21W-COMSCIM51A-1 Homework 8

CHARLES ZHANG

TOTAL POINTS

120 / 120

QUESTION 1

1 26 pts

1.1 a 6 / 6

✓ **- 0 pts Correct**

![1a.PNG](/files/769000e2-b45a-4173-a572-cc546185a890)

Or equivalent

- **0.5 pts** Minor error in expression for y0.
- **0.5 pts** Minor error in expression for y1.
- **0.5 pts** Minor error in expression for z.
- **1 pts** Error in expression for y0.
- **1 pts** Error in expression for y1.
- **1 pts** Error in expression for z.

1.2 b 8 / 8

✓ **- 0 pts Correct**

![1b.PNG](/files/3be0e956-746e-4345-9864-d2db82e98206)

- **2 pts** Error in output.
- **1 pts** Error in first row of next state
- **1 pts** Error in second row of next state
- **1 pts** Error in third row of next state
- **1 pts** Error in forth row of next state

1.3 c 4 / 4

✓ **- 0 pts Correct: Moore**

- **3 pts** Incorrect: Mealy

1.4 d 8 / 8

✓ **- 0 pts Correct**

![1d.PNG](/files/1ff0896a-cd11-47ac-8021-e071362a53d4)

- **1.5 pts** Error in diagram due to incorrect table
- **1.5 pts** State 00 error
- **1.5 pts** State 01 error
- **1.5 pts** State 10 error
- **1.5 pts** State 11 error

QUESTION 2

2 20 pts

2.1 a 6 / 6

✓ **- 0 pts Correct**

![Screen_Shot_2021-02-26_at_2.12.42_PM.png](/files/abaeb80a-b765-485c-be13-5d78d0805f84)

- **0.5 pts** Minor error in T2
- **0.5 pts** Minor error in T1
- **0.5 pts** Minor error in T0
- **1 pts** Wrote expressions for Q(t+1) not T, but T is correct.
- **2 pts** Error in T2
- **2 pts** Error in T1
- **2 pts** Error in T0

2.2 b 10 / 10

✓ **- 0 pts Correct**

![Screen_Shot_2021-02-26_at_2.15.38_PM.png](/files/fea2318c-41c8-4436-b412-6d5aff63910a)

- **5 pts** Used values of T for NS instead of computing Q(t+1)
- **1.5 pts** Error in PS=000
- **1.5 pts** Error in PS=001
- **1.5 pts** Error in PS=010
- **1.5 pts** Error in PS=100
- **1.5 pts** Error in PS=101
- **1.5 pts** Error in PS=110

2.3 c 4 / 4

✓ **- 0 pts Correct (state `011`, `111` and their edges are**

optional)

![Screen_Shot_2021-02-26_at_2.17.16_PM.png](/files/634c73df-f130-45ff-8bad-a9a83a4cbefb)

- **1 pts** Minor error (or error due to incorrect table)
- **3 pts** Major error
- **4 pts** Blank

QUESTION 3

3 3 4 / 4

✓ **- 0 pts** **Correct: 001**

- **2 pts** Pattern is backwards: 100
- **3 pts** Incorrect

QUESTION 4

4 26 pts

4.1 a 4 / 4

✓ **- 0 pts** **Correct**

![Screen_Shot_2021-02-26_at_2.18.34_PM.png](/files/303b37a6-5b5a-4cbc-a9ad-a9e0a156aecb) OR ![Screen_Shot_2021-02-26_at_2.18.39_PM.png](/files/92e6fb10-ff93-447f-b19a-94efa53cdc42)

- **1 pts** Minor error
- **2 pts** Major error
- **4 pts** Blank

4.2 b 6 / 6

✓ **- 0 pts** **Correct**

![Screen_Shot_2021-02-26_at_2.20.05_PM.png](/files/fe417073-f97b-4788-9dba-bfa8dee3303b) OR ![Screen_Shot_2021-02-26_at_2.20.00_PM.png](/files/7b77c060-b482-4b51-b707-23250847ea44)

- **1.5 pts** Error in PS=00
- **1.5 pts** Error in PS=01
- **1.5 pts** Error in PS=10
- **1.5 pts** Error in PS=11

4.3 c 6 / 6

✓ **- 0 pts** **Correct**

![Screen_Shot_2021-02-26_at_2.24.00_PM.png](/files/7c906cf6-4e6e-4dbc-9445-c090440adff9) OR ![Screen_Shot_2021-02-26_at_2.23.54_PM.png](/files/6d3e714c-ff6b-4e16-bf10-1f2639a1f8e5)

- **1 pts** Minor error in D1
- **2 pts** Blank in D1
- **1 pts** Minor error in D0
- **2 pts** Blank in D0
- **1 pts** Minor error in z
- **2 pts** Blank in z

4.4 d 6 / 6

✓ **- 0 pts** **Correct**

![Screen_Shot_2021-02-26_at_2.25.21_PM.png](/files/eff2221b-2028-4b07-84ec-91ba26633716) OR ![Screen_Shot_2021-02-26_at_2.25.18_PM.png](/files/11af93da-002d-40a5-9fb1-df8aa0f1ca42)

- **1 pts** Minor error in D1
- **2 pts** Blank in D1
- **1 pts** Minor error in D0
- **2 pts** Blank in D0
- **1 pts** Minor error in z
- **2 pts** Blank in z

4.5 e 4 / 4

✓ **- 0 pts** **Correct**

![Screen_Shot_2021-02-26_at_2.27.17_PM.png](/files/db567b4a-4bcb-4de9-ab51-b5bb65055810) OR ![Screen_Shot_2021-02-26_at_2.27.09_PM.png](/files/c6f13529-4a86-45b7-8e43-4da259e55e79)

- **1 pts** Minor error
- **2 pts** Major error
- **4 pts** Blank

QUESTION 5

5 28 pts

5.1 a 4 / 4

✓ **- 0 pts** **Correct**

![3a.PNG](/files/bf5c5592-0dff-46c3-882e-428298373baf)

(Not writing outputs is ok)

- **1 pts** Diagram has inputs (clk input is ok)
- **1 pts** Single wrong transition
- **2 pts** Multiple incorrect transitions

5.2 b 6 / 6

✓ **- 0 pts** **Correct**

![3b.PNG](/files/04c3bb25-cd71-442e-9edf-fd58ad34cf97)

Having all 8 rows is ok, as long as the NS, output, and 3 T inputs are don't cares. Table may be out of order.

- **1 pts** Error in first row
- **1 pts** Error in second row
- **1 pts** Error in third row
- **1 pts** Error in forth row
- **1 pts** Error in fifth row
- **1 pts** Error in sixth row

5.3 c 6 / 6

✓ **- 0 pts** **Correct**

![3c.PNG](/files/e731661a-a60e-4c0e-8619-bf9f6403bc94)

- **1.5 pts** K Map for TA/T2 incorrectly filled out (circles not required)
- **1.5 pts** K Map for TB/T1 incorrectly filled out (circles not required)
- **1.5 pts** K Map for TC/T0 incorrectly filled out (circles not required)

5.4 d 6 / 6

✓ **- 0 pts** **Correct**

![3d.PNG](/files/11052efa-35f5-4e65-b52d-c4518c603969)

Note: A=Q2, B=Q1, C=Q0

- **0.5 pts** TA/T2 minor error
- **0.5 pts** TB/T1 minor error
- **0.5 pts** TC/T0 minor error
- **1 pts** TA/T2 incorrect equation
- **1 pts** TB/T1 incorrect equation
- **1 pts** TC/T0 incorrect equation

5.5 e 6 / 6

✓ **- 0 pts** **Correct**

![3e.PNG](/files/fb28b7d6-dd4c-4798-8e1f-84ed7073a6e1)

XOR gates may be used for TA/T2 and TB/T1

XNOR gates may be used to TC/T0

- **3 pts** All inputs incorrect due to incorrect part D equations
- **0.5 pts** Minor error
- **1 pts** Input to TA/T2 incorrect
- **1 pts** Input to TB/T1 incorrect
- **1 pts** Input to TC/T0 incorrect

QUESTION 6

6 6 6 / 6

✓ **- 0 pts** **Correct**

![6.PNG](/files/f28a87d1-0403-4e86-abf7-c7d1928f4685)

$$z_{1} = \sum m(3, 6, 7)$$

$$z_{2} = \sum m(3, 5, 6)$$

(Equations not required)

- **1 pts** Mixed MSB and LSB for input (ie xyz instead of zyx)
- **1 pts** Minor error in z1
- **2 pts** Major error in z1
- **3 pts** Blank in z1
- **1 pts** Minor error in z2
- **2 pts** Major error in z2
- **3 pts** Blank in z2

