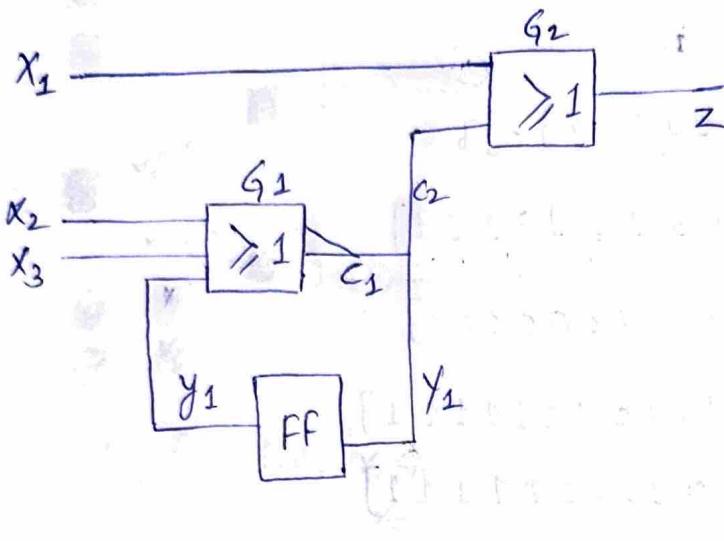


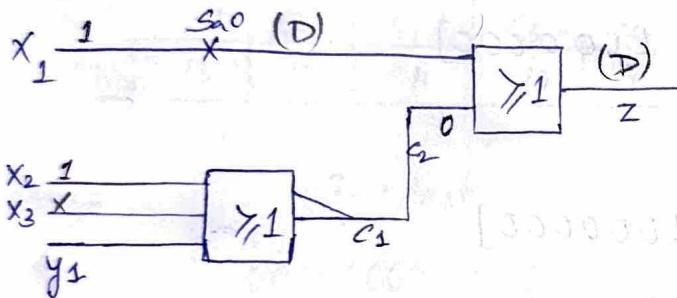
Homework 3

1. Figure 5.5



| A | B | Z | NOR | OR |
|---|---|---|-----|----|
| 0 | 0 | 1 | 1 | 0 |
| 0 | 1 | 0 | 0 | 1 |
| 1 | 0 | 0 | 0 | 1 |
| 1 | 1 | 0 | 1 | 1 |

