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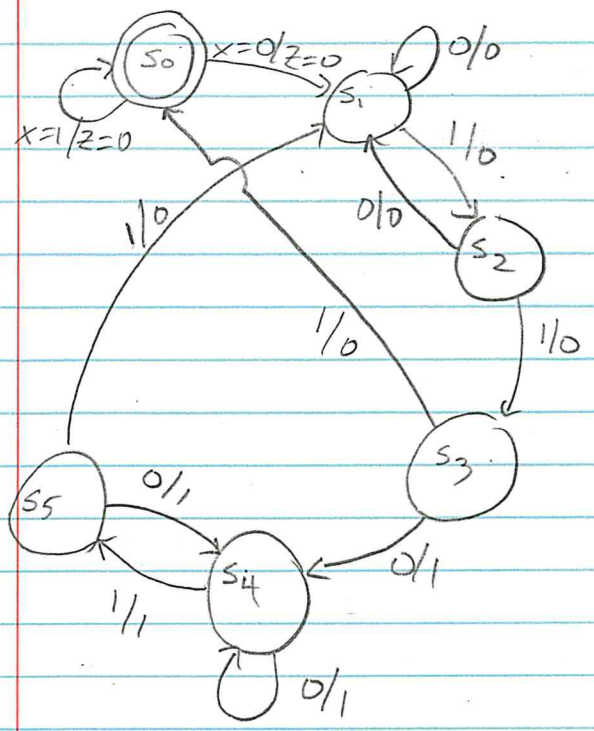
CSC 355 Assignment 3 Answers Fall 2016.

#1



S_0: no part of sequence found
S_1: 0 of 0110 has been found
S_2: 01 of 0110 has been found
S_3: 011 of 0110 has been found
S_4: 0110 has been found
S_5: 01 after 0110 has been found

State Table

Present	Next x=0	Next x=1	Output x=0	Output x=1
S_0	S_1	S_0	0	0
S_1	S_1	S_2	0	0
S_2	S_1	S_3	0	0
S_3	S_4	S_0	1	0
S_4	S_4	S_5	1	1
S_5	S_4	S_1	1	0

#2.

Present AB	Next xy=00 A^+B^+	xy=01 A^+B^+	xy=10 A^+B^+	xy=11 A^+B^+	Output xy=00 z	xy=01 z	xy=10 z	xy=11 z
00	00	01	10	11	0	0	1	1
01	01	10	10	00	1	1	0	0
10	11	11	11	10	1	0	1	0
11	00	00	00	01	0	1	0	1

JK Characteristic: $Q^+ = \bar{K}Q + J\bar{Q}$

∴ JK State Table

J	K	Q	Q^+
0	0	0	0
0	0	1	1
0	1	0	0
0	1	1	0
1	0	0	1
1	0	1	1
1	1	0	1
1	1	1	0

AB \ xy	00	01	11	10
00	0	0	1	1
01	0	1	0	1
11	0	0	0	0
10	1	1	1	1

A^+

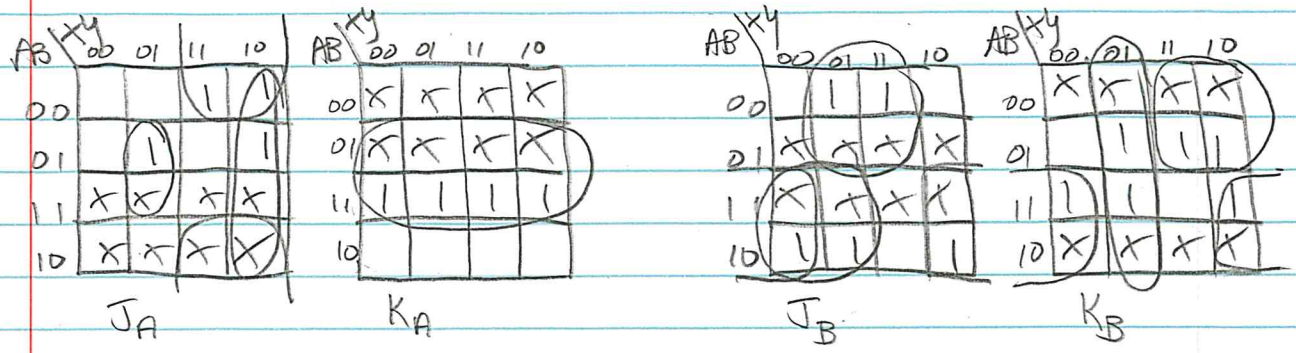
AB \ xy	00	01	11	10
00	0	1	1	0
01	1	0	0	0
11	0	0	1	0
10	1	1	0	1

