

Ve270 Introduction to Logic Design

# Homework 7

Assigned: July 5, 2018

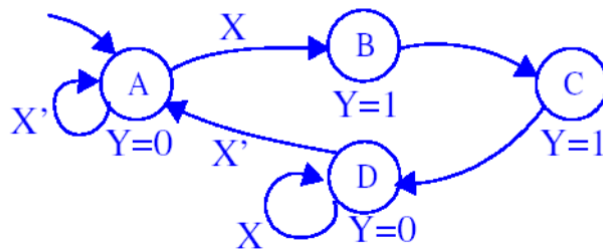
Due: July 12, 2018, 2:00pm.

The homework should be submitted in hard copies.

1. Problem 3.24. (10 points)
2. Implement a circuit for the FSM designed in Problem 3.24. (15 points)

Two ways to solve the problem:

Inputs: X, Outputs: Y



2. Inputs Outputs.

	$s_1$	$s_0$	X	Y	$n_1$	$n_0$
A	0	0	0	0	0	0
A	0	0	1	0	0	1
B	0	1	0	1	1	0
B	0	1	1	1	1	0
C	1	0	0	1	1	1
C	1	0	1	1	1	1
D	1	1	0	0	0	0
D	1	1	1	0	1	1

Y

X	$s_1 s_0$	00	01	11	10
0	0	0	1	0	1
1	0	0	1	0	1

$$Y = s_1' s_0 + s_1 s_0' = s_1 \oplus s_0$$

$n_1$

X	$s_1 s_0$	00	01	11	10
0	0	0	1	0	1
1	0	1	1	1	1

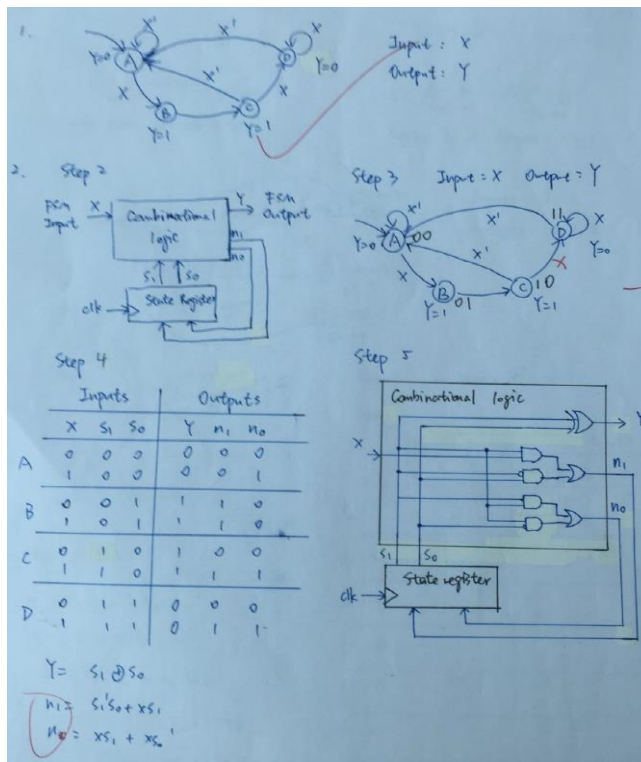
$$n_1 = s_1' s_0 + s_1 s_0' + X s_1$$

$n_0$

X	$s_1 s_0$	00	01	11	10
0	0	0	0	0	1
1	0	1	0	1	1

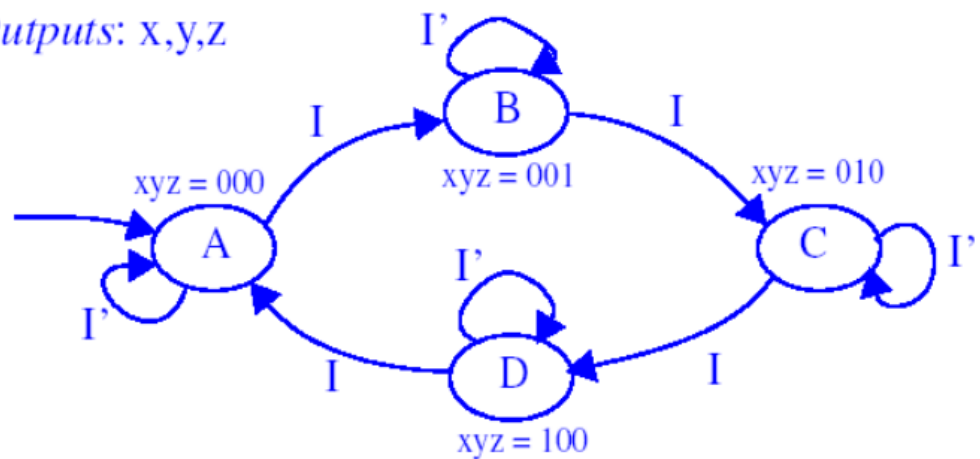
$$n_0 = X s_1' s_0' + s_1 s_0' + X s_1$$

the circuit graph is attached.