QUESTION 7

7 7 10 / 10

✓ **- 0 pts** **Correct**

![7.PNG](/files/f62f6705-02e6-443f-89e3-8a7f84b9144f)

- **2 pts** Input E for top (D0 to D7) missing not gate
- **4 pts** MSB is not connected to enable bit E
- **3 pts** Mixed MSB and LSB inputs
- **1 pts** Missing labels for (D8-D15)
- **2 pts** Missing labels for outputs
- **2 pts** Missing labels for inputs
- **2 pts** Wrong output labels
- **6 pts** Error
- **8 pts** Major design error
- **10 pts** Blank

Charles Zhang
305413655

33

MSIA HW #8

1a) JK → $Q(t+1) = Q(t)K'(t) + Q'(t)J(t)$

$y_1(t+1) = (y_1(y_0' y_1' x_1')) + y_1'(y_0 + x_0')$

$\boxed{y_1(t+1) = y_1(y_0 + y_1 + x_1') + y_1'(y_0 + x_0')}$ → $y_1 + y_0 + x_0'$

T → $Q(t+1) = Q(t) \oplus T(t)$

$y_0(t+1) = y_0 \oplus (x_1' y_0' + y_1' x_0)$

$A \oplus B = AB' + A'B$

$\boxed{y_0(t+1) = y_0(x_1' y_0' + y_1' x_0)' + y_0'(x_1' y_0' + y_1' x_0)}$

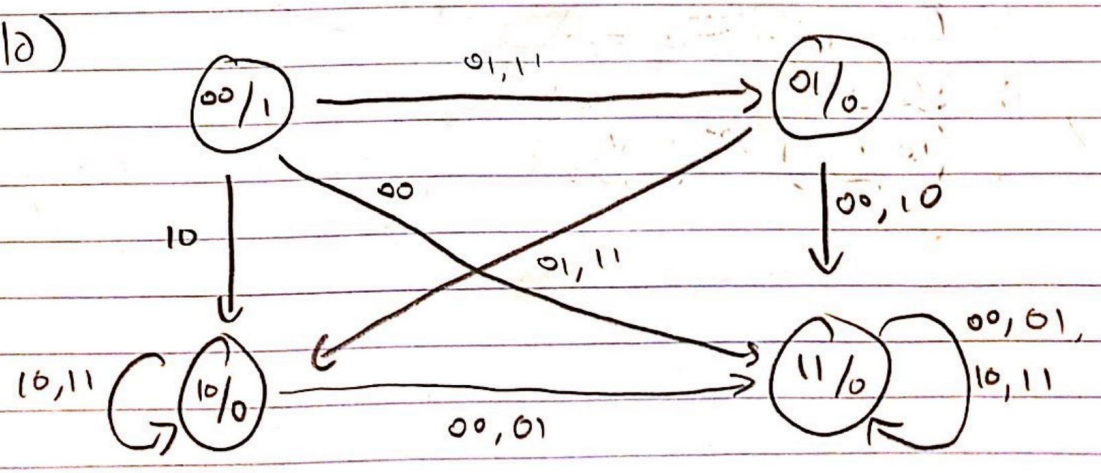
$\boxed{z = y_1' y_0'}$

1b)

PS	Input $x_1(t)x_0(t)$				Output
$y_1(t)\ y_0(t)$	00	01	10	11	z_1
00	11	01	10	01	1
01	11	10	11	10	0
10	11	11	10	10	0
11	11	11	11	11	0
	$y_1(t+1)y_0(t+1)$				
	NS				

1c) Moore

1d)



1.1 a **6 / 6**

✓ **- 0 pts** Correct

![1a.PNG](/files/769000e2-b45a-4173-a572-cc546185a890)

Or equivalent

- **0.5 pts** Minor error in expression for y0.
- **0.5 pts** Minor error in expression for y1.
- **0.5 pts** Minor error in expression for z.
- **1 pts** Error in expression for y0.
- **1 pts** Error in expression for y1.
- **1 pts** Error in expression for z.

Charles Zhang
305413655

33

MSIA HW #8

1a) JK → $Q(t+1) = Q(t)K'(t) + Q'(t)J(t)$

$y_1(t+1) = (y_1(y_0' y_1' x_1')) + y_1'(y_0 + x_0')$

$\boxed{y_1(t+1) = y_1(y_0 + y_1 + x_1') + y_1'(y_0 + x_0')}$ → $y_1 + y_0 + x_0'$

T → $Q(t+1) = Q(t) \oplus T(t)$

$y_0(t+1) = y_0 \oplus (x_1' y_0' + y_1' x_0)$

$A \oplus B = AB' + A'B$

$\boxed{y_0(t+1) = y_0(x_1' y_0' + y_1' x_0)' + y_0'(x_1' y_0' + y_1' x_0)}$

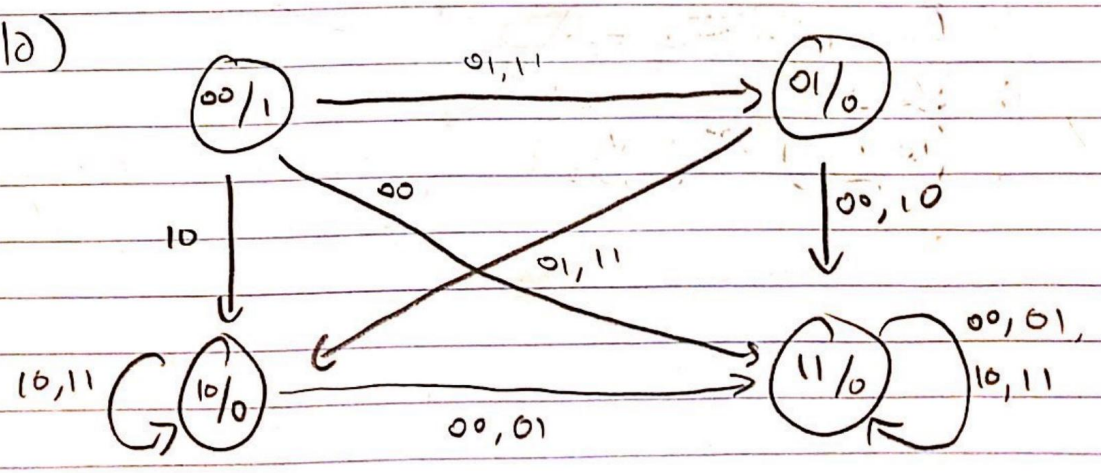
$\boxed{z = y_1' y_0'}$

1b)

PS	Input $x_1(t)x_0(t)$				Output
$y_1(t)\ y_0(t)$	00	01	10	11	z_1
00	11	01	10	01	1
01	11	10	11	10	0
10	11	11	10	10	0
11	11	11	11	11	0
	$y_1(t+1)y_0(t+1)$				
	NS				

1c) Moore

1d)



1.2 b **8 / 8**

✓ **- 0 pts** **Correct**

![1b.PNG](/files/3be0e956-746e-4345-9864-d2db82e98206)

- 2 pts Error in output.

- 1 pts Error in first row of next state

- 1 pts Error in second row of next state

- 1 pts Error in third row of next state

- 1 pts Error in forth row of next state

Charles Zhang
305413655

33

MSIA HW #8

1a) JK → $Q(t+1) = Q(t)K'(t) + Q'(t)J(t)$

$y_1(t+1) = (y_1(y_0' y_1' x_1')) + y_1'(y_0 + x_0')$

$\boxed{y_1(t+1) = y_1(y_0 + y_1 + x_1') + y_1'(y_0 + x_0')}$ → $y_1 + y_0 + x_0'$