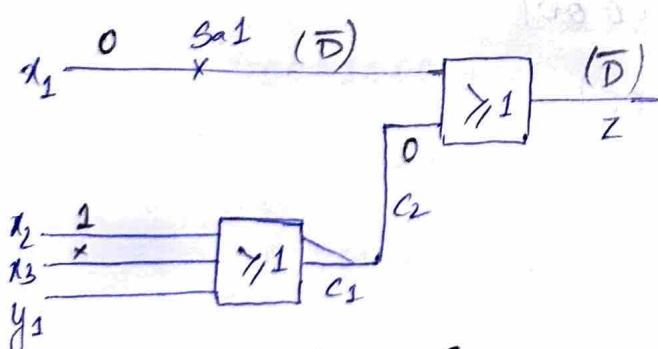
(i) $x_1 = 0$



Time frame 0

Test Sequence : $(x_1 \ x_2 \ x_3) = \{ (1 \ 1 \ x) \text{ or } (1 \ x \ 1) \}$

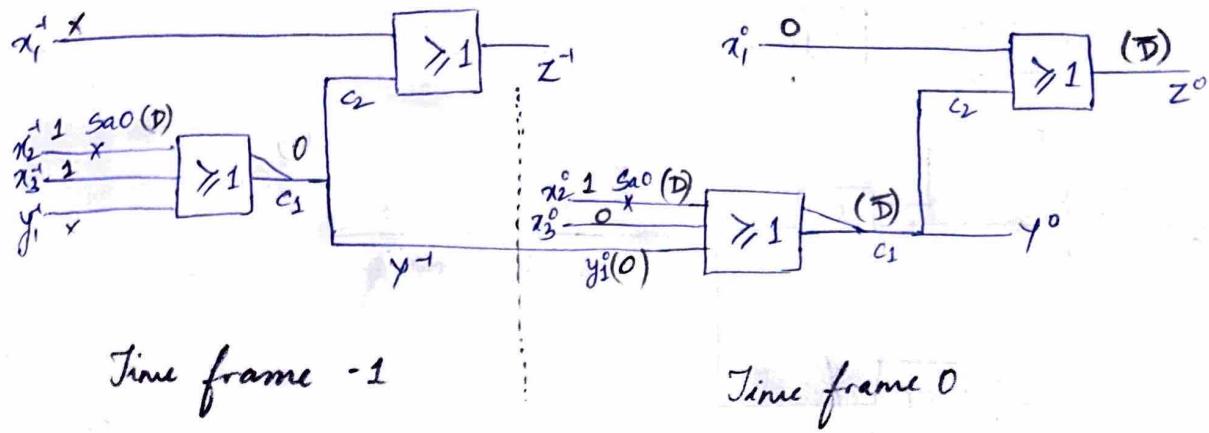
(ii) $x_1 = 1$



Time frame 0

Test Sequence : $(x_1 \ x_2 \ x_3) = \{ 0 \ 1 \ x \text{ or } 0 \ x \ 1 \}$

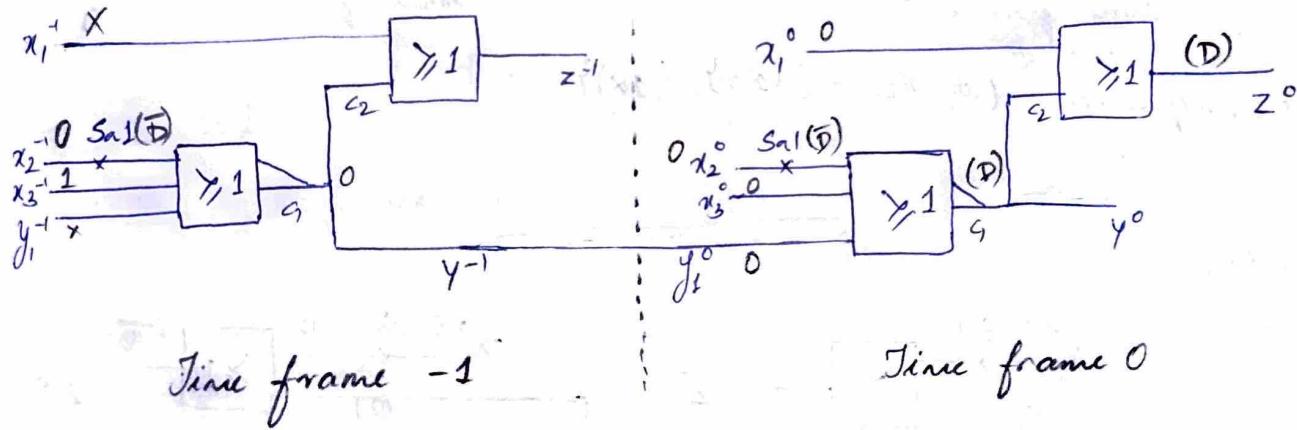
(iii) x_2 Sa0



Test Sequence : $(x, x_2 x_3) = \{(xx1), (010)\}$

In order to get \bar{D} at the output, y_1^0 has to be set to 0. Thus extending one time frame backward.

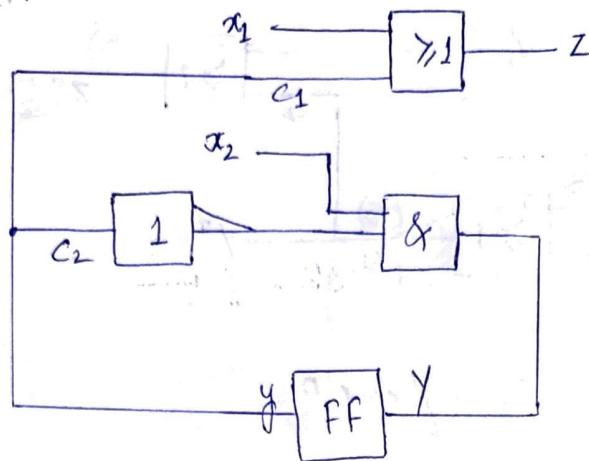
(iv) x_2 Sa1



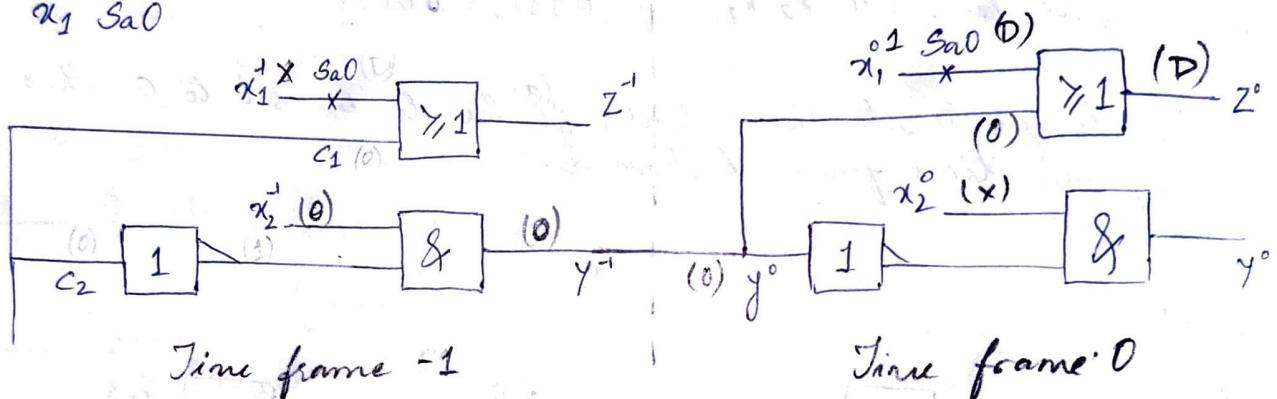
Test Sequence : $(x, x_2 x_3) = \{(xx1), (000)\}$