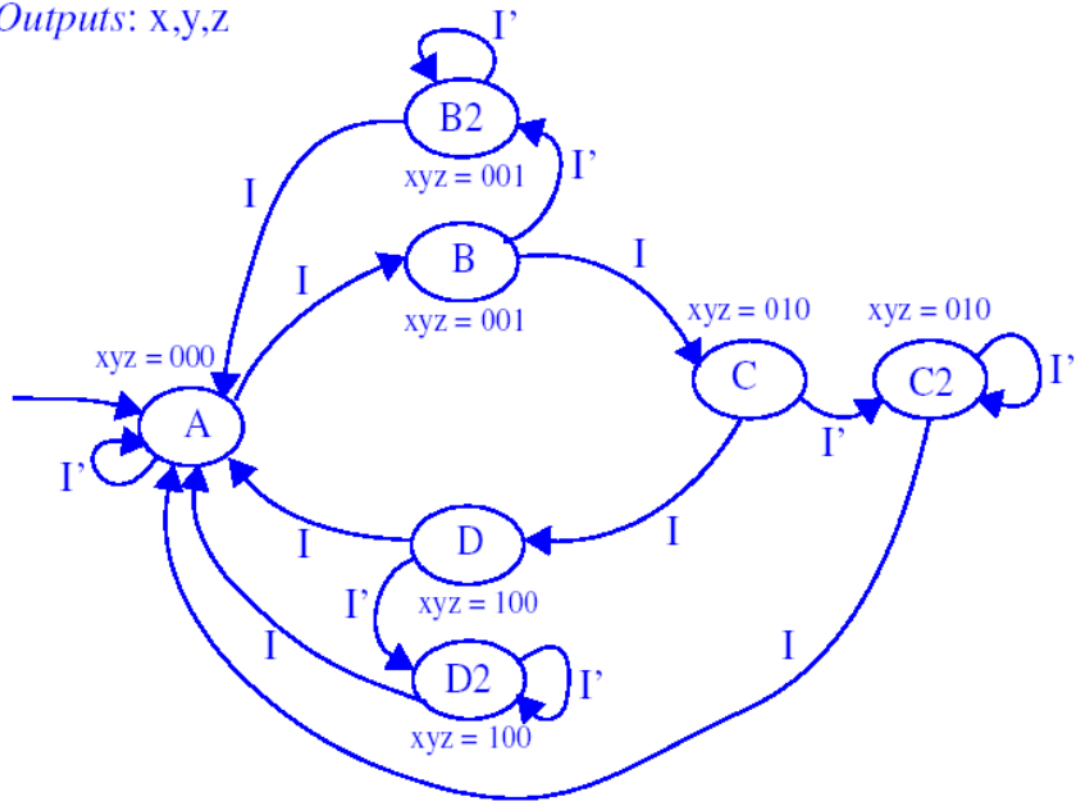
3. Problem 3.25 (10 points)

Inputs: I, Outputs: x,y,z



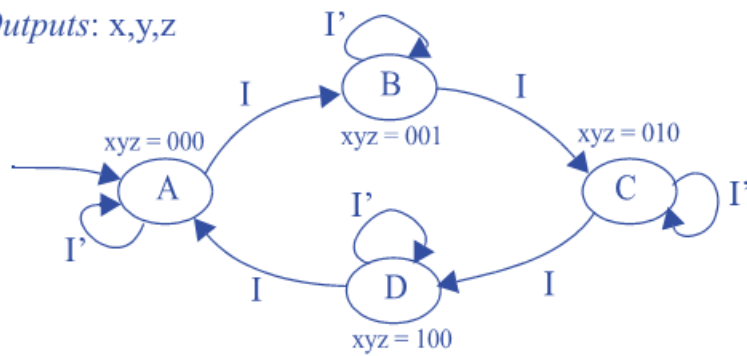
4. Problem 3.26. (10 Points)

