Race Condition :-

A race condition said to exist in an asynchronous Sequential Circuits when two or more binary state variables change value in response to a change in an input variable.

When unequal delays are encountered, a race condition may cause the state variables to change in an unpredictable manner.

y \ x_1x_2	00	01	11	10
0	(0) 0	(0) 1	(0) 3	1 2
1	0 4	0 5	(1) 7	(1) 6

Transition Table $Y = x_1x_2' + x_1y$

y \ x_1x_2	00	01	11	10
0	0 0	0 1	0 3	0 2
1	0 4	0 5	1 7	0 6

Map for output $Z = x_1x_2y$.

For example, if State Variable changes from 00 to 11. the difference in delays may cause the first Variable to change faster than the second,

Therefore the State Variable change in Sequence from 00 to 10 and then to 11. If Second Variable change faster than the first then State Variable changes from 00 to 01 and then to 11.

Critical race and Non-critical Race

If the final Stable State that the circuit reaches does not depend on the order in which the State Variable changes, the race is called a non-critical race.

If it is possible to end up in two or more different Stable States, depending on the order in which the State Variable changes, then it is a critical race. For proper operation, critical race must be avoided.

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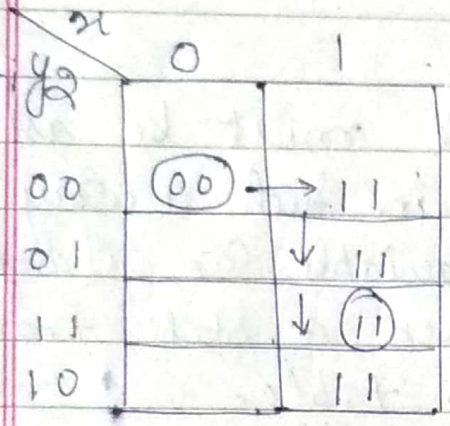
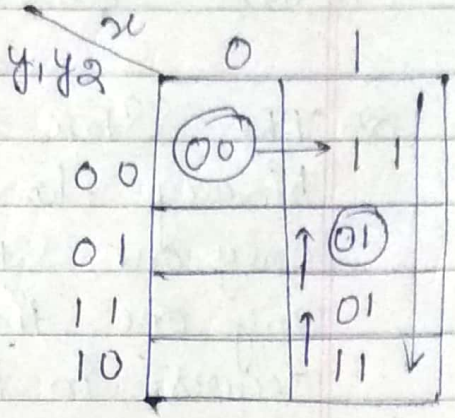
Examples :-

Non-critical race :-





(a) possible transitions

$00 \longrightarrow 11$

$00 \longrightarrow 01 \longrightarrow 11$

$00 \longrightarrow 10 \longrightarrow 11$

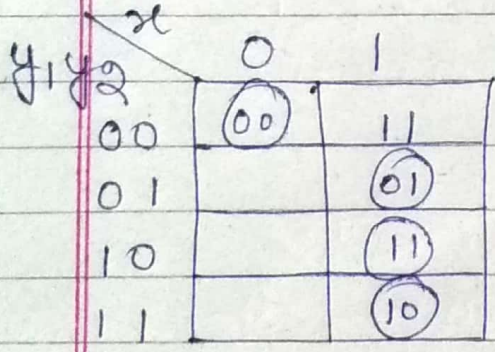
(b) possible transitions

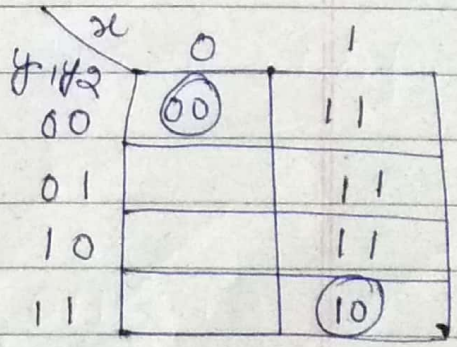
$00 \longrightarrow 11 \longrightarrow 01$

$00 \longrightarrow 01$

$00 \longrightarrow 10 \longrightarrow 11 \longrightarrow 01$

Critical race :-





(a) Possible transitions

$00 \longrightarrow 11$

$00 \longrightarrow 01$

$00 \longrightarrow 10$

(b) Possible transitions

$00 \longrightarrow 11$

$00 \longrightarrow 01 \longrightarrow 11$

$00 \longrightarrow 10$

Methods of avoidance :-

1. Race may be avoided by making a proper binary assignment to the State Variable.

2. The State Variable must be assigned binary numbers in such a way that only one State Variable can change at any one time when a state transition occurs in the flo. table.

3. Race may be avoided by directing the circuit through intermidiate unstable state with a unique State Variable change. Race around condition in an example of race.