Final Solutions ECE2060 Sp 2022

Show all relevant steps. Don't just write down the answers.

Submit your answers in Word or pdf format to Carmen. Write all your answers on the provided assignment. You can add your own pages to the assignment if you run out of space.

Do not email directly to your TAs or me. Files emailed directly to the TAs or me will not be accepted. Fill out the following

Please provide the following information:

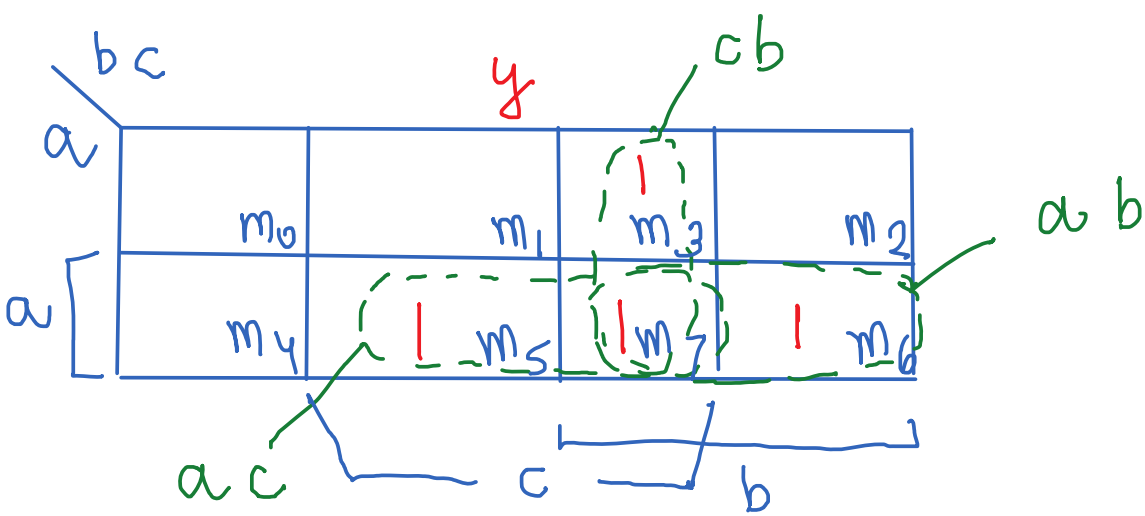
Your Last Name_____

Your First Name_____

OSU email _____

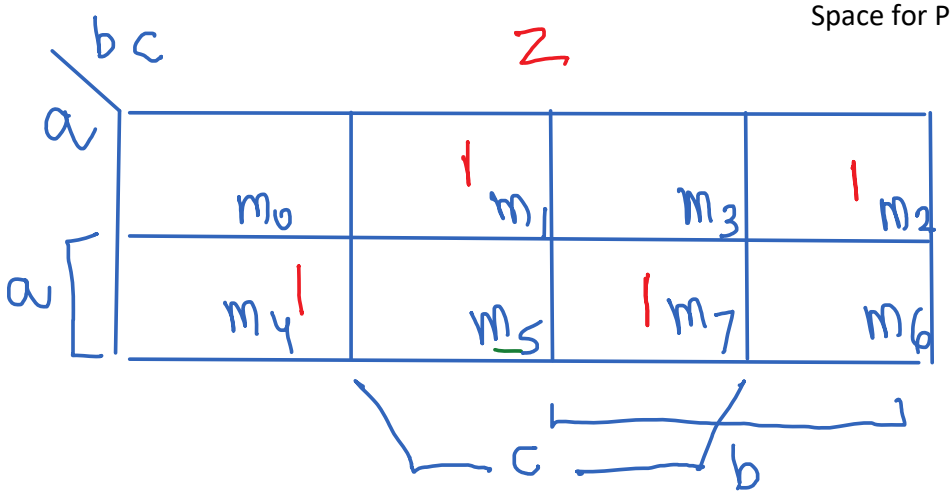
Problem 1 (50 Points)

	a	b	c	# of 1s	y	z
m_0	0	0	0	(0)	0	0
m_1	0	0	1	(1)	0	1
m_2	0	1	0	(1)	0	1
m_3	0	1	1	(2)	1	0
m_4	1	0	0	(1)	0	1
m_5	1	0	1	(2)	1	0
m_6	1	1	0	(2)	1	0
m_7	1	1	1	(3)	1	1