or $\{(x1x), (000)\}$

2. Figure 5.27

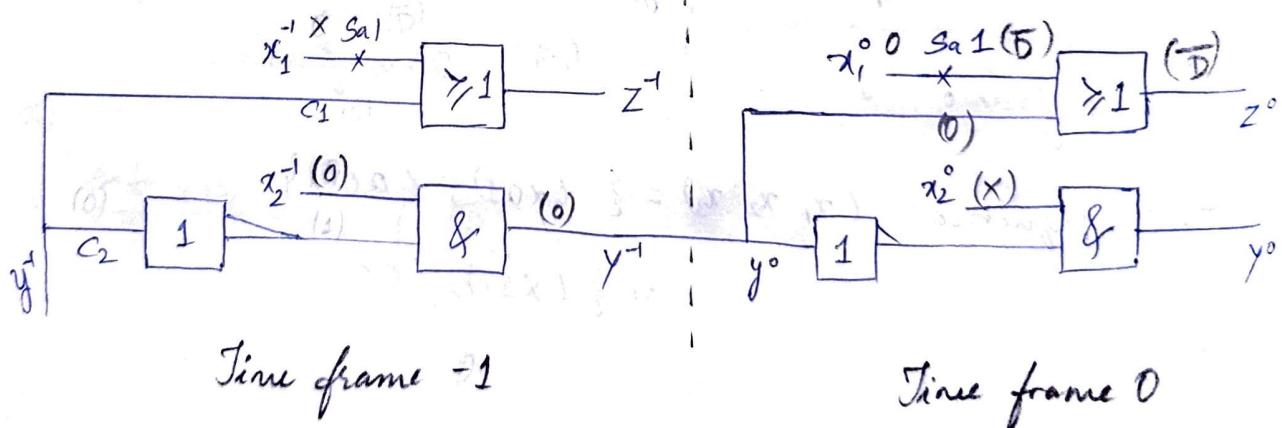


(i) $x_1 = 0$



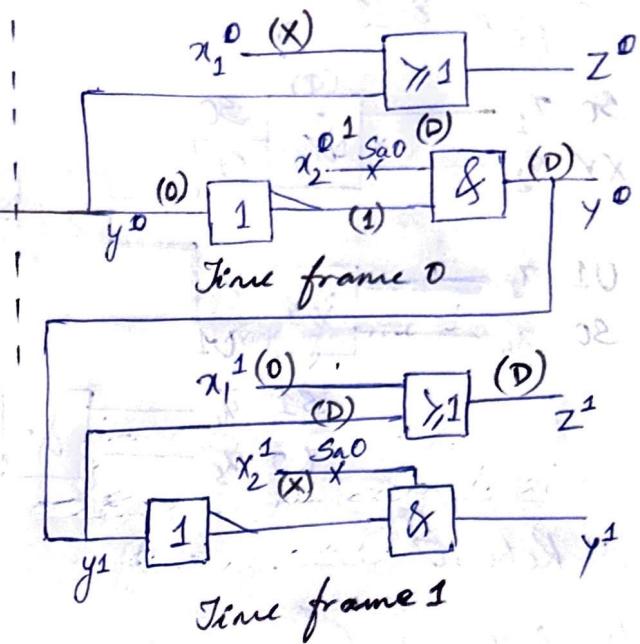
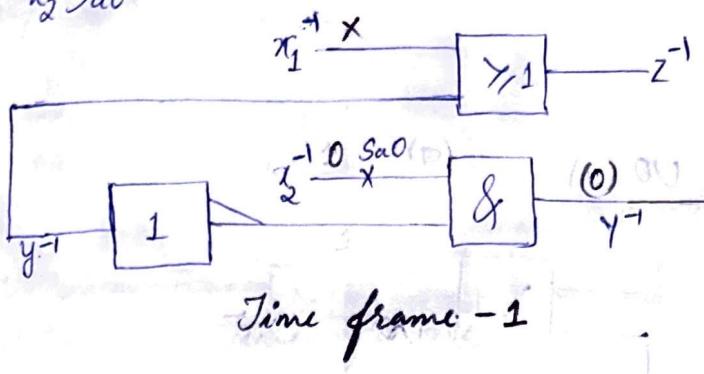
Test sequence: $(x_1, x_2) = \{(00), (1x)\}$