T → $Q(t+1) = Q(t) \oplus T(t)$

$y_0(t+1) = y_0 \oplus (x_1' y_0' + y_1' x_0)$

$A \oplus B = AB' + A'B$

$\boxed{y_0(t+1) = y_0(x_1' y_0' + y_1' x_0)' + y_0'(x_1' y_0' + y_1' x_0)}$

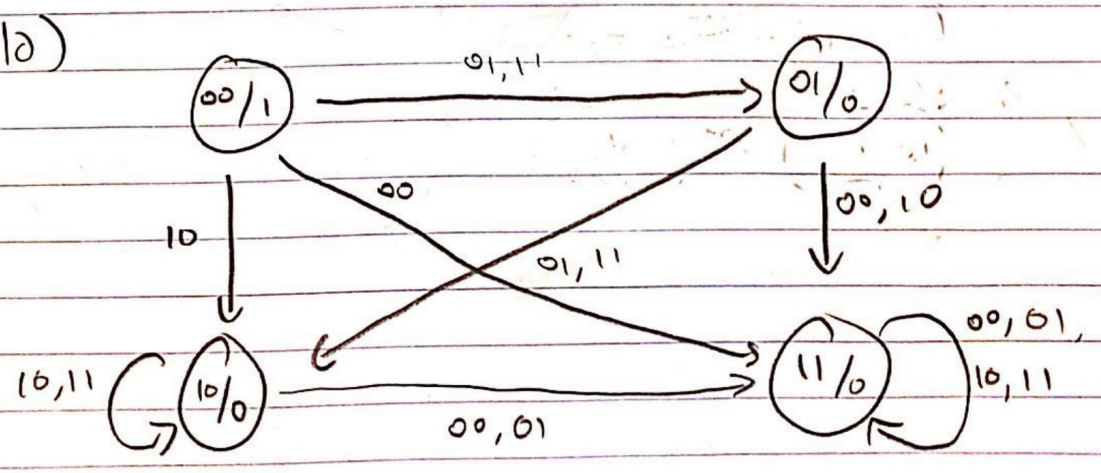
$\boxed{z = y_1' y_0'}$

1b)

PS	Input $x_1(t)x_0(t)$				Output
$y_1(t)\ y_0(t)$	00	01	10	11	z_1
00	11	01	10	01	1
01	11	10	11	10	0
10	11	11	10	10	0
11	11	11	11	11	0
	$y_1(t+1)y_0(t+1)$				
	NS				

1c) Moore

1d)



1.3 C **4 / 4**

✓ **- 0 pts** **Correct: Moore**

- 3 pts Incorrect: Mealy

Charles Zhang
305413655

33

MSIA HW #8

1a) JK → $Q(t+1) = Q(t)K'(t) + Q'(t)J(t)$

$y_1(t+1) = (y_1(y_0' y_1' x_1')) + y_1'(y_0 + x_0')$

$\boxed{y_1(t+1) = y_1(y_0 + y_1 + x_1') + y_1'(y_0 + x_0')}$ → $y_1 + y_0 + x_0'$

T → $Q(t+1) = Q(t) \oplus T(t)$

$y_0(t+1) = y_0 \oplus (x_1' y_0' + y_1' x_0)$

$A \oplus B = AB' + A'B$

$\boxed{y_0(t+1) = y_0(x_1' y_0' + y_1' x_0)' + y_0'(x_1' y_0' + y_1' x_0)}$

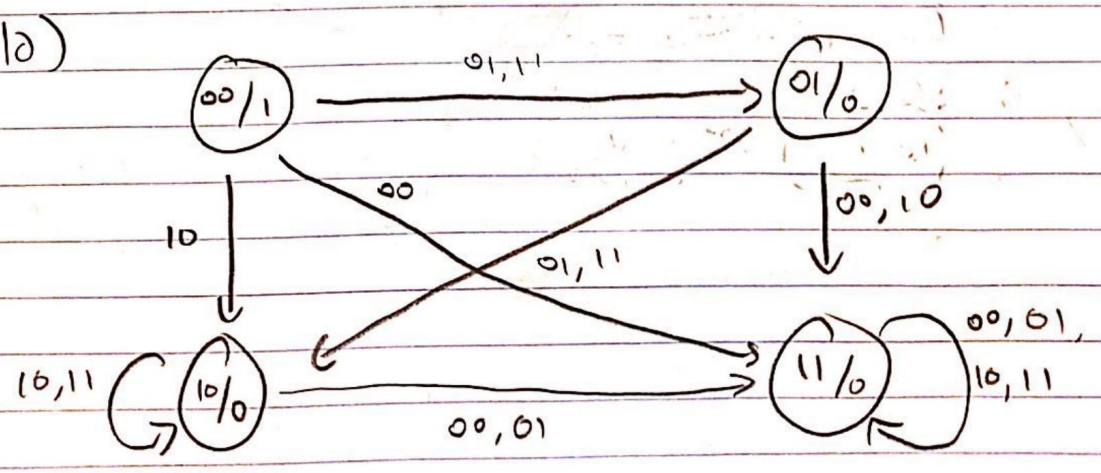
$\boxed{z = y_1' y_0'}$

1b)

PS	Input $x_1(t)x_0(t)$				Output
$y_1(t)\ y_0(t)$	00	01	10	11	z_1
00	11	01	10	01	1
01	11	10	11	10	0
10	11	11	10	10	0
11	11	11	11	11	0
	$y_1(t+1)y_0(t+1)$				
	NS				

1c) Moore

1d)



1.4 d **8 / 8**

✓ **- 0 pts** **Correct**

![1d.PNG](/files/1ff0896a-cd11-47ac-8021-e071362a53d4)

- **1.5 pts** Error in diagram due to incorrect table
- **1.5 pts** State 00 error
- **1.5 pts** State 01 error
- **1.5 pts** State 10 error
- **1.5 pts** State 11 error

2a) $T2 = (Q_0 + (Q_2 \oplus Q_1))'$

$T2 = Q_0 + (Q_2 Q_1' + Q_2' Q_1)'$

$T2 = Q_0 + (Q_2 Q_1')' (Q_2' Q_1)'$

$T2 = Q_0 + (Q_2' + Q_1)(Q_2 + Q_1')$

$\boxed{T2 = Q_0 + (Q_1 Q_2) + (Q_1' Q_2')}$

$\boxed{T1 = Q_1 + Q_0}$

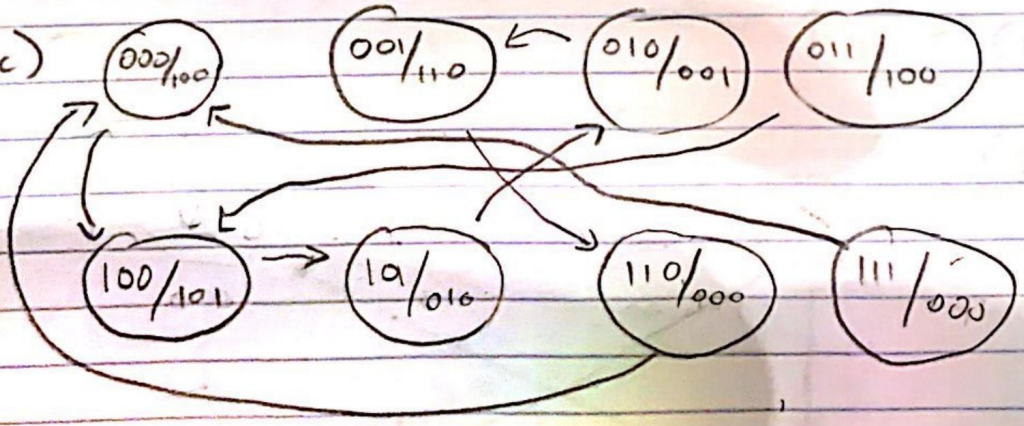
$T0 = Q_1 + (Q_2 \oplus Q_1)$

$\boxed{T0 = Q_0 + (Q_2 Q_1' + Q_2' Q_1)}$

2b)

PS	NS/output	T-inputs
$Q_2 Q_1 Q_0$	$Q_2(t+1)\,Q_1(t+1)\,Q_0(t+1)$	T2 T1 T0
000	100	1 0 0
001	110	1 1 1
010	001	0 1 1
011	100	1 1 1
100	101	0 0 1
101	010	1 1 1
110	000	1 1 0
111	000	1 1 1

2c)



2.1 a **6 / 6**

✓ **- 0 pts** **Correct**

![Screen_Shot_2021-02-26_at_2.12.42_PM.png](/files/abaeb80a-b765-485c-be13-5d78d0805f84)

- 0.5 pts Minor error in T2

- 0.5 pts Minor error in T1

- 0.5 pts Minor error in T0

- 1 pts Wrote expressions for Q(t+1) not T, but T is correct.