B^+

and

JK Excitation

Q Q^+	J K
0 0	0 X
0 1	1 X
1 0	X 1
1 1	X 0



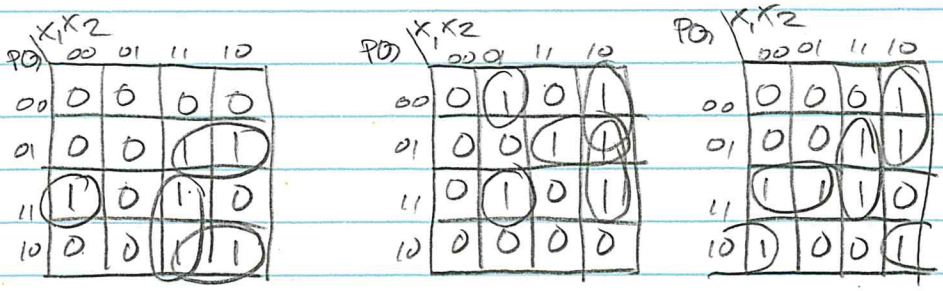
$J_A = B\bar{X}y + \bar{B}X + x\bar{y}$ $\quad K_A = B$ $\quad J_B = \bar{A}y + A\bar{X} + A\bar{y}$ $\quad K_B = A\bar{y} + \bar{X}y + \bar{A}X$

NOTE: The question did not ask for the output (Z) equation or the circuit drawing, so I did not provide them!

#3 a) b)

Present PQ	Next x_1x_2=00 P^+Q^+	01 P^+Q^+	10 P^+Q^+	11 P^+Q^+	Output x_1x_2=00 Z	01 Z	10 Z	11 Z
A = 00	A=00	B=01	B=01	A=00	0	0	1	0
B = 01	A=00	A=00	D=11	D=11	0	0	1	1
C = 10	A=00	A=00	C=10	C=10	1	0	1	0
D = 11	C=10	B=01	B=01	C=10	1	1	0	1
↑ a)	↑ b)	↑ a)	↑ b)	↑ a)	↑ b)	↑ a)	↑ b)	↑ a)	↑ b)

c)