Inputs: I, Outputs: x,y,z

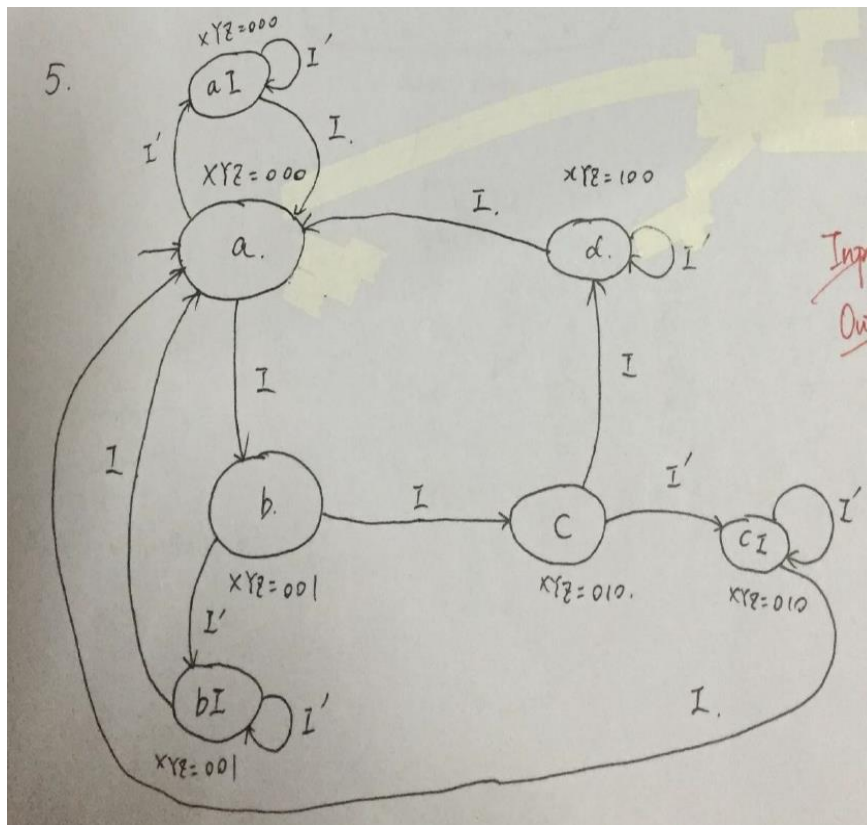


Or

Inputs: I, Outputs: x,y,z



5. Problem 3.27. (10 Points)



6. Implement a circuit for the FSM designed in Problem 3.27. (15 points)

6. present:  $s_2, s_1, s_0$ . next:  $n_2, n_1, n_0$ . output:  $X, Y, Z$ . input:  $I$ .

a: 000. aI: 001 b: 010 bI: 011 c: 100  
cI: 101 d: 110.

inputs

	$s_2$	$s_1$	$s_0$	$I$
a:	0	0	0	0
	0	0	0	1
aI:	0	0	1	0
	0	0	1	1
b:	0	1	0	0
	0	1	0	1
bI:	0	1	1	0
	0	1	1	1
c:	1	0	0	0
	1	0	0	1
cI:	1	0	1	0
	1	0	1	1
d:	1	1	0	0
	1	1	0	1
111:	1	1	1	0
(d3):	1	1	1	1

outputs.

	$X$	$Y$	$Z$	$n_2$	$n_1$	$n_0$
a:	0	0	0	0	0	1
	0	0	0	0	1	0
aI:	0	0	0	0	0	1
	0	0	0	0	0	0
b:	0	0	1	0	1	1
	0	0	1	1	0	0
bI:	0	0	1	0	1	1
	0	0	1	0	0	0
c:	0	1	0	1	0	1
	0	1	0	1	1	0
cI:	0	1	0	1	0	1
	0	1	0	0	0	0
d:	1	0	0	1	1	0
	1	0	0	0	0	0
111:	1	0	0	x	x	x
(d3):	1	0	0	x	x	x

don't care.