- 2 pts Error in T2

- 2 pts Error in T1

- 2 pts Error in T0

2a) $T2 = (Q_0 + (Q_2 \oplus Q_1))'$

$T2 = Q_0 + (Q_2 Q_1' + Q_2' Q_1)'$

$T2 = Q_0 + (Q_2 Q_1')' (Q_2' Q_1)'$

$T2 = Q_0 + (Q_2' + Q_1)(Q_2 + Q_1')$

$\boxed{T2 = Q_0 + (Q_1 Q_2) + (Q_1' Q_2')}$

$\boxed{T1 = Q_1 + Q_0}$

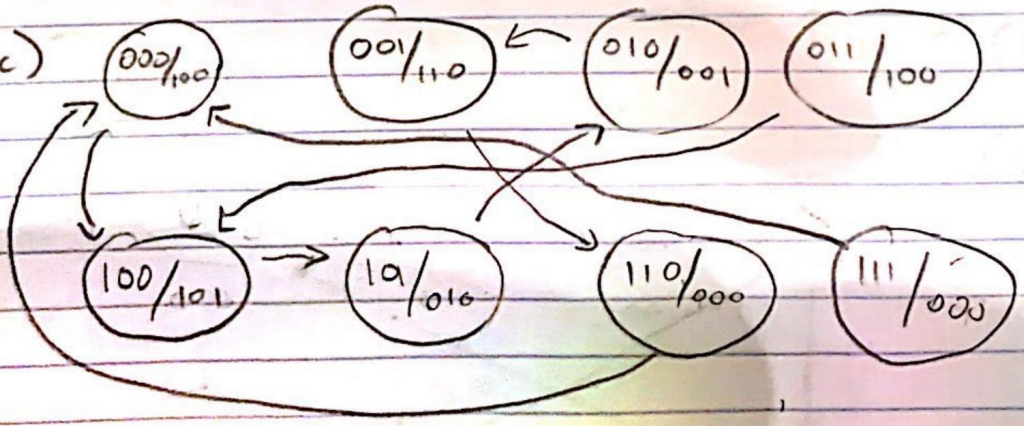
$T0 = Q_1 + (Q_2 \oplus Q_1)$

$\boxed{T0 = Q_0 + (Q_2 Q_1' + Q_2' Q_1)}$

2b)

PS	NS/output	T-inputs
$Q_2 Q_1 Q_0$	$Q_2(t+1)\,Q_1(t+1)\,Q_0(t+1)$	T2 T1 T0
000	100	1 0 0
001	110	1 1 1
010	001	0 1 1
011	100	1 1 1
100	101	0 0 1
101	010	1 1 1
110	000	1 1 0
111	000	1 1 1

2c)



2.2 b **10 / 10**

✓ **- 0 pts** **Correct**

![Screen_Shot_2021-02-26_at_2.15.38_PM.png](/files/fea2318c-41c8-4436-b412-6d5aff63910a)

- **5 pts** Used values of T for NS instead of computing Q(t+1)
- **1.5 pts** Error in PS=000
- **1.5 pts** Error in PS=001
- **1.5 pts** Error in PS=010
- **1.5 pts** Error in PS=100
- **1.5 pts** Error in PS=101
- **1.5 pts** Error in PS=110

2a) $T2 = (Q_0 + (Q_2 \oplus Q_1))'$

$T2 = Q_0 + (Q_2 Q_1' + Q_2' Q_1)'$

$T2 = Q_0 + (Q_2 Q_1')' (Q_2' Q_1)'$

$T2 = Q_0 + (Q_2' + Q_1)(Q_2 + Q_1')$

$\boxed{T2 = Q_0 + (Q_1 Q_2) + (Q_1' Q_2')}$

$\boxed{T1 = Q_1 + Q_0}$

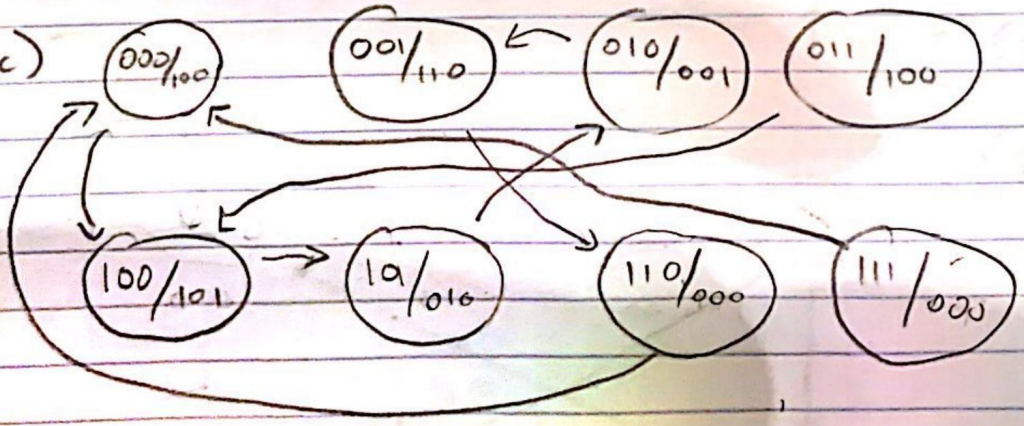
$T0 = Q_1 + (Q_2 \oplus Q_1)$

$\boxed{T0 = Q_0 + (Q_2 Q_1' + Q_2' Q_1)}$

2b)

PS	NS/output	T-inputs
$Q_2 Q_1 Q_0$	$Q_2(t+1)\,Q_1(t+1)\,Q_0(t+1)$	T2 T1 T0
000	100	1 0 0
001	110	1 1 1
010	001	0 1 1
011	100	1 1 1
100	101	0 0 1
101	010	1 1 1
110	000	1 1 0
111	000	1 1 1

2c)



2.3 C **4 / 4**

✓ **- 0 pts** **Correct (state `011`, `111` and their edges are optional)**

![Screen_Shot_2021-02-26_at_2.17.16_PM.png](/files/634c73df-f130-45ff-8bad-a9a83a4cbefb)

- 1 pts Minor error (or error due to incorrect table)

- 3 pts Major error

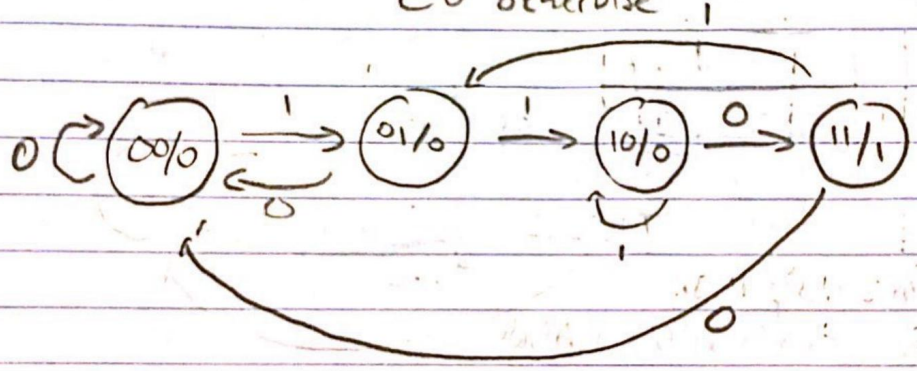
- 4 pts Blank

3) 001

4a) Input: $x(t) \in \{0,1\}$

Output: $z(t) \in \{0,1\}$

Function: $z(t) = \begin{cases} 1 \text{ if } x(t-3,t) = 110 \\ 0 \text{ otherwise} \end{cases}$



4b)

	Input		
PS	$x(t)=0$	$x(t)=1$	z
00	00	01	0
01	00	10	0
10	11	10	0
11	00	01	1
	NS		

4c) $D_A \rightarrow$ left, $D_B \rightarrow$ right

PS		Input	NS				
A	B	x	A	B	D_A	D_B	z
0	0	0	0	0	0	0	0
0	0	1	0	1	0	1	0
0	1	0	0	0	0	0	0
0	1	1	1	0	1	0	0
1	0	0	1	1	1	1	0
1	0	1	1	0	1	0	0
1	1	0	0	0	0	0	1
1	1	1	0	1	0	1	1

3 3 **4 / 4**

✓ **- 0 pts** **Correct: 001**

- 2 pts Pattern is backwards: 100

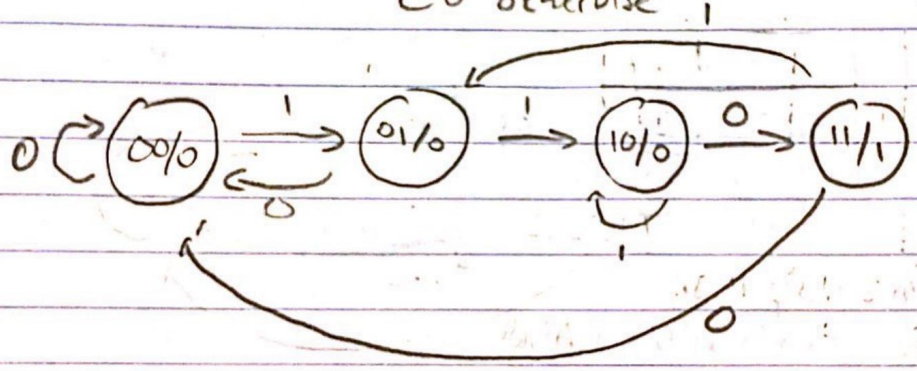
- 3 pts Incorrect

3) 001

4a) Input: $x(t) \in \{0,1\}$

Output: $z(t) \in \{0,1\}$

Function: $z(t) = \begin{cases} 1 \text{ if } x(t-3,t) = 110 \\ 0 \text{ otherwise} \end{cases}$



