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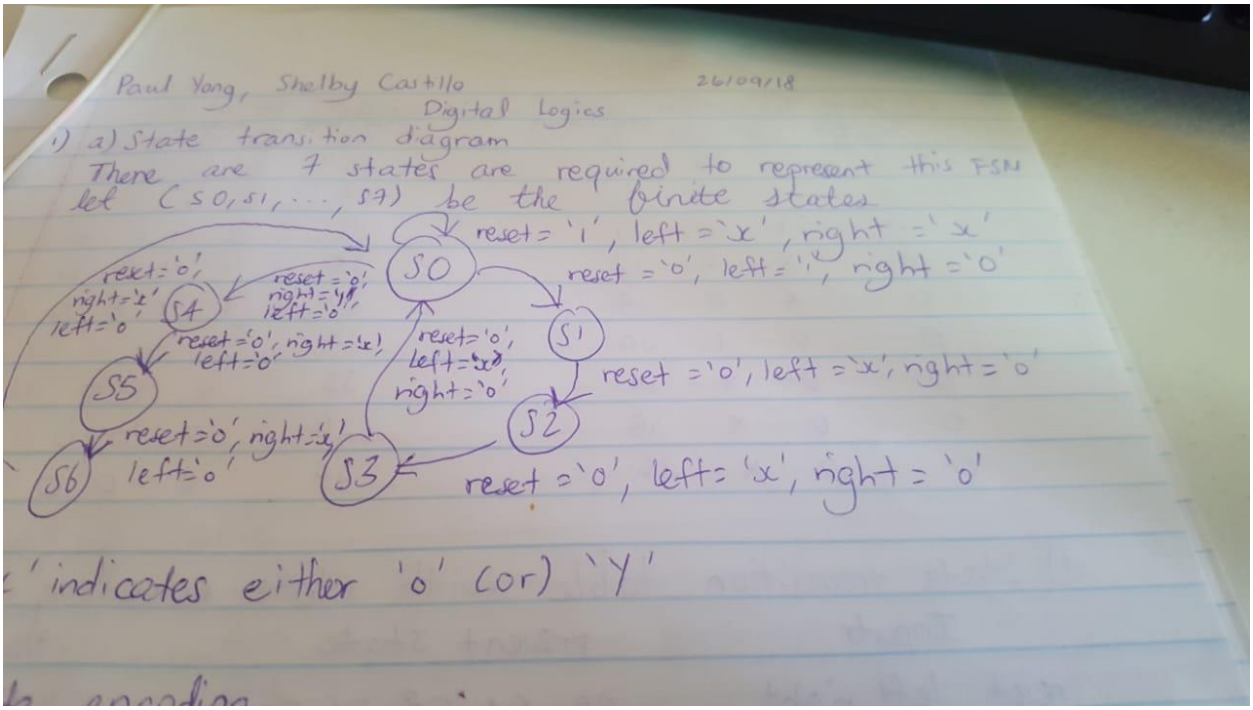
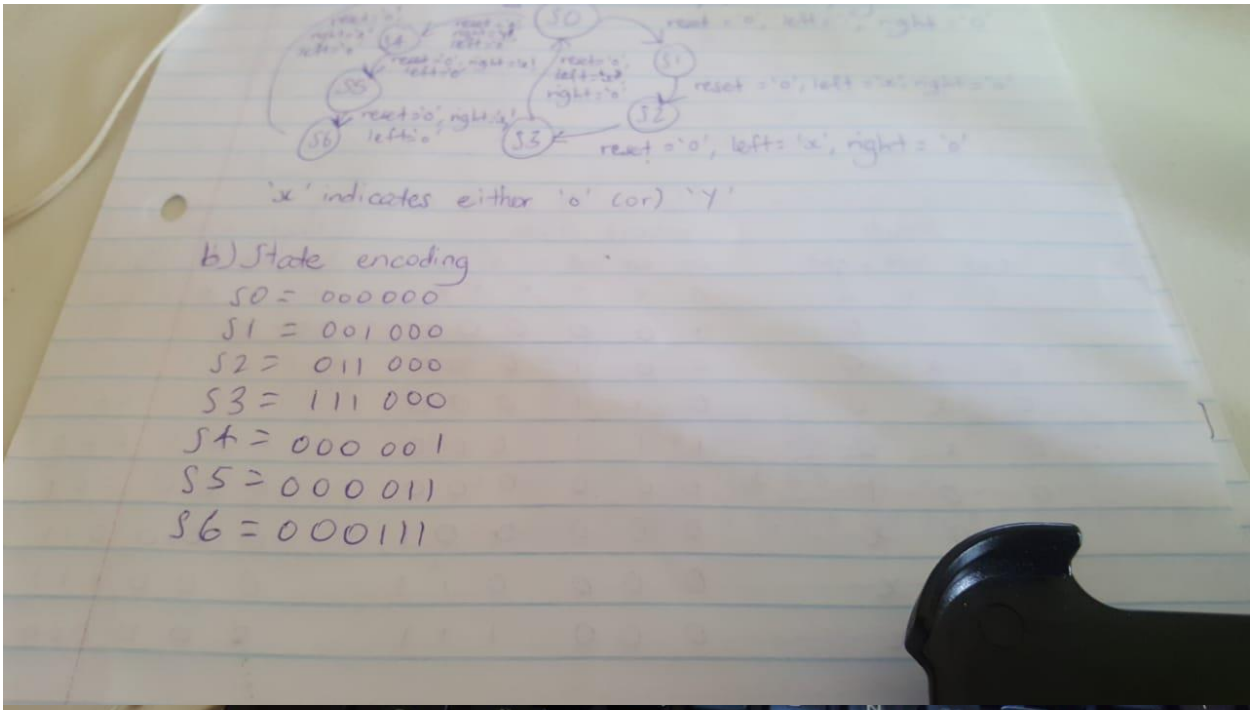
Digital Logics Lab 4

