as possible (even after the input is no longer known).

d.

q	$q^\star$ $x=0$	$q^\star$ $x=1$	z $x=0$	z $x=1$
A	A	B	1	0
B	C	D	0	0
C	A	B	0	0
D	C	D	1	0

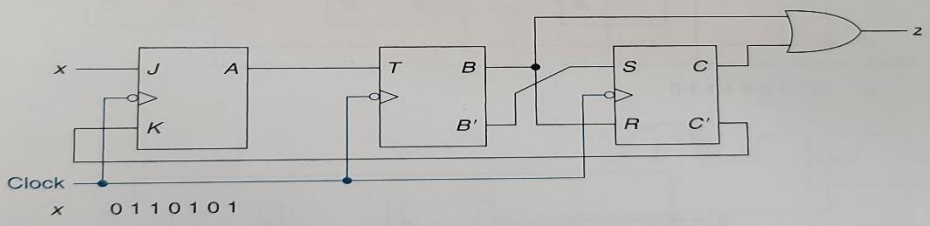
Problem 6

6. We have a new type of flip flop, with inputs A and B. If $A = 0$, then $Q^\star = B$; if $A = 1$, $Q^\star = B'$.
   a. Show a state diagram for this flip flop.
   b. Write an equation for $Q^\star$ in terms of A, B, and Q.

Problem 9(a)

9. For the following circuits, complete the timing trace as far as possible. The state of some flip flops and the output can be determined for as many as three clocks after the input is no longer known. Assume that all flip flops are initially 0.

a.



Chapter 6

Problem 3(e)

3. For each of the following state tables and state assignments, find the flip flop input equations and the system output equation for an implementation using
   i. D flip flops
   ii. JK flip flops

e.

q	$q^\star$ $x=0$	$q^\star$ $x=1$	z $x=0$	z $x=1$
A	B	D	0	0
B	D	C	1	0
C	A	B	0	0
D	C	A	1	0

q	$q_1 q_2$
A	0 0
B	0 1
C	1 1
D	1 0

Problem 9

9. Design a counter with two *JK* flip flops, *A* and *B*, and one input, *x*. If $x = 0$, it counts 1, 3, 0 and repeat; if $x = 1$, it counts 1, 2, 3 and repeat.
   a. Assume that *x* changes only when it is in state 1 or 3 (in which case there are two combinations which never occur—state 2 and $x = 0$, and state 0 and $x = 1$).
   b. After building the design of part a (with the two don't cares), what happens if somehow *x* is 0 in state 2 and what happens if somehow *x* is 1 in state 0?

Problem 15 (d)

15. For each of the following problems show a state table or a state diagram. (A sample input/output trace and the minimum number of states required is shown for each.)

d. A Mealy system that produces a 1 output iff the input has been either 0 1 0 or 1 0 1. Overlapping is allowed. When first turned on, it is in an initial state *A*. (There are four additional states.)

x 0 0 1 0 0 1 0 1 0 0 1 1 0 1 1 0 1 0 0

z 0 0 0 1 0 0 1 1 1 0 0 0 0 1 0 0 1 1 0 0

Problem 15 (g)

g. A Mealy system, the output of which is 1 iff there have been exactly two consecutive 1's followed by at least two consecutive 0's (five states).

x 0 1 1 0 0 0 1 1 0 0 1 1 0 0 1 1 1 0 0 0 0 1 1 0 0

z ? 0 0 0 1 1 0 0 0 1 0 0 0 1 0 0 0 0 0 0 0 0 0 1