4b)

	Input		
PS	$x(t)=0$	$x(t)=1$	z
00	00	01	0
01	00	10	0
10	11	10	0
11	00	01	1
	NS		

4c) $D_A \rightarrow$ left, $D_B \rightarrow$ right

PS		Input	NS				
A	B	x	A	B	D_A	D_B	z
0	0	0	0	0	0	0	0
0	0	1	0	1	0	1	0
0	1	0	0	0	0	0	0
0	1	1	1	0	1	0	0
1	0	0	1	1	1	1	0
1	0	1	1	0	1	0	0
1	1	0	0	0	0	0	1
1	1	1	0	1	0	1	1

4.1 a **4 / 4**

✓ **- 0 pts** Correct

![Screen_Shot_2021-02-26_at_2.18.34_PM.png](/files/303b37a6-5b5a-4cbc-a9ad-a9e0a156aecb) OR

![Screen_Shot_2021-02-26_at_2.18.39_PM.png](/files/92e6fb10-ff93-447f-b19a-94efa53cdc42)

- 1 pts Minor error

- 2 pts Major error

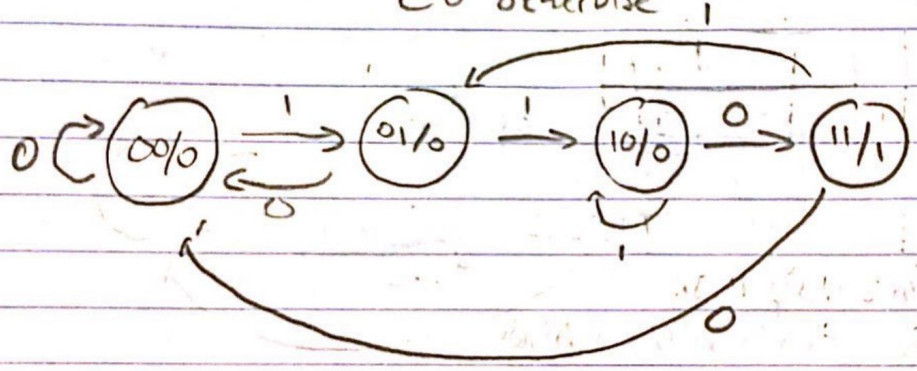
- 4 pts Blank

3) 001

4a) Input: $x(t) \in \{0,1\}$

Output: $z(t) \in \{0,1\}$

Function: $z(t) = \begin{cases} 1 \text{ if } x(t-3,t) = 110 \\ 0 \text{ otherwise} \end{cases}$



4b)

	Input		
PS	$x(t)=0$	$x(t)=1$	z
00	00	01	0
01	00	10	0
10	11	10	0
11	00	01	1
	NS		

4c) $D_A \rightarrow$ left, $D_B \rightarrow$ right

PS		Input	NS				
A	B	x	A	B	D_A	D_B	z
0	0	0	0	0	0	0	0
0	0	1	0	1	0	1	0
0	1	0	0	0	0	0	0
0	1	1	1	0	1	0	0
1	0	0	1	1	1	1	0
1	0	1	1	0	1	0	0
1	1	0	0	0	0	0	1
1	1	1	0	1	0	1	1

4.2 b **6 / 6**

✓ **- 0 pts** Correct

![Screen_Shot_2021-02-26_at_2.20.05_PM.png](/files/fe417073-f97b-4788-9dba-bfa8dee3303b) OR

![Screen_Shot_2021-02-26_at_2.20.00_PM.png](/files/7b77c060-b482-4b51-b707-23250847ea44)

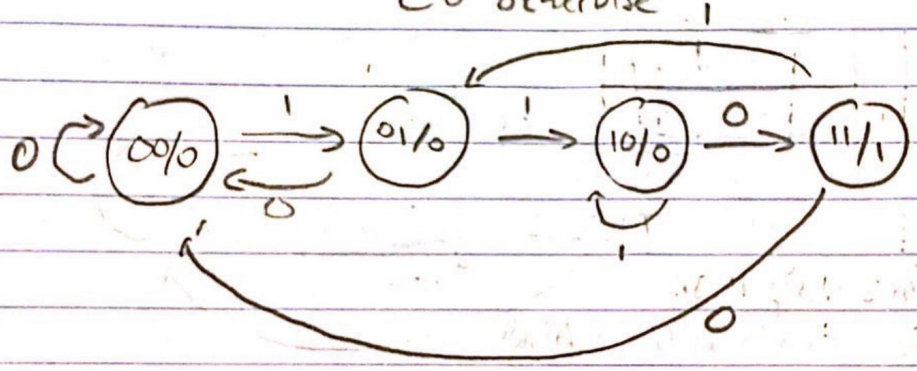
- **1.5 pts** Error in PS=00
- **1.5 pts** Error in PS=01
- **1.5 pts** Error in PS=10
- **1.5 pts** Error in PS=11

3) 001

4a) Input: $x(t) \in \{0,1\}$

Output: $z(t) \in \{0,1\}$

Function: $z(t) = \begin{cases} 1 \text{ if } x(t-3,t) = 110 \\ 0 \text{ otherwise} \end{cases}$



4b)

	Input		
PS	$x(t)=0$	$x(t)=1$	z
00	00	01	0
01	00	10	0
10	11	10	0
11	00	01	1
	NS		

4c) $D_A \rightarrow$ left, $D_B \rightarrow$ right

PS		Input	NS				
A	B	x	A	B	D_A	D_B	z
0	0	0	0	0	0	0	0
0	0	1	0	1	0	1	0
0	1	0	0	0	0	0	0
0	1	1	1	0	1	0	0
1	0	0	1	1	1	1	0
1	0	1	1	0	1	0	0
1	1	0	0	0	0	0	1
1	1	1	0	1	0	1	1

4c) D_A:

A \ x	00	01	11	10
0	0	0	1	0
1	1	1	0	0

$D_A = B$

D_B:

A \ x	00	01	11	10
0	0	1	0	0
1	1	0	1	0

$D_B = B$

z:

A \ x	00	01	11	10
0	0	0	0	0
1	0	0	1	1

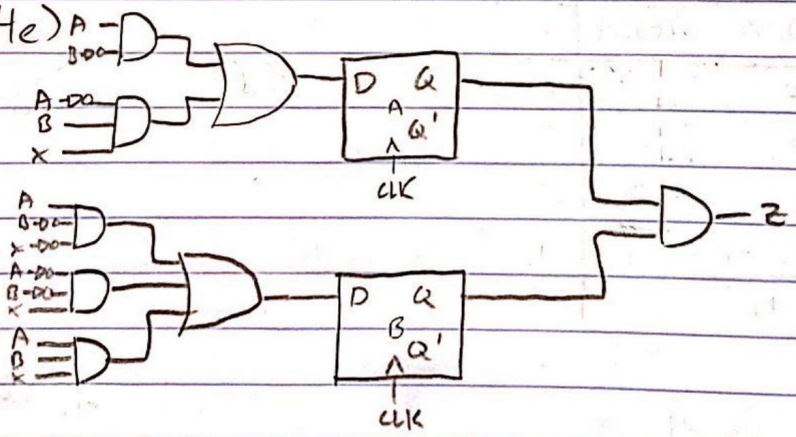
$z = AB$

4d) $D_A = AB' + A'Bx$

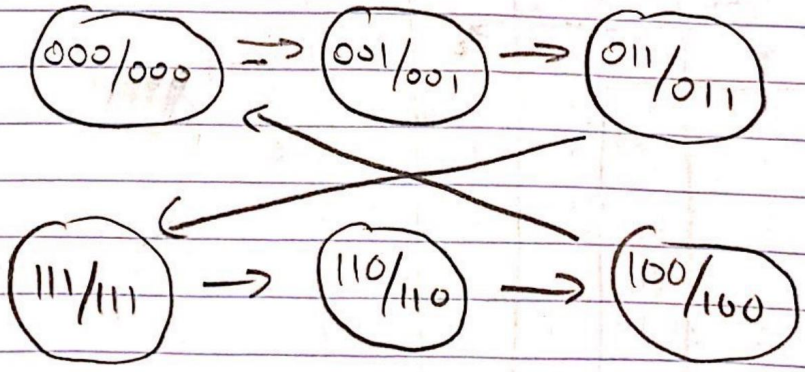
$D_B = AB'x' + A'B'x + ABx$

$z = AB$

4e)