1) Spent a total of 2 days and 3 hours on this lab





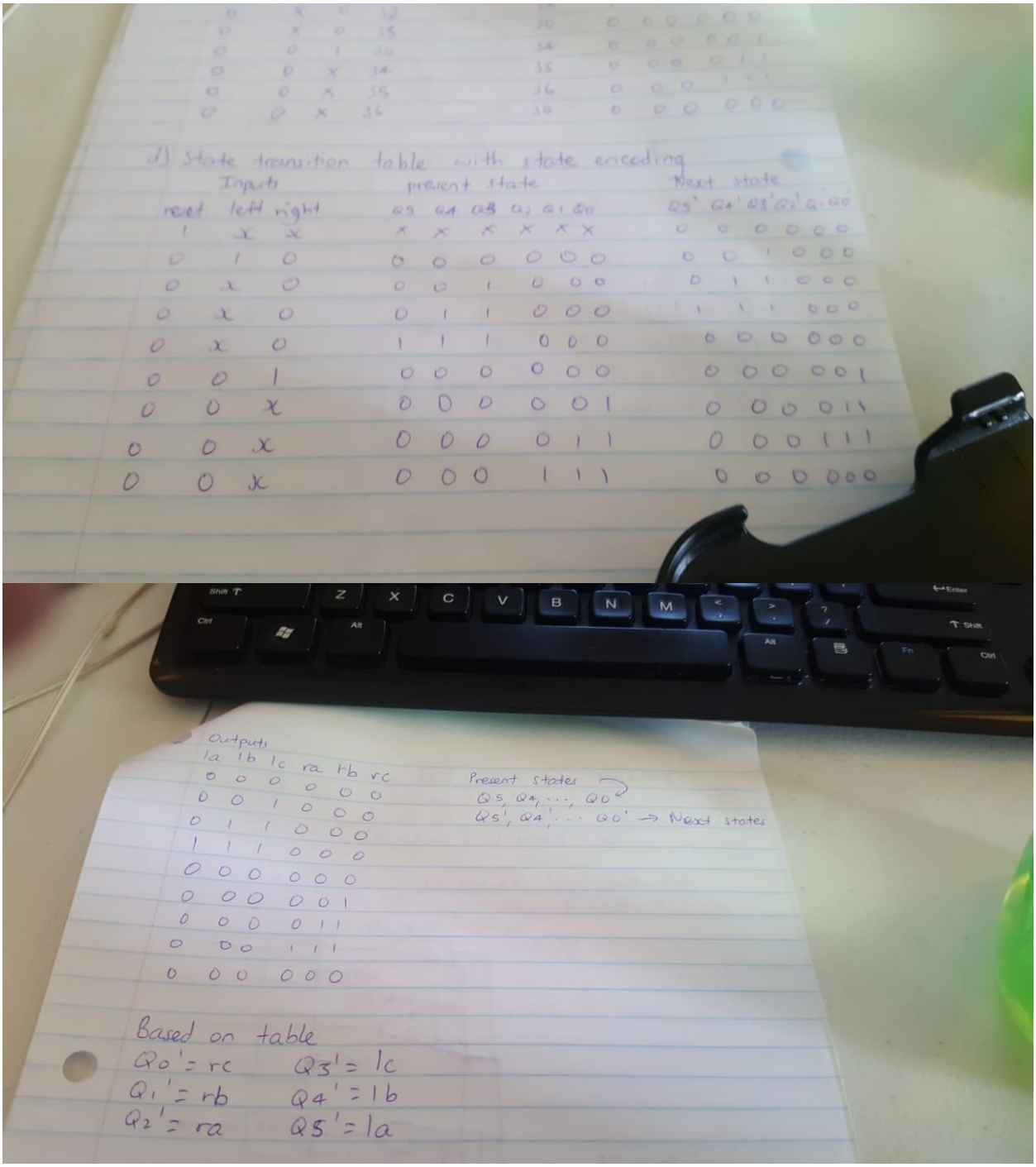
'x' indicates either '0' (or) '1'

