EC 3352 – DIGITAL SYSTEM DESIGN

UNIT – IV : ASYNCHRONOUS SEQUENTIAL CIRCUITS

4.2 RACE CONDITIONS

A race condition is said to exist in an asynchronous sequential circuit 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 stale variables to change in an unpredictable manner. For example, if the state variables must change from 00 to 11, the difference in delays may cause the first variable to change sooner than the second, with the result that the state variables change in sequence from 00 to 10 and then to 11 . If the second variable changes sooner than the first, the State variables will change from 00 to 01 and then to 11. Thus, the order by which the state variables change may not be known in advance. If the final stable state that the circuit reaches does not depend on the order in which the state variables change, the race is called a noncritical race. If it is possible to end up in two or more different stable stares, depending on the order in which the state variables change, then the race is a critical race. For proper operation, critical races must be avoided.

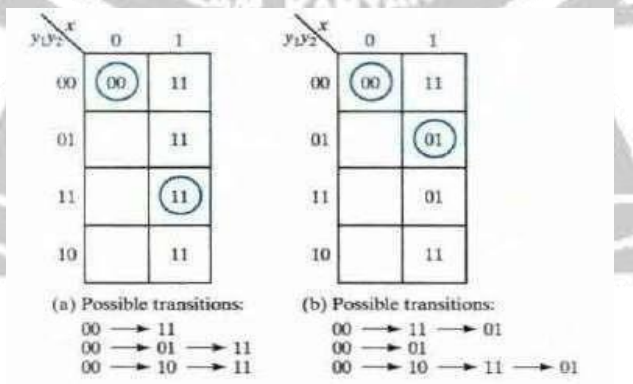

Fig: 4.5 - Examples of noncritical Races

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