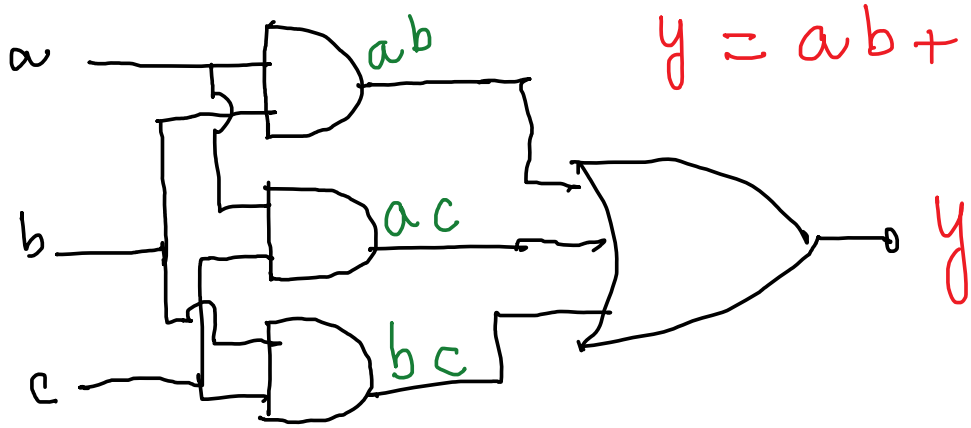
$y = ab + ac + cb$

Space for Problem 1 solution ....