$X = s_2 s_1$

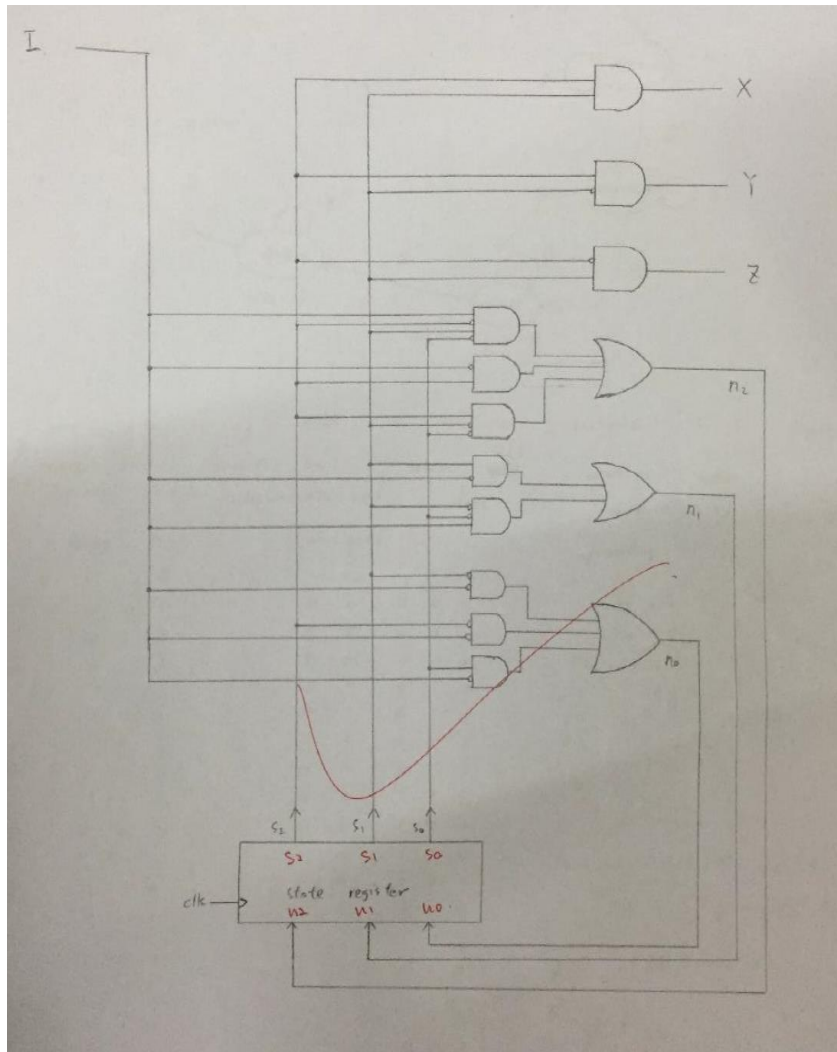
$Y = s_2 s_1'$

$Z = s_2' s_1$

$n_2 = s_2' s_1 s_0' I + s_2 s_1' s_0'$

$n_1 = s_1 I' + s_1' s_0' I$

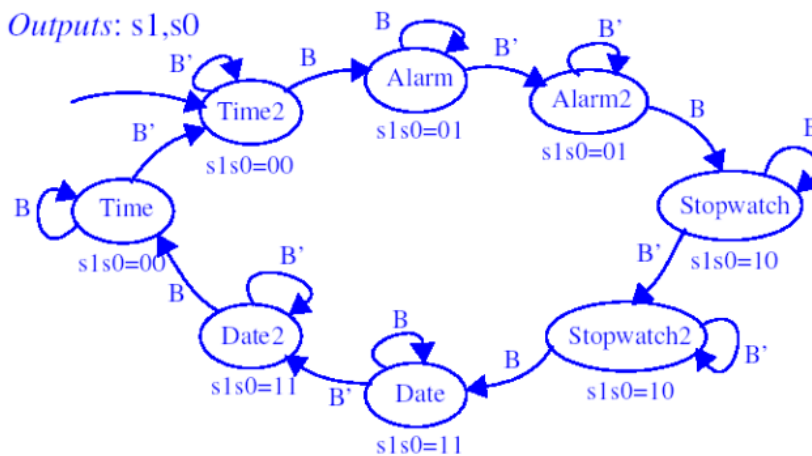
$n_0 = s_1' I' + s_2' I' + s_0 I'$



7. Problem 3.28, show design steps, equations, and draw schematics. (20 points)

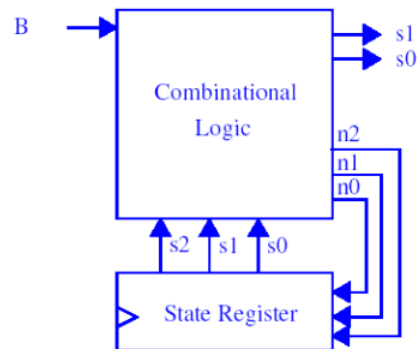
### Step 1 - Capture the FSM

Inputs: B, Outputs: s1,s0



The FSM was created during Exercise 3.27.

## Step 2 - Create the architecture



### Step 3 - Encode the states

A straightforward encoding is Time2=000, Alarm=001, Alarm2=010, Stopwatch=011, Stopwatch2=100, Date=101, Date2=110, Time=111.

### Step 4 - Create the state table

[illegible]



**Step 5 - Implement the combinational logic**

$$n2 = s2's1s0B' + s2s1' + s2s0' + s2B$$

$$n1 = s1s0' + s1B + s2s0B + s2's1's0B'$$

$$n0 = s0'B + s2'B + s1B + s2s1's0B'$$

$$s1 = s2s0' + s2s1' + s2's1s0$$

$$s0 = s1 \text{ XOR } s0$$

8. Problem 3.42 (10 points)