(ii) $x_1 = 1$



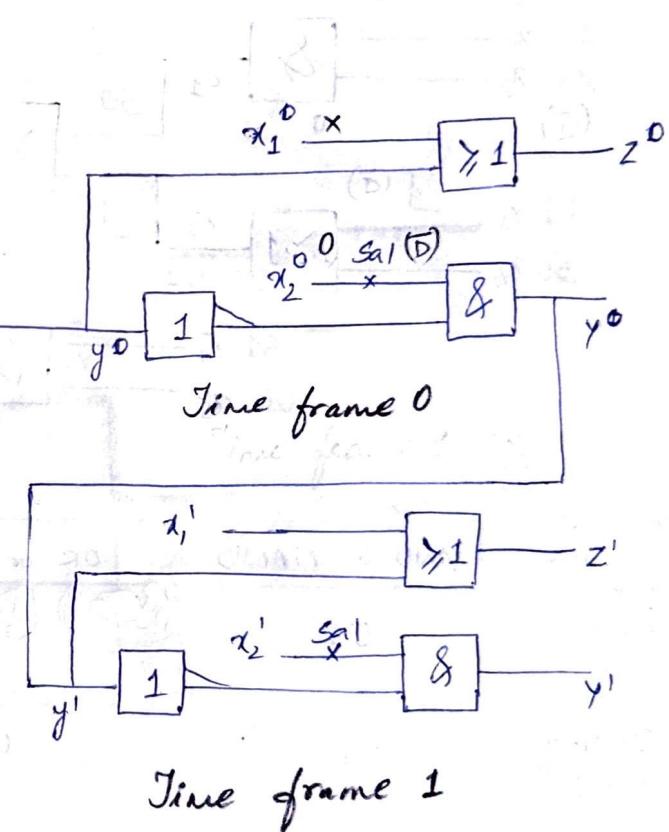
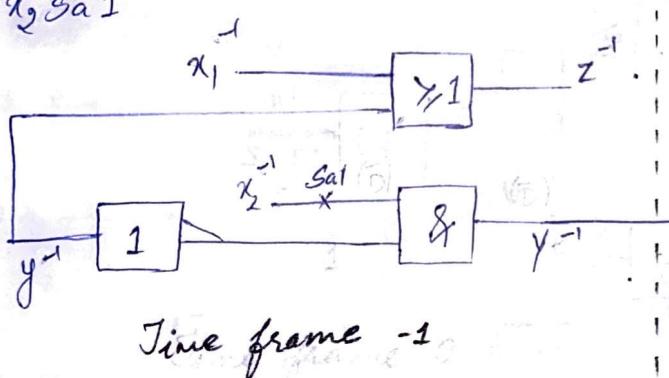
Test sequence: $(x_1, x_2) = \{(x0), (ox)\}$

(iii) x_2 Sa0



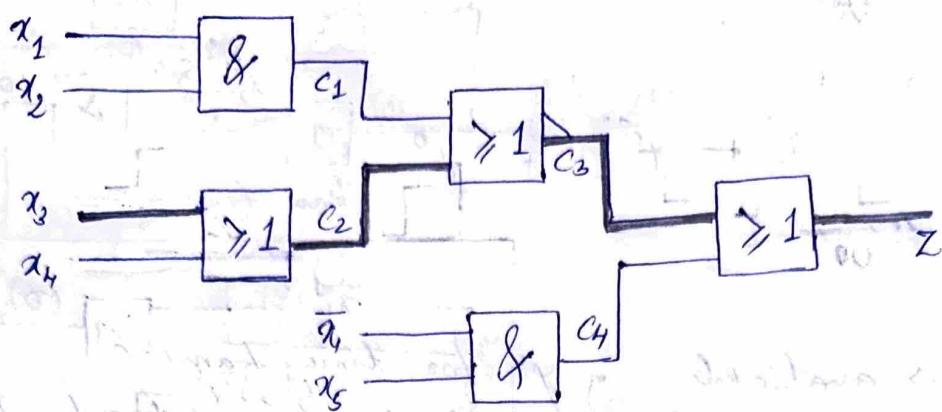
∴ Test sequence: $(x_1 x_2) = \{(x_0 0), (x_1 1), (0x)\}$

(iv) x_2 Sa1



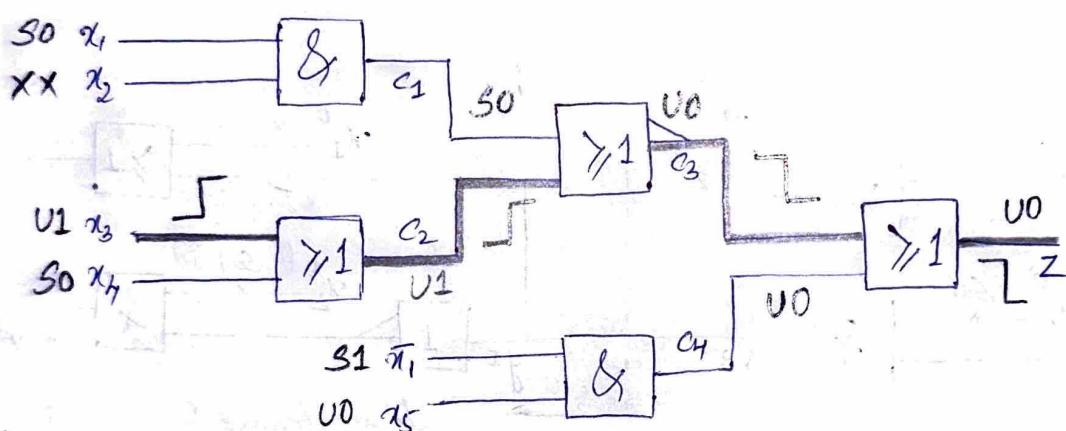
We are unable to generate 0 on y at all time frames, thus this fault is undetectable.