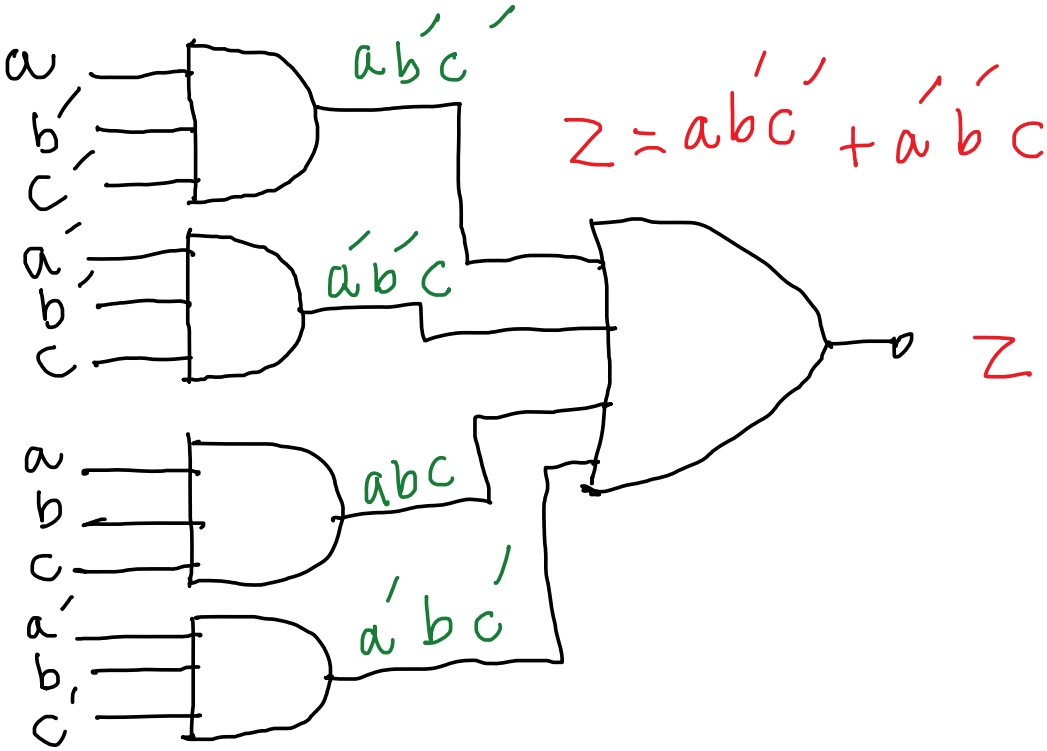


$$Z = ab'c' + a'b'c + abc + a'b'c$$

$$y = ab + ac + bc$$



$$Z = ab'c' + a'b'c + abc + a'b'c$$



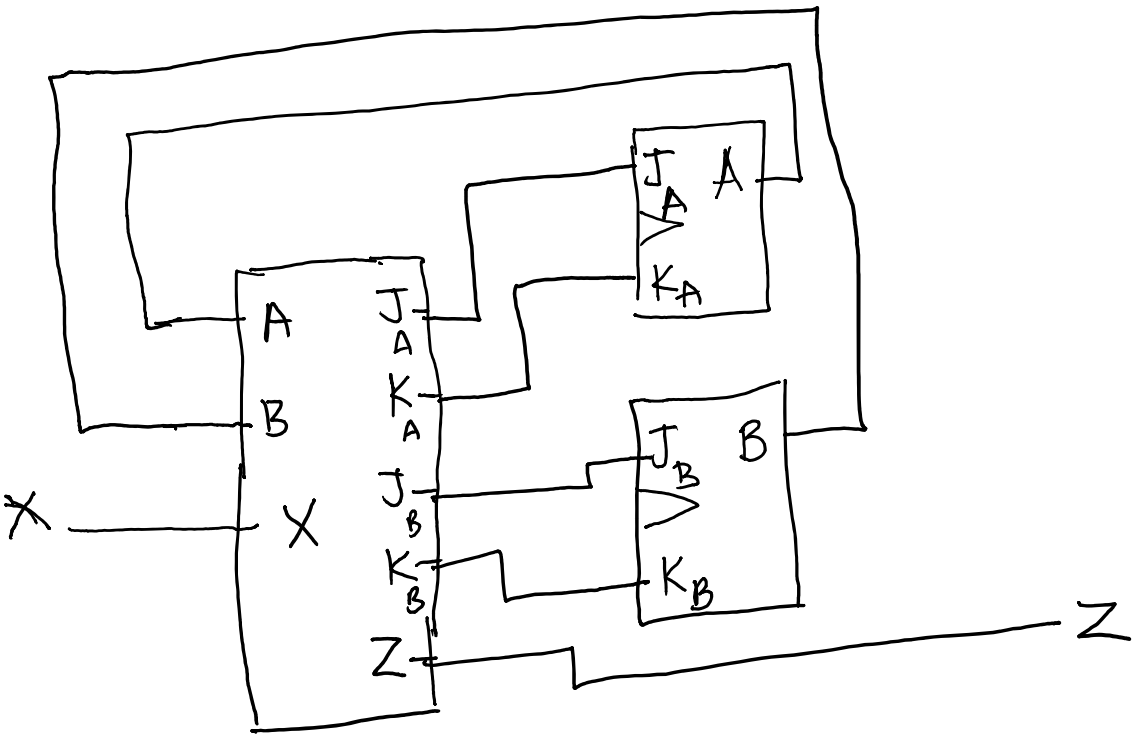
Problem 2 (50 points): A sequential circuit with input X, output Z and two JK Flip-flops A and B is defined by the Flip-flop input equations