5a)



4.3 C **6 / 6**

✓ **- 0 pts** Correct

![Screen_Shot_2021-02-26_at_2.24.00_PM.png](/files/7c906cf6-4e6e-4dbc-9445-c090440adff9) OR ![Screen_Shot_2021-02-26_at_2.23.54_PM.png](/files/6d3e714c-ff6b-4e16-bf10-1f2639a1f8e5)

- **1 pts** Minor error in D1
- **2 pts** Blank in D1
- **1 pts** Minor error in D0
- **2 pts** Blank in D0
- **1 pts** Minor error in z
- **2 pts** Blank in z

4c) D_A:

A \ x	00	01	11	10
0	0	0	1	0
1	1	1	0	0

$D_A = B$

D_B:

A \ x	00	01	11	10
0	0	1	0	0
1	1	0	1	0

$D_B = B$

z:

A \ x	00	01	11	10
0	0	0	0	0
1	0	0	1	1

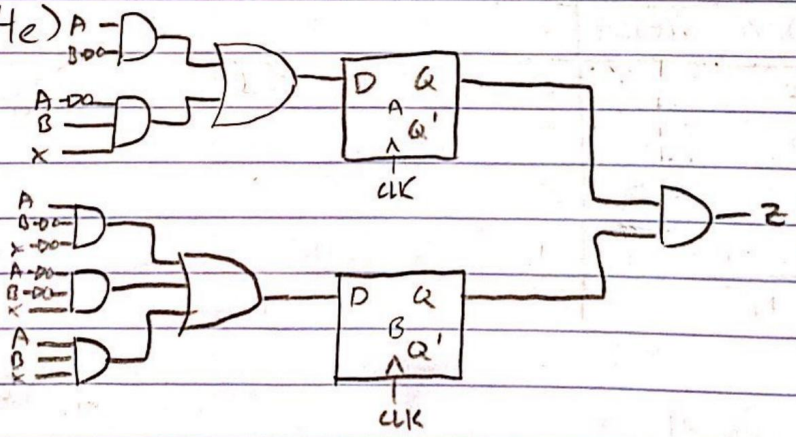
$z = AB$

4d) $D_A = AB' + A'Bx$

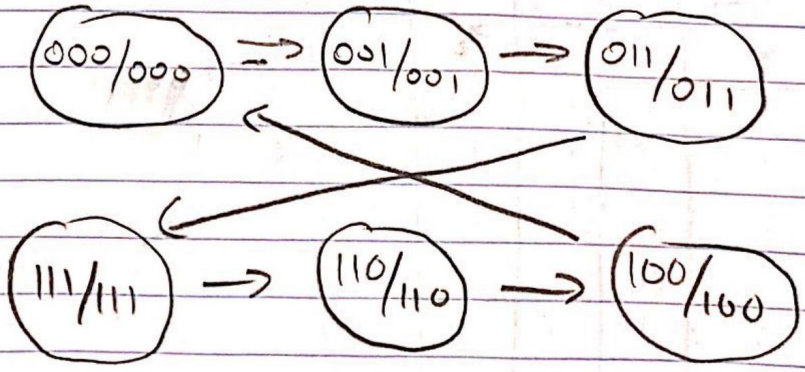
$D_B = AB'x' + A'B'x + ABx$

$z = AB$

4e)



5a)



4.4 d **6 / 6**

✓ **- 0 pts** **Correct**

![Screen_Shot_2021-02-26_at_2.25.21_PM.png](/files/eff2221b-2028-4b07-84ec-91ba26633716) OR

![Screen_Shot_2021-02-26_at_2.25.18_PM.png](/files/11af93da-002d-40a5-9fb1-df8aa0f1ca42)

- **1 pts** Minor error in D1
- **2 pts** Blank in D1
- **1 pts** Minor error in D0
- **2 pts** Blank in D0
- **1 pts** Minor error in z
- **2 pts** Blank in z

4c) D_A:

A \ x	00	01	11	10
0	0	0	1	0
1	1	1	0	0

$D_A = B$

D_B:

A \ x	00	01	11	10
0	0	1	0	0
1	1	0	1	0

$D_B = B$

z:

A \ x	00	01	11	10
0	0	0	0	0
1	0	0	1	1

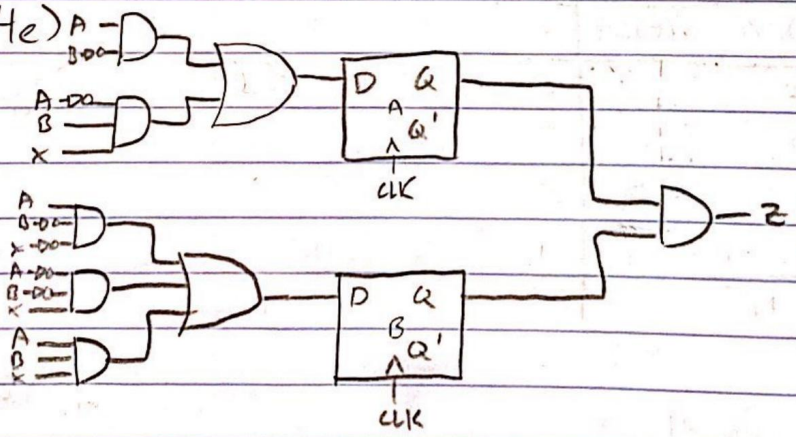
$z = AB$

4d) $D_A = AB' + A'Bx$

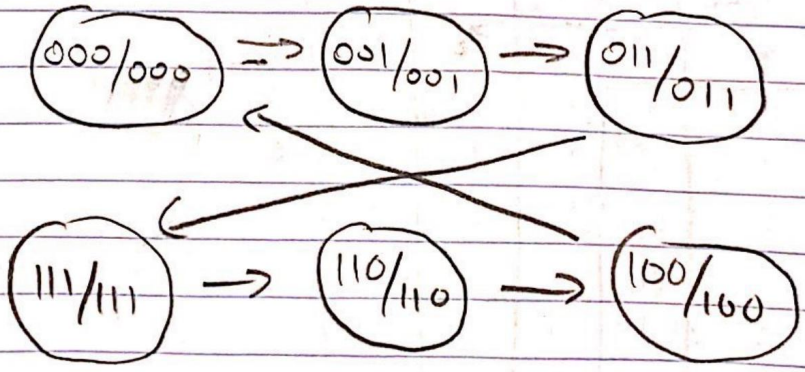
$D_B = AB'x' + A'B'x + ABx$

$z = AB$

4e)



5a)



4.5 e **4 / 4**

✓ **- 0 pts** Correct

![Screen_Shot_2021-02-26_at_2.27.17_PM.png](/files/db567b4a-4bcb-4de9-ab51-b5bb65055810) OR

![Screen_Shot_2021-02-26_at_2.27.09_PM.png](/files/c6f13529-4a86-45b7-8e43-4da259e55e79)

- 1 pts Minor error

- 2 pts Major error

- 4 pts Blank

4c) D_A:

A \ x	00	01	11	10
0	0	0	1	0
1	1	1	0	0

$D_A = B$

D_B:

A \ x	00	01	11	10
0	0	1	0	0
1	1	0	1	0

$D_B = B$

z:

A \ x	00	01	11	10
0	0	0	0	0
1	0	0	1	1

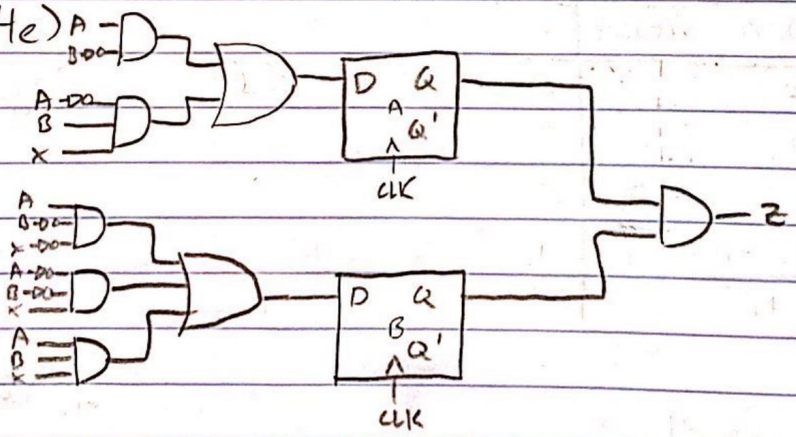
$z = AB$

4d) $D_A = AB' + A'Bx$

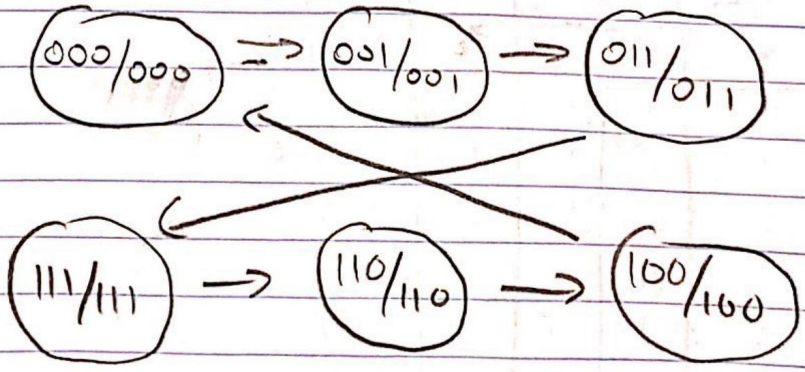
$D_B = AB'x' + A'B'x + ABx$

$z = AB$

4e)



5a)



5.1 a **4 / 4**

✓ **- 0 pts** **Correct**

![3a.PNG](/files/bf5c5592-0dff-46c3-882e-428298373baf)

(Not writing outputs is ok)

- 1 pts Diagram has inputs (clk input is ok)

- 1 pts Single wrong transition

- 2 pts Multiple incorrect transitions

5b)

	PS	NS	T-inputs
	$Q_2Q_1Q_0$	$Q_2(t+1)Q_1(t+1)Q_0(t+1)$	$T_2T_1T_0$
0	000	001	001
1	001	011	010
3	011	111	100
7	111	110	001
6	110	100	010
4	100	000	100

5c) T_2:

Q_2 \ Q_1	0	0	1	X
1	1	X	0	0

T_1:

Q_2 \ Q_0	0	1	0	X
0	0	X	0	1

T_0:

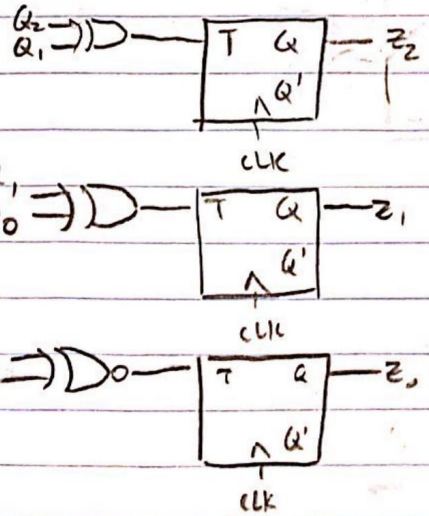
Q_2 \ Q_1	1	0	0	X
0	0	X	1	0

5d) $T_2 = Q_2Q_1' + Q_2'Q_1 = Q_2 \oplus Q_1$

$T_1 = Q_1'Q_0 + Q_1Q_0' = Q_1 \oplus Q_0$

$T_0 = Q_2'Q_0' + Q_2Q_0 = (Q_2 \oplus Q_0)'$

5e)



5.2 b **6 / 6**

✓ **- 0 pts** Correct

![3b.PNG](/files/04c3bb25-cd71-442e-9edf-fd58ad34cf97)

Having all 8 rows is ok, as long as the NS, output, and 3 T inputs are don't cares. Table may be out of order.

- **1 pts** Error in first row
- **1 pts** Error in second row
- **1 pts** Error in third row
- **1 pts** Error in forth row
- **1 pts** Error in fifth row
- **1 pts** Error in sixth row

5b)

	PS	NS	T-inputs
	$Q_2Q_1Q_0$	$Q_2(t+1)Q_1(t+1)Q_0(t+1)$	$T_2T_1T_0$
0	000	001	001
1	001	011	010
3	011	111	100
7	111	110	001
6	110	100	010
4	100	000	100

5c) T_2:

Q_2 \ Q_1	0	0	1	X
1	1	X	0	0

T_1:

Q_2 \ Q_0	0	1	0	X
0	0	X	0	1

T_0:

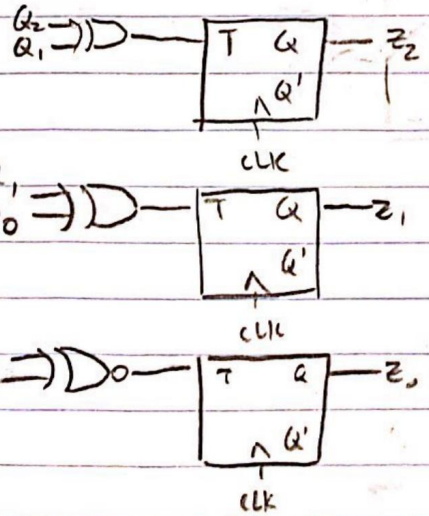
Q_2 \ Q_1	1	0	0	X
0	0	X	1	0

5d) $T_2 = Q_2Q_1' + Q_2'Q_1 = Q_2 \oplus Q_1$

$T_1 = Q_1'Q_0 + Q_1Q_0' = Q_1 \oplus Q_0$

$T_0 = Q_2'Q_0' + Q_2Q_0 = (Q_2 \oplus Q_0)'$

5e)



5.3 C **6 / 6**

✓ **- 0 pts** Correct

![3c.PNG](/files/e731661a-a60e-4c0e-8619-bf9f6403bc94)

- **1.5 pts** K Map for TA/T2 incorrectly filled out (circles not required)
- **1.5 pts** K Map for TB/T1 incorrectly filled out (circles not required)
- **1.5 pts** K Map for TC/T0 incorrectly filled out (circles not required)

5b)

	PS	NS	T-inputs
	$Q_2Q_1Q_0$	$Q_2(t+1)Q_1(t+1)Q_0(t+1)$	$T_2T_1T_0$
0	000	001	001
1	001	011	010
3	011	111	100
7	111	110	001
6	110	100	010
4	100	000	100

5c) T_2:

Q_2 \ Q_1	0	0	1	X
1	1	X	0	0

T_1:

Q_2 \ Q_0	0	1	0	X
0	0	X	0	1

T_0:

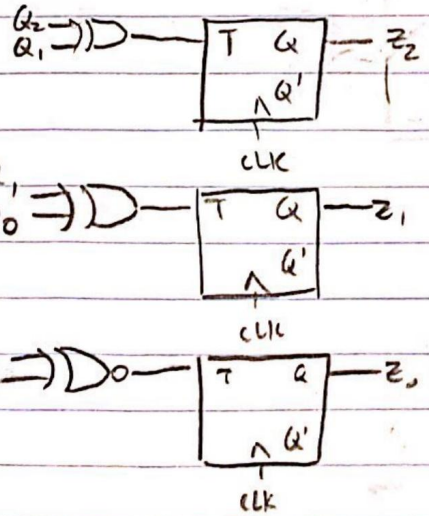
Q_2 \ Q_1	1	0	0	X
0	0	X	1	0

5d) $T_2 = Q_2Q_1' + Q_2'Q_1 = Q_2 \oplus Q_1$

$T_1 = Q_1'Q_0 + Q_1Q_0' = Q_1 \oplus Q_0$

$T_0 = Q_2'Q_0' + Q_2Q_0 = (Q_2 \oplus Q_0)'$

5e)



5.4 d **6 / 6**

✓ **- 0 pts** **Correct**

![3d.PNG](/files/11052efa-35f5-4e65-b52d-c4518c603969)

Note: A=Q2, B=Q1, C=Q0

- **0.5 pts** TA/T2 minor error
- **0.5 pts** TB/T1 minor error
- **0.5 pts** TC/T0 minor error
- **1 pts** TA/T2 incorrect equation
- **1 pts** TB/T1 incorrect equation
- **1 pts** TC/T0 incorrect equation

5b)

	PS	NS	T-inputs
	$Q_2Q_1Q_0$	$Q_2(t+1)Q_1(t+1)Q_0(t+1)$	$T_2T_1T_0$
0	000	001	001
1	001	011	010
3	011	111	100
7	111	110	001
6	110	100	010
4	100	000	100

5c) T_2:

Q_2 \ Q_1	0	0	1	X
1	1	X	0	0

T_1:

Q_2 \ Q_0	0	1	0	X
0	0	X	0	1

T_0:

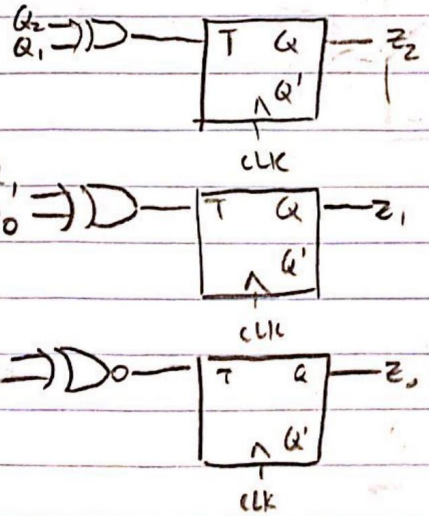
Q_2 \ Q_1	1	0	0	X
0	0	X	1	0

5d) $T_2 = Q_2Q_1' + Q_2'Q_1 = Q_2 \oplus Q_1$

$T_1 = Q_1'Q_0 + Q_1Q_0' = Q_1 \oplus Q_0$

$T_0 = Q_2'Q_0' + Q_2Q_0 = (Q_2 \oplus Q_0)'$

5e)



5.5 e **6 / 6**

✓ **- 0 pts** **Correct**

![3e.PNG](/files/fb28b7d6-dd4c-4798-8e1f-84ed7073a6e1)

XOR gates may be used for TA/T2 and TB/T1

XNOR gates may be used to TC/T0

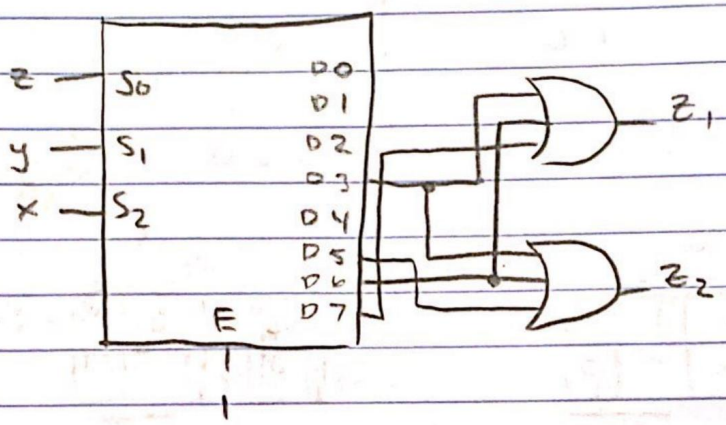
- **3 pts** All inputs incorrect due to incorrect part D equations
- **0.5 pts** Minor error
- **1 pts** Input to TA/T2 incorrect
- **1 pts** Input to TB/T1 incorrect
- **1 pts** Input to TC/T0 incorrect

6) $z_1 = xyz + xyz' + x'yz$

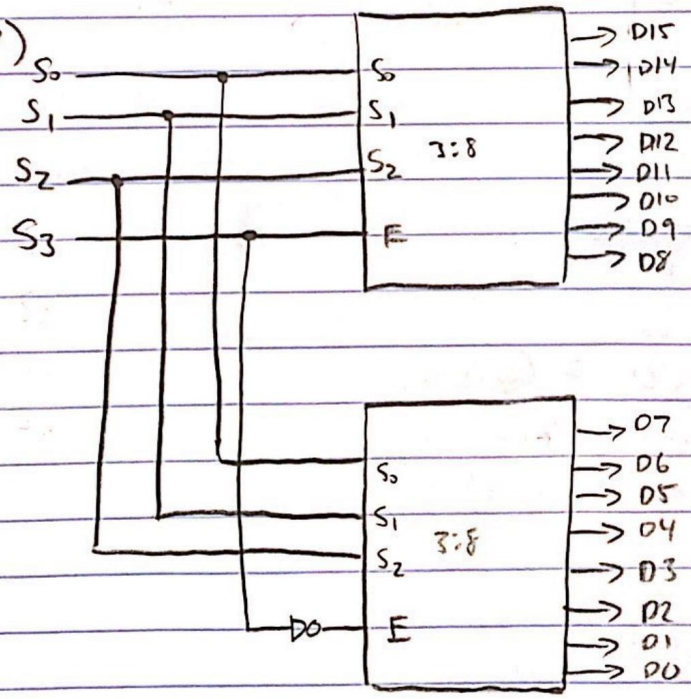
$z_2 = xy'z + xyz' + x'yz$

$z_1 = \Sigma m(3,6,7)$

$z_2 = \Sigma m(3,5,6)$



7)



6 6 6 / 6

✓ - 0 pts Correct

![6.PNG](/files/f28a87d1-0403-4e86-abf7-c7d1928f4685)

$$z_{1} = \sum m(3, 6, 7)$$

$$z_{2} = \sum m(3, 5, 6)$$

(Equations not required)

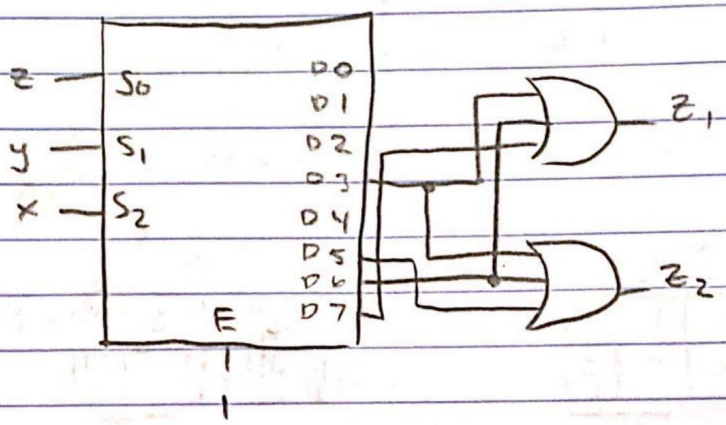
- **1 pts** Mixed MSB and LSB for input (ie xyz instead of zyx)
- **1 pts** Minor error in z1
- **2 pts** Major error in z1
- **3 pts** Blank in z1
- **1 pts** Minor error in z2
- **2 pts** Major error in z2
- **3 pts** Blank in z2

6) $z_1 = xyz + xyz' + x'yz$

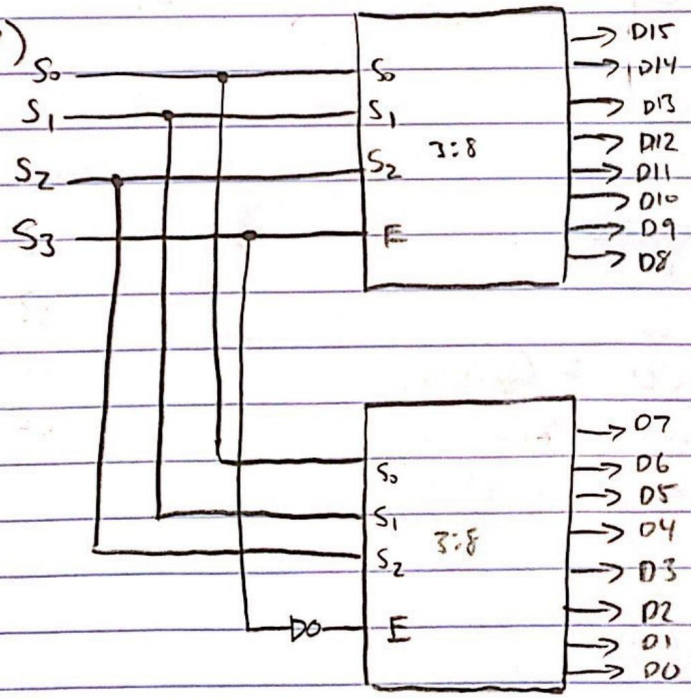
$z_2 = xy'z + xyz' + x'yz$

$z_1 = \Sigma m(3,6,7)$

$z_2 = \Sigma m(3,5,6)$



7)



7 7 **10 / 10**

✓ **- 0 pts** **Correct**

![7.PNG](/files/f62f6705-02e6-443f-89e3-8a7f84b9144f)

- 2 pts Input E for top (D0 to D7) missing not gate

- 4 pts MSB is not connected to enable bit E

- 3 pts Mixed MSB and LSB inputs

- 1 pts Missing labels for (D8-D15)

- 2 pts Missing labels for outputs

- 2 pts Missing labels for inputs

- 2 pts Wrong output labels

- 6 pts Error

- 8 pts Major design error

- 10 pts Blank