4. Figure 8.13



(a) Robust

(i) $\uparrow x_3 c_2 c_3 z$



gate type

on input transition

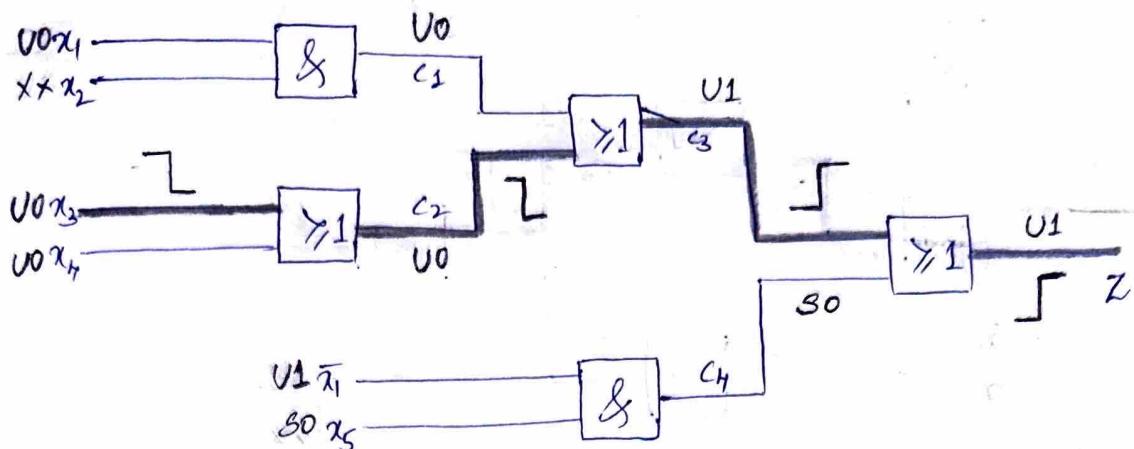
| | AND or NAND | OR or NOR |
|--------------|-------------|-----------|
| Rising (U1) | U1 | U0 |
| Falling (U0) | S1 | U0 |

Test Vector : $(V_1, V_2) = \{(0x00X), (0x100)\}$

$(V_1, V_2) = (S0, XX, U1, S0, U0)$

(ii) $\downarrow x_3 c_2 c_3 z$

U_0 Corrisso
not vice versa

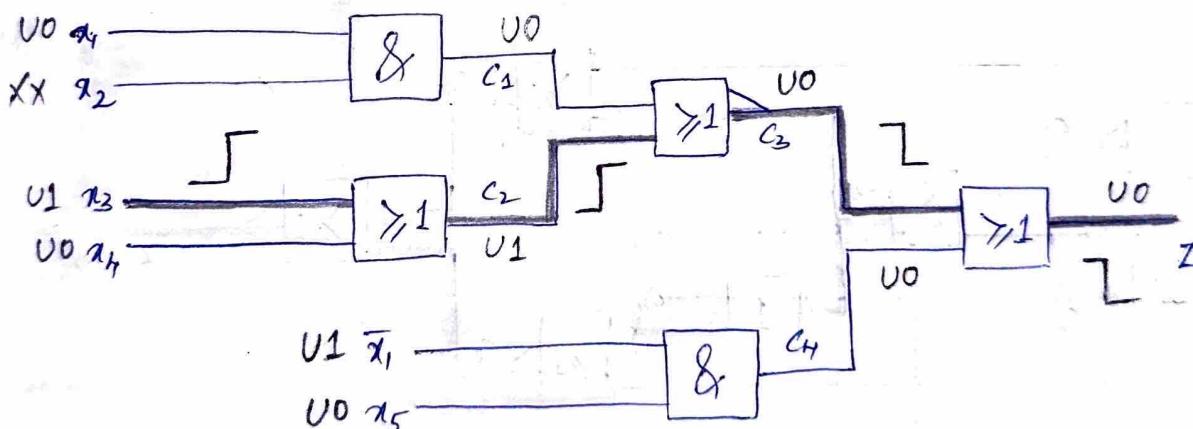


Test Vector: $(V_1, V_2) = \{(XX1X0), (0X000)\}$

$(V_1, V_2) = \{U_0, XX, U_0, U_0, s_0\}$

(b) Non Robust

(i) $\uparrow x_3 c_2 c_3 z$

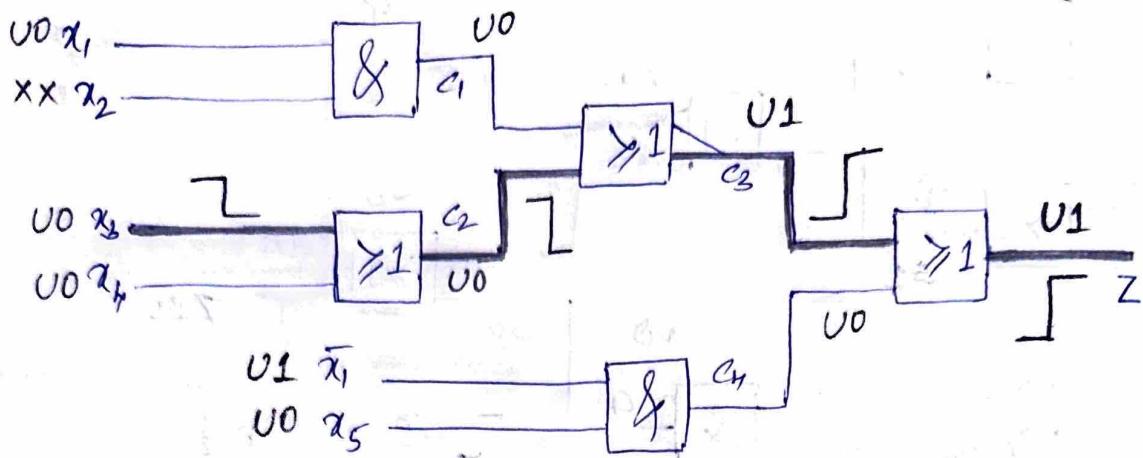


| on-input transition | gate type | AND or NAND | OR or NOR |
|---------------------|-----------|-------------|-----------|
| Rising (U_1) | | U_1 | U_0 |
| Falling (U_0) | | U_1 | U_0 |