$J_A = XA$
$K_A = XA + B$
$J_B = XA + A$
$K_B = XA$

and output equation Z = A

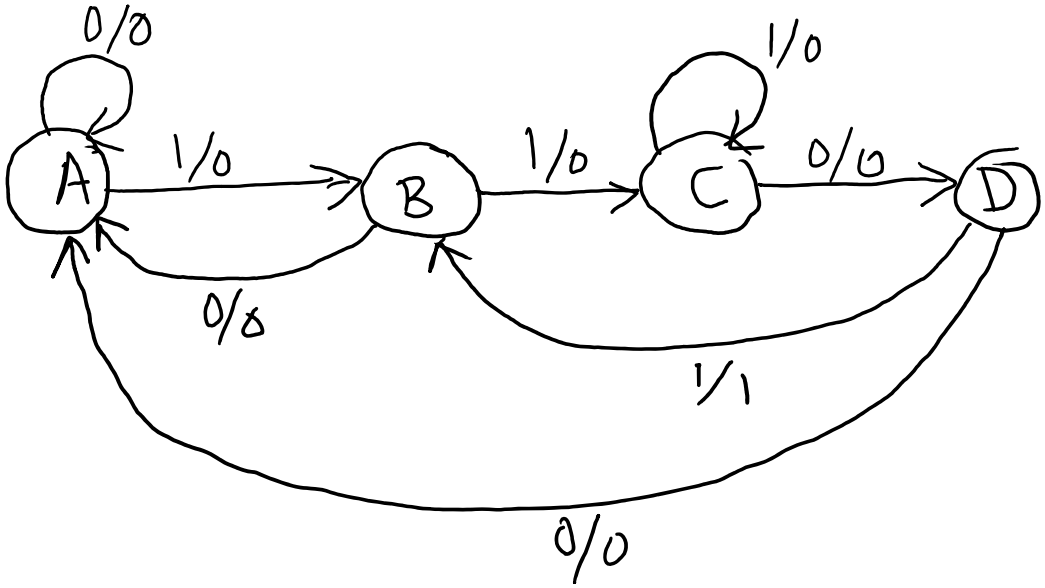
Draw the PLA table and Implement this circuit by using a Programmable Logic Array (PLA) and JK Flip-flops. Do not us AND or OR gates.

	inputs			outputs				
Product terms	A	B	X	J_A	K_A	J_B	K_B	Z
XA	1	–	1	1	1	1	1	0
A	1	–	–	0	0	1	0	1
B	–	1	–	0	1	0	0	0



Problem 3 (50 points): For the state diagram of a sequential circuit with input X, output Z and states A, B, C and D given below use grey coding A -> 00, B -> 01, C -> 11, D -> 10 to determine the state table. Use two T Flip-flops to store this state. Determine the Flip-flop input equations and output equation as a sum of minterms. Implement the circuit using a PROM OR Array (do not use gates like AND, OR etc.). Draw the full circuit diagram including switches and resistors.