D Characteristic

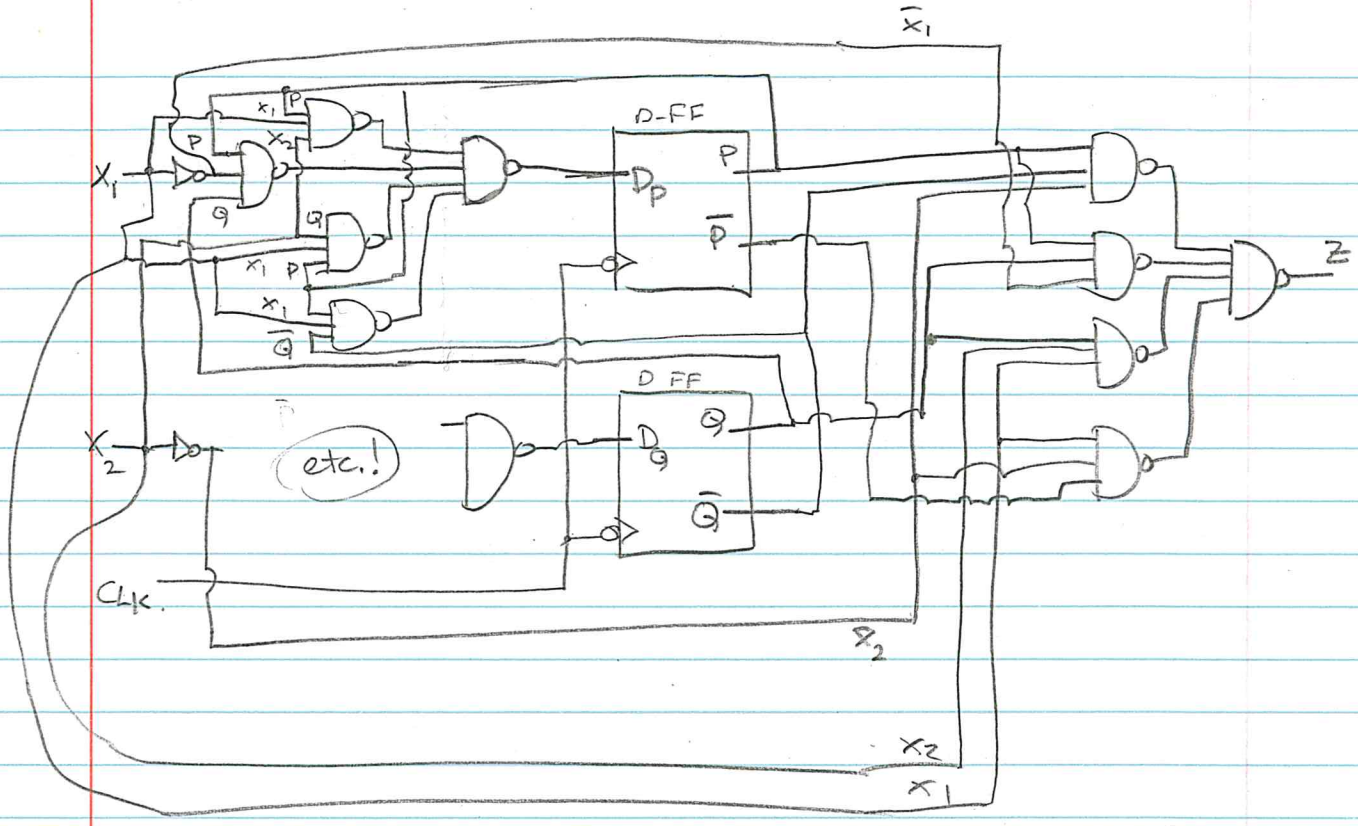
$Q^+ = D$

↑ easy! ☺

$P^+ = PQ\bar{x}_1 + P\bar{x}_1\bar{x}_2 + PQx_1 + P\bar{Q}x_1$

$Z = P\bar{Q}\bar{x}_2 + PQ\bar{x}_1 + Qx_1x_2 + \bar{P}x_1\bar{x}_2$

$Q^+ = \bar{P}Q\bar{x}_1x_2 + PQ\bar{x}_1x_2 + \bar{P}Qx_1 + \bar{P}x_1\bar{x}_2 + Qx_1\bar{x}_2$



#4 Next State Table for GL-F-F

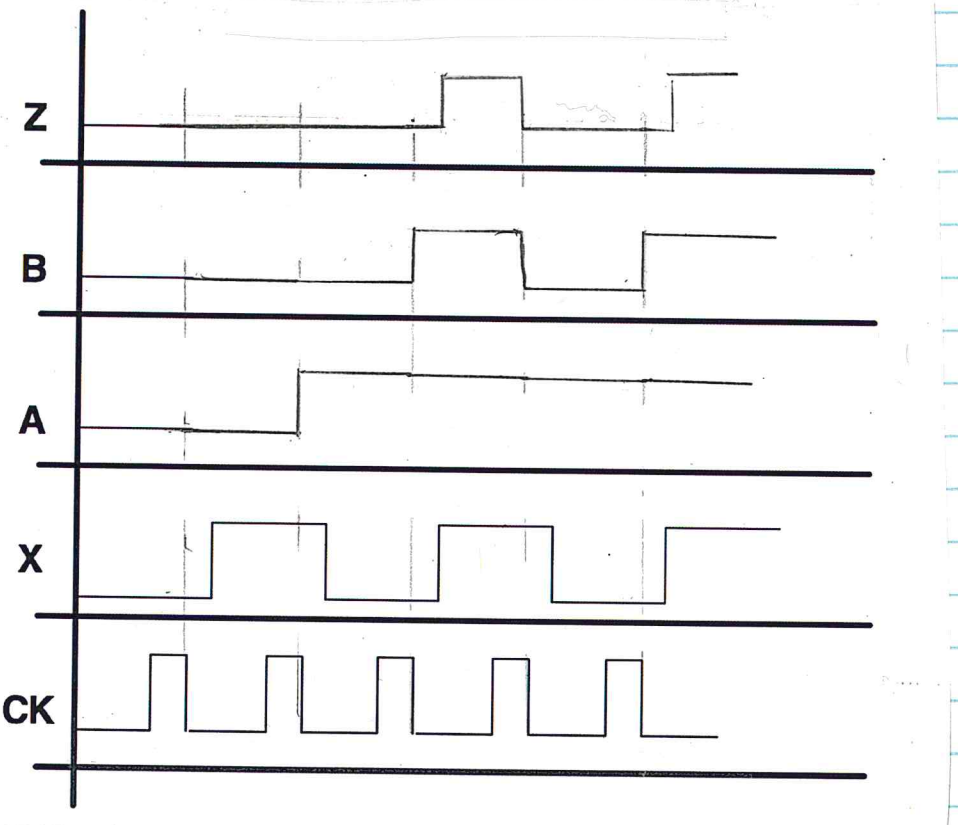
GL Q	Q^+
000	0
001	1
010	0
011	1
100	0
101	0
110	1
111	1