b) State encoding

S0 = 000000
S1 = 001000
S2 = 011000
S3 = 111000
S4 = 000001
S5 = 000011
S6 = 000111

c) State transition and output tables

Inputs (reset)	left	right	PS (present state)	NS (next state)	outputs la	lb	lc	ra	rb	rc
1	x	x	x	S0	0	0	0	0	0	0
0	1	0	S0	S1	0	0	1	0	0	0
0	x	0	S1	S2	0	1	1	0	0	0
0	x	0	S2	S3	1	1	1	0	0	0
0	x	0	S3	S0	0	0	0	0	0	0
0	0	1	S0	S4	0	0	0	0	0	1
0	0	x	S4	S5	0	0	0	0	1	1
0	0	x	S5	S6	0	0	0	1	1	1
0	0	x	S6	S0	0	0	0	0	0	0



d) State transition table with state encoding

Inputs			present state						Next state					
reset	left	right	Q_5	Q_4	Q_3	Q_2	Q_1	Q_0	Q_5'	Q_4'	Q_3'	Q_2'	Q_1'	Q_0'
1	x	x	x	x	x	x	x	x	0	0	0	0	0	0
0	1	0	0	0	0	0	0	0	0	0	1	0	0	0
0	x	0	0	0	1	0	0	0	0	1	1	0	0	0
0	x	0	0	1	1	0	0	0	1	1	1	0	0	0
0	x	0	1	1	1	0	0	0	0	0	0	0	0	0
0	0	1	0	0	0	0	0	0	0	0	0	0	0	1
0	0	x	0	0	0	0	0	1	0	0	0	0	1	1
0	0	x	0	0	0	0	1	1	0	0	0	1	1	1
0	0	x	0	0	0	1	1	1	0	0	0	0	0	0

Outputs

l_a	l_b	l_c	r_a	r_b	r_c
0	0	0	0	0	0
0	0	1	0	0	0
0	1	1	0	0	0
1	1	1	0	0	0
0	0	0	0	0	0
0	0	0	0	0	1
0	0	0	0	1	1
0	0	0	1	1	1
0	0	0	0	0	0

Present states → $Q_5, Q_4, \ldots, Q_0$

$Q_5', Q_4', \ldots Q_0'$ → Next states

Based on table

$Q_0' = r_c$ $\quad Q_3' = l_c$

$Q_1' = r_b$ $\quad Q_4' = l_b$

$Q_2' = r_a$ $\quad Q_5' = l_a$

Based on table

$Q_0' = rc$ $\quad Q_3' = lc$

$Q_1' = rb$ $\quad Q_4' = lb$

$Q_2' = ra$ $\quad Q_5' = la$

By inspection

$rc = right \cdot \overline{reset} = Q_0'$

$lc = left \cdot \overline{reset} = Q_3'$

$rb = \overline{reset} \cdot \overline{left} = \bar{Q}_5\,\bar{Q}_4\,\bar{Q}_3\,\bar{Q}_2\,\bar{Q}_0\,[a_1 + \bar{Q}_1]\,[right + \overline{right}]$

$= \overline{reset}\;\overline{left}\;\bar{Q}_5\;\bar{Q}_4\;\bar{Q}_3\;\bar{Q}_2\;\bar{Q}_0$

$= \overline{reset + left + Q_5 + Q_4 + Q_3 + Q_2 + \bar{Q}_0} = Q_1'$

$lb = \overline{reset}\;right\;[left + \overline{left}]\;\bar{Q}_5\,\bar{Q}_3\,\bar{Q}_2\,\bar{Q}_1\,\bar{Q}_0\,[a_4 + \bar{a}_4]$