Note: The problem is asking you to design with two T Flip-flops not D Flip-flops



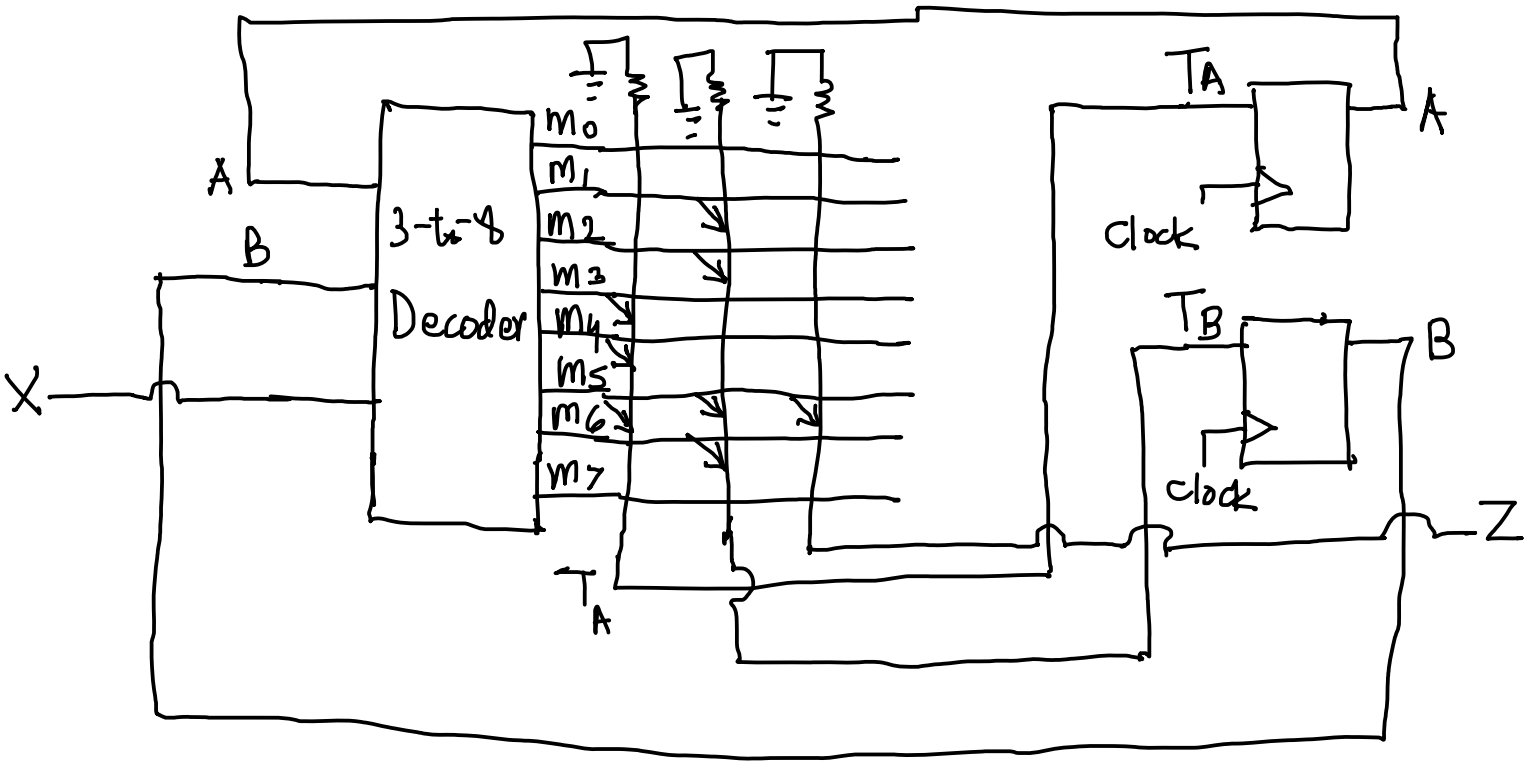
A	B	X	A^+	B^+	Z	T_A	T_B
0	0	0	0	0	0	0	0
0	0	1	0	1	0	0	1
0	1	0	0	0	0	0	1
0	1	1	1	1	0	1	0
1	0	0	0	0	0	1	0
1	0	1	0	1	1	1	1
1	1	0	1	0	0	0	1
1	1	1	1	1	0	0	0

Space for Problem 3 solution ….