GL \ Q	0	1
00	0	1
01	0	1
11	1	1
10	0	0

$Q^+ = GL + \bar{G}Q$

#5 $J_A = X \quad K_A = B\bar{X}$ $\quad A^+ = \bar{K}_A A + J_A \bar{A} = \overline{B\bar{X}} A + X\bar{A} = A\bar{B} + AX + \bar{A}X = A\bar{B} + X$

$J_B = A\bar{X} \quad K_B = A$ $\quad B^+ = \bar{K}_B B + J_B \bar{B} = \bar{A}B + A\bar{X}\bar{B}$ $\quad Z = XB$



#6

X	Y	I_P	Q	Q^+	O_P
0	0	0	0	0	Hi-Z
0	0	0	1	1	Hi-Z
0	0	1	0	0	Hi-Z
0	0	1	1	1	Hi-Z
0	1	0	0	1	Hi-Z
0	1	0	1	0	Hi-Z
0	1	1	0	1	Hi-Z
0	1	1	1	0	Hi-Z
1	0	0	0	0	Hi-Z
1	0	0	1	0	Hi-Z
1	0	1	0	1	Hi-Z
1	0	1	1	1	Hi-Z
1	1	0	0	0	0
1	1	0	1	1	1
1	1	1	0	0	0
1	1	1	1	1	1

XY \ I_PQ	00	01	11	10
00	0	1	1	0
01	1	0	0	1
11	0	1	1	0
10	0	0	1	1

Q^+

RS Characteristic Eqn

$Q^+ = \bar{R}Q + S \quad (SR = 0)$

RS State

R	S	Q	Q^+
0	0	0	0
0	0	1	1
0	1	0	1
0	1	1	1
1	0	0	0
1	0	1	0
1	1	0	x
1	1	1	x

RS Excitation

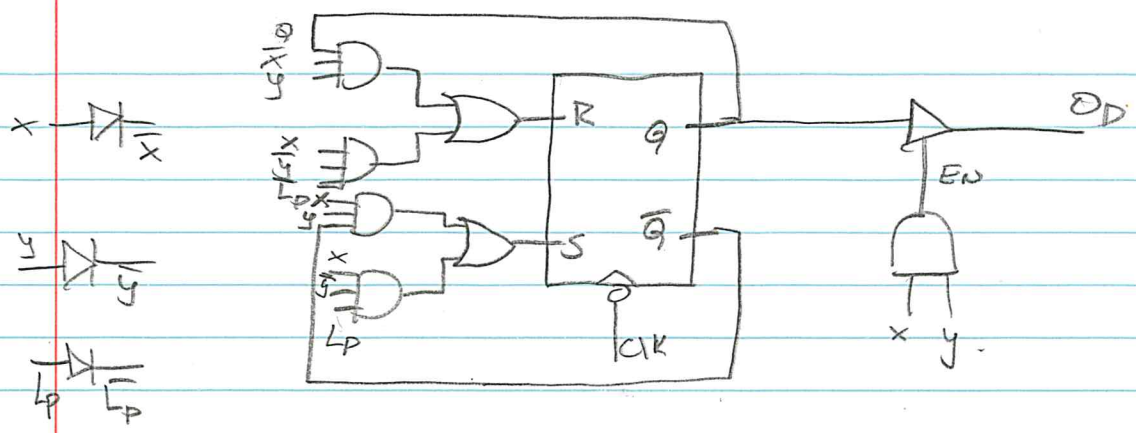
Q	Q^+	R	S
0	0	x	0
0	1	0	1
1	0	1	0
1	1	0	x