Test Vector: $(V_1, V_2) = \{(XX0XX), (0X100)\}$

$(V_1, V_2) = \{U_0, XX, U_1, U_0, U_0\}$

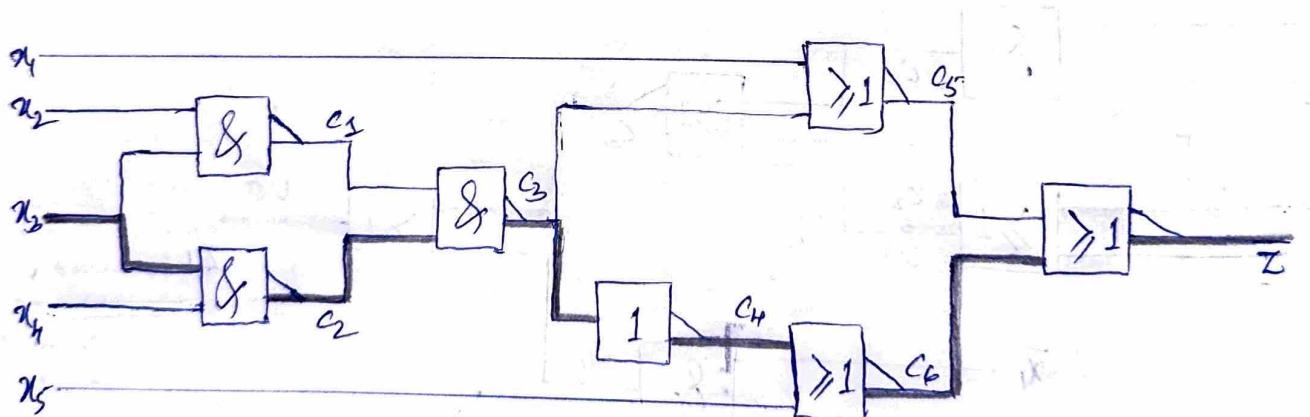
(ii) $\downarrow x_3 c_2 c_3 z$



Test Vector: $(V_1, V_2) = \{(xx1xx), (00000)\}$

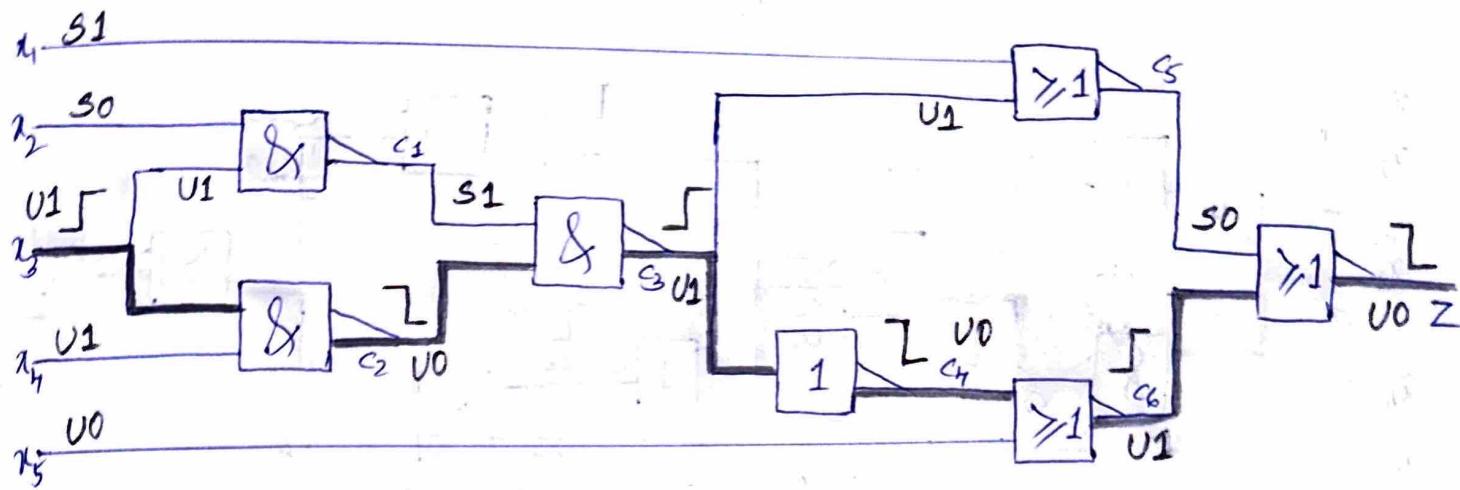
$(V_1, V_2) = (U0, xx, U0, U0, U0)$

5. Figure 8.20



(a) Robust

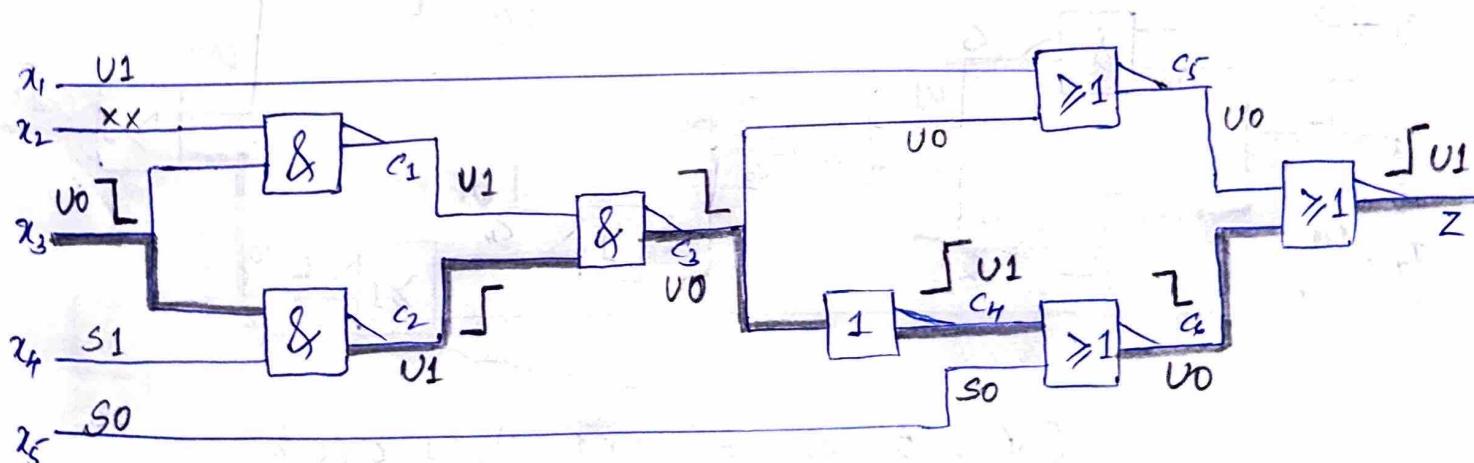
(i) $\uparrow x_3 c_2 c_3 c_4 c_6 z$



Test Vector: $(V_1, V_2) = \{(100xx), (10110)\}$

$(V_1, V_2) = (s_1, s_0, u_1, u_0, u_0)$

(ii) $\downarrow x_3 c_2 c_3 c_4 c_6 z$

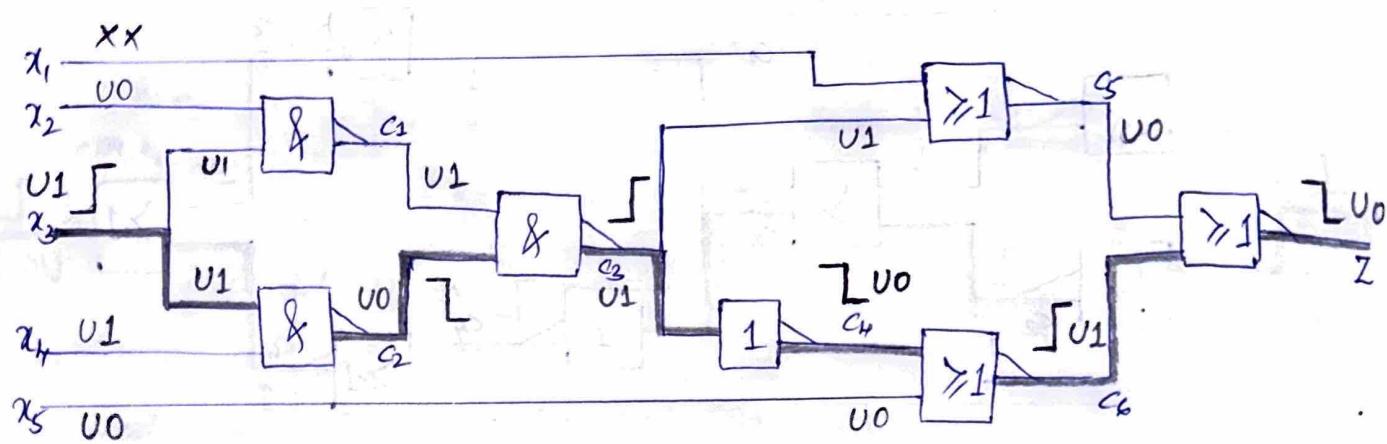


Test Vector: $(V_1, V_2) = \{(xx110), (1x010)\}$

$(V_1, V_2) = (u_1, xx, u_0, s_1, s_0)$

(b) Non Robust