$$T_A = \sum m(3,4,5)$$

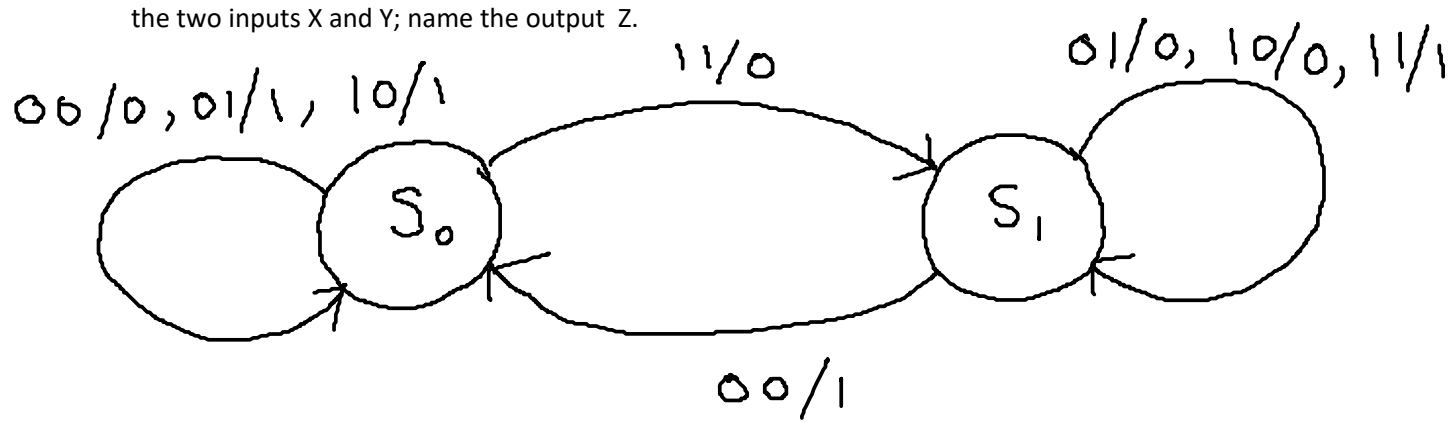
$$T_B = \sum m(1,2,5,6)$$

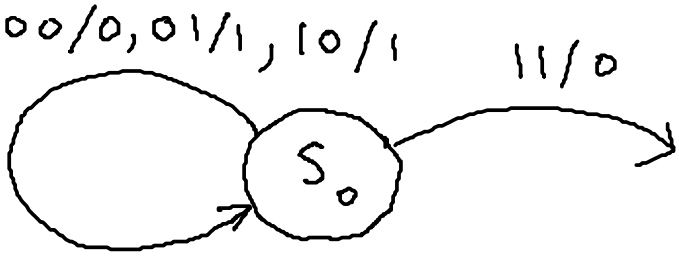
$$Z = \sum m(5)$$



Space for Problem 3 solution ….

Problem 4 (50 points) Convert the state diagram shown below into a state machine diagram. Name the two inputs X and Y; name the output Z.