XY \ I_PQ	00	01	11	10
00	x	0	0	x
01	0	1	1	0
11	x	0	0	x
10	x	1	0	0

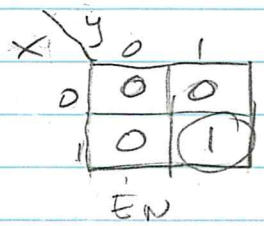
$R_Q = \bar{x}yQ + x\bar{y}\bar{I}_P$

XY \ I_PQ	00	01	11	10
00	0	x	x	0
01	1	0	0	1
11	0	x	x	0
10	0	0	x	1

$S_Q = \bar{x}y\bar{Q} + x\bar{y}I_P$

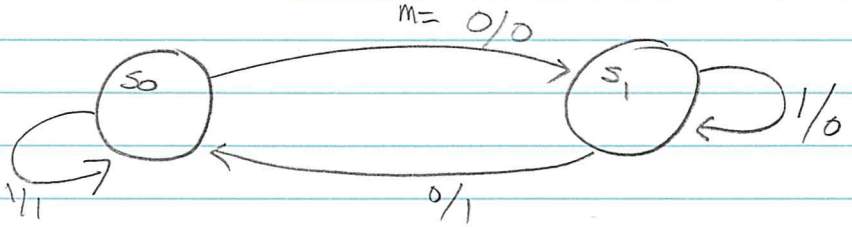


Design of the gates on the buffer's En enable input:



$EN = x \cdot y$

#7. a)

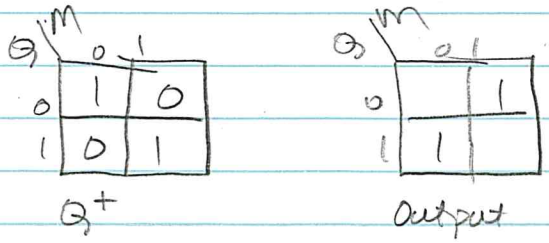


m = message.

b)

Present	Next		Output	
	m=0	m=1	m=0	m=1
Q	Q^+	Q^+		
$S_0 = 0$	$S_1 = 1$	$S_0 = 0$	0	1
$S_1 = 1$	$S_0 = 0$	$S_1 = 1$	1	0

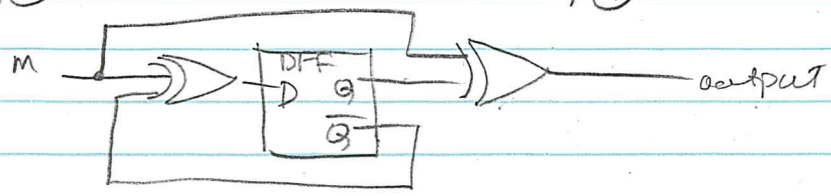
c)



D characteristic
$Q^+ = D$

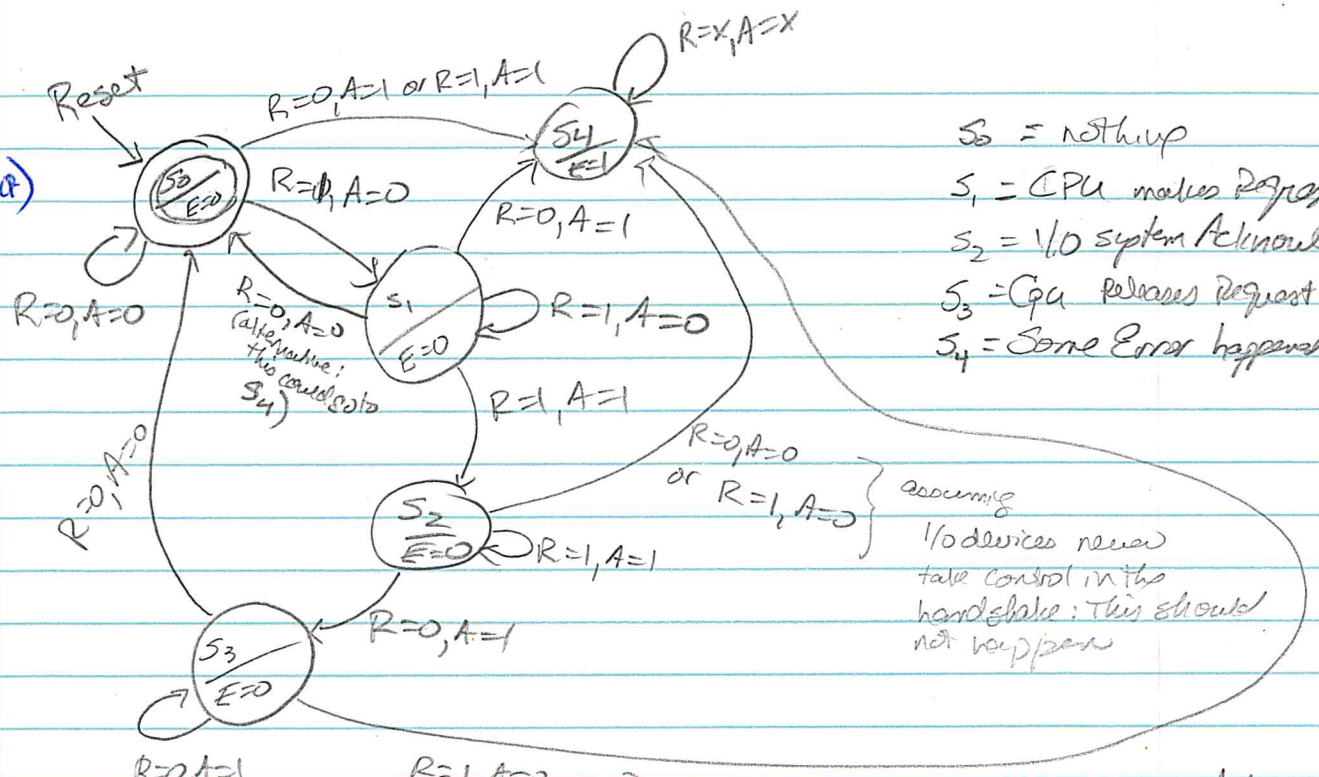
$Q^+ = \bar{Q}m + Q\bar{m}$
$= Q \oplus m$