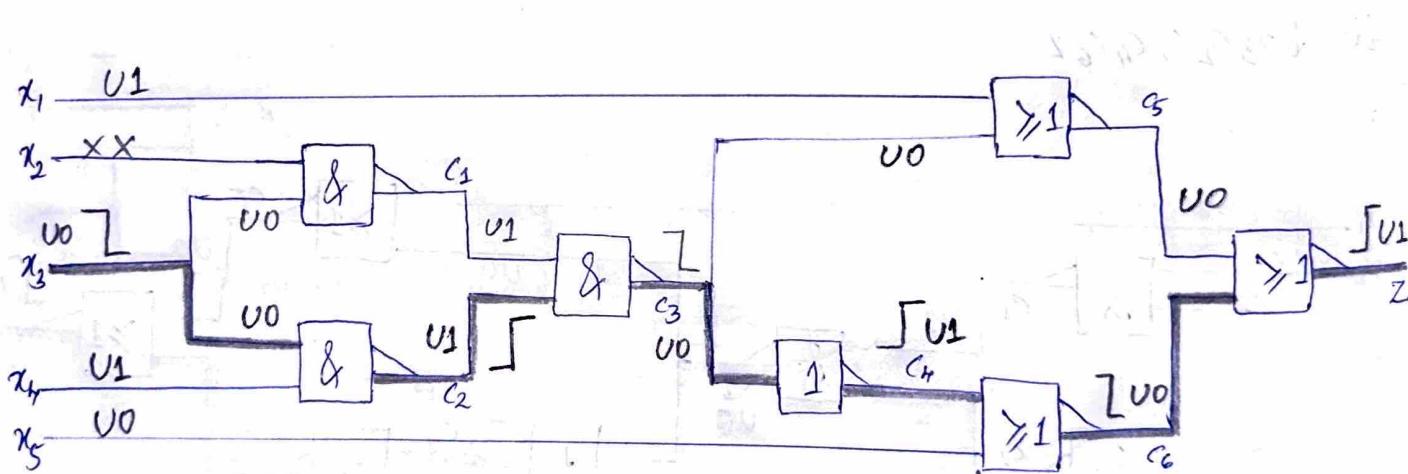
(i) $\uparrow x_3 c_2 c_3 c_4 c_6 Z$



Test Vector : $(V_1, V_2) = \{(xx0xx), (x0110)\}$

$$(V_1, V_2) = (xx, U0, U1, U1, U0)$$

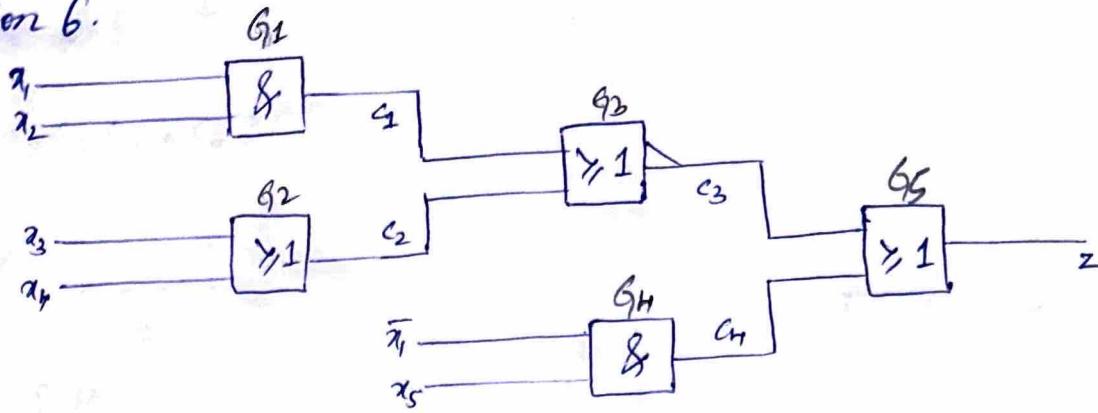
(ii) $\downarrow x_3 c_2 c_3 c_4 c_6 Z$



Test Vector : $(V_1, V_2) = \{(xx1xx), (1x010)\}$

$$(V_1, V_2) = (U1, XX, U0, U1, U0)$$

Question 6.



| Path | x_1 | x_2 | x_3 | x_4 | x_5 | \bar{x}_1 | c_1 | c_2 | c_3 | c_4 | z |
|----------------------------|-------|-------|-------|-------|-------|-------------|-------|-------|-------|-------|-----|
| $\uparrow x_1 c_1 c_3 z$ | U1 | U1 | S0 | S0 | XX | U0 | U1 | S0 | U0 | U0 | U0 |
| $\uparrow x_2 c_1 c_3 z$ | U1 | U1 | S0 | S0 | XX | U0 | U1 | S0 | U0 | U0 | U0 |