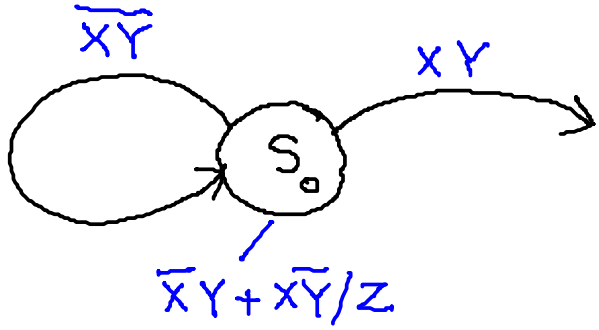
TC. 00, 01, 10

$\bar{X}\bar{Y} + \bar{X}Y + X\bar{Y}$

$\bar{X}(\bar{Y} + Y) + X\bar{Y} = \bar{X} + X\bar{Y}$

$= \underbrace{(\bar{X} + X)}_{1}(\bar{X} + \bar{Y}) = \bar{X} + \bar{Y}$

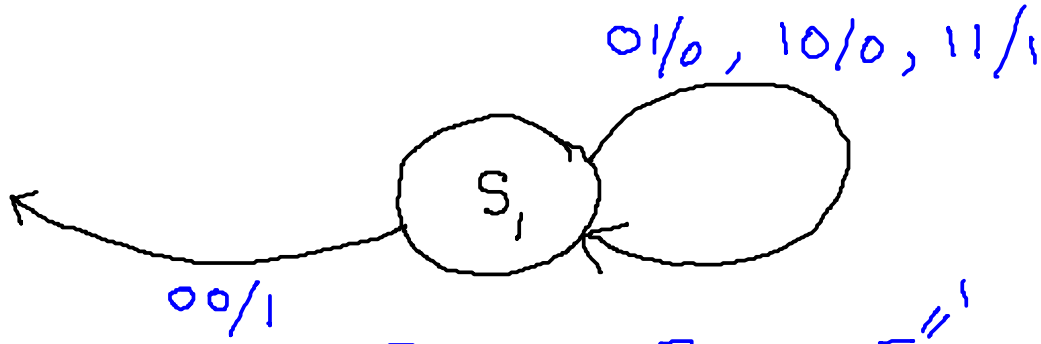
$= \overline{XY}$



TC : 11 → XY

OC for Z=1 01, 10

$\bar{X}Y + X\bar{Y}$



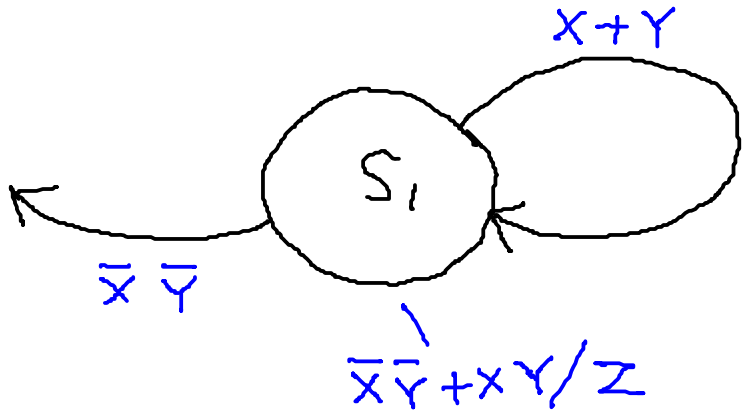
TC: 01, 10, 11 → $\bar{X}Y + X\bar{Y} + XY = \bar{X}Y + X\underbrace{(\bar{Y} + Y)}_{1}$

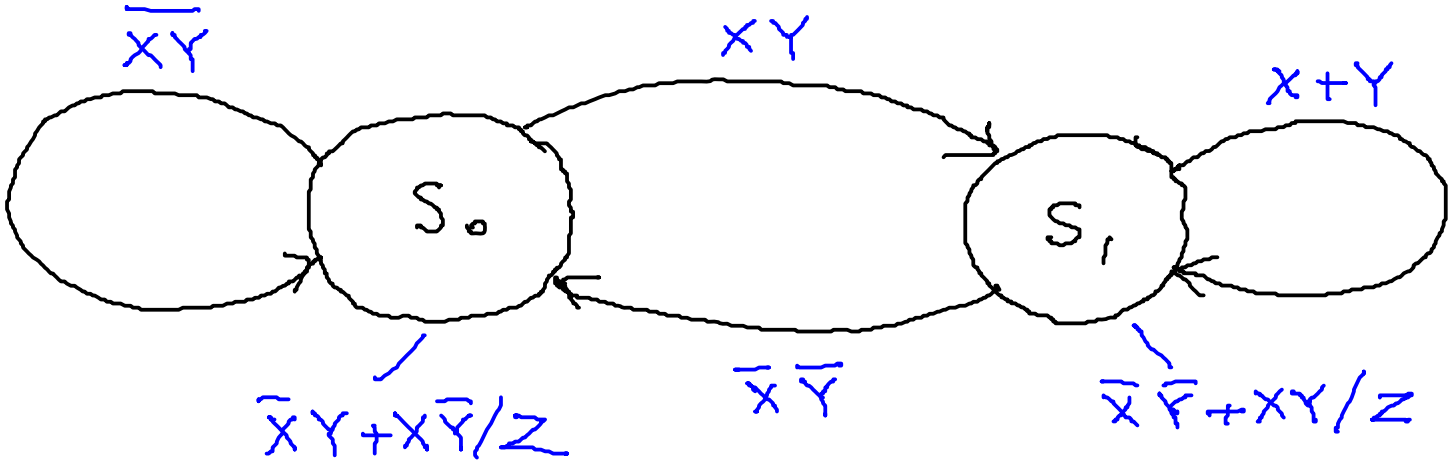
$= \bar{X}Y + X = \underbrace{(\bar{X} + X)}_{1}(Y + X) = X + Y$

TC : 00 → $\bar{X}\bar{Y}$

Space for Problem 4 solution ....

DC for $Z=1$, 00, 11 $\rightarrow \bar{X}\bar{Y} + XY$





Space for Problem 4 solution ….