$Output = Q\bar{m} + \bar{Q}m$
$= Q \oplus m$



#8

a)



S_0 = nothing

S_1 = CPU makes Request

S_2 = I/O system Acknowledge

S_3 = Cpu Releases Request

S_4 = Some Error happened

assuming I/O devices never take control in the handshake: This should not happen

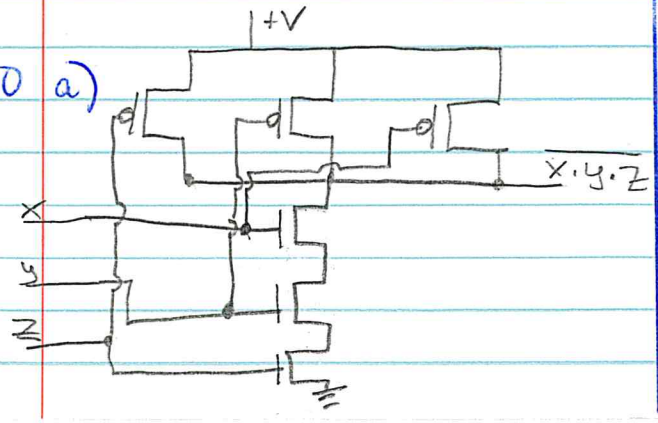
Assuming CPU knows to delay a second request until after the acknowledge of the previous is finished

b)

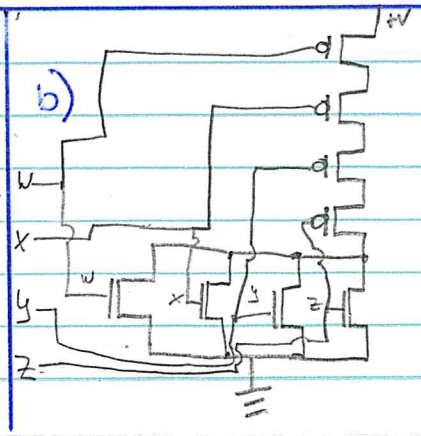
Present	Next				Output
	BA=00	01	10	11	
S_0	S_0	S_4	S_1	S_4	0
S_1	S_0	S_1	S_4	S_2	0
S_2	S_4	S_3	S_4	S_2	0
S_3	S_1	S_3	S_4	S_4	0
S_4	S_4	S_4	S_4	S_4	1

#9. a) $\overline{C} \cdot \overline{D} = \overline{C+D}$ b) $A \cdot D + A \cdot \overline{C} + \overline{B} \cdot D + \overline{B} \cdot \overline{C}$

#10 a)



b)



#11 Cancelled!

#12 $2^6 = 64$, Thus 6 select lines are needed

#13