| $\uparrow x_3 c_2 c_3 z$ | S0 | XX | U1 | S0 | U0 | S1 | S0 | U1 | U0 | U0 | U0 |
| $\uparrow x_4 c_2 c_3 z$ | S0 | XX | S0 | U1 | U0 | S1 | S0 | U1 | U0 | U0 | U0 |
| $\uparrow x_5 c_4 z$ | S1 | S1 | XX | XX | U1 | U1 | S1 | XX | S0 | U1 | U1 |
| $\downarrow x_1 c_1 c_3 z$ | U0 | S1 | U0 | U0 | S0 | U1 | U0 | U0 | S0 | U1 | U1 |
| $\downarrow x_2 c_1 c_3 z$ | S1 | U0 | U0 | U0 | XX | S0 | U0 | U0 | S0 | U1 | U1 |
| $\downarrow x_3 c_2 c_3 z$ | U0 | XX | U0 | U0 | S0 | U1 | U0 | U0 | S0 | U1 | U1 |
| $\downarrow x_4 c_2 c_3 z$ | U0 | XX | U0 | U0 | S0 | U1 | U0 | U0 | S0 | U1 | U1 |
| $\downarrow x_5 c_4 z$ | S0 | XX | U1 | XX | U0 | S1 | S0 | U1 | U0 | U0 | U0 |