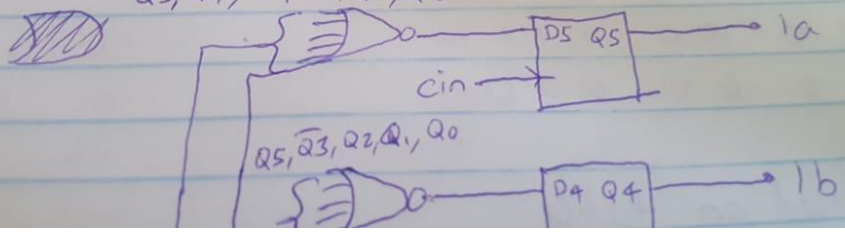
$= \overline{reset}\; + right + Q_5 + \bar{Q}_3 + Q_2 + Q_1 + Q_0 = Q_4'$

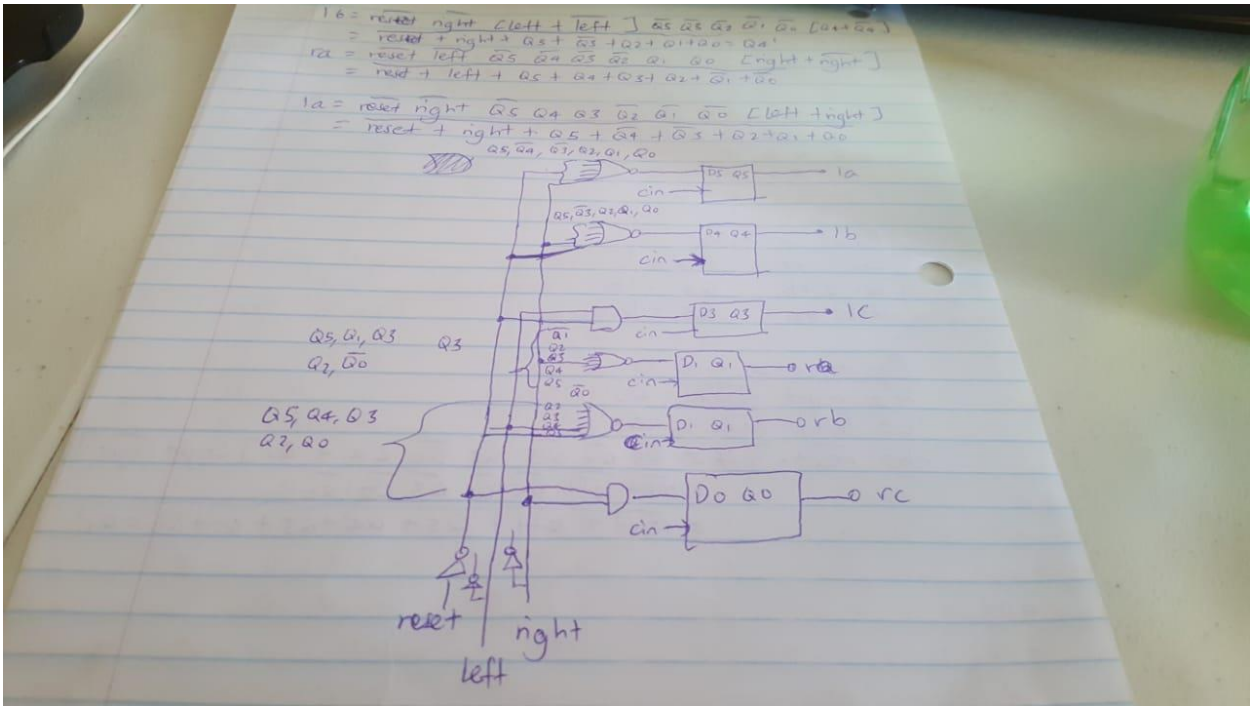
$ra = \overline{reset}\;\overline{left}\;\bar{Q}_5\;\bar{Q}_4\;\bar{Q}_3\;\bar{Q}_2\;Q_1\;Q_0\;[right + \overline{right}]$

$= \overline{reset + left + Q_5 + Q_4 + Q_3 + Q_2 + \bar{Q}_1 + \bar{Q}_0}$

$la = \overline{reset}\;right\;\bar{Q}_5\;Q_4\;Q_3\;\bar{Q}_2\;\bar{Q}_1\;\bar{Q}_0\;[left + \overline{right}]$

$= \overline{reset + right + Q_5 + \bar{Q}_4 + \bar{Q}_3 + Q_2 + Q_1 + Q_0}$




reset
right
left
cin
D5 Q5
D4 Q4
D3 Q3
D1 Q1
D0 Q0
Q3
Q5, Q4, Q3
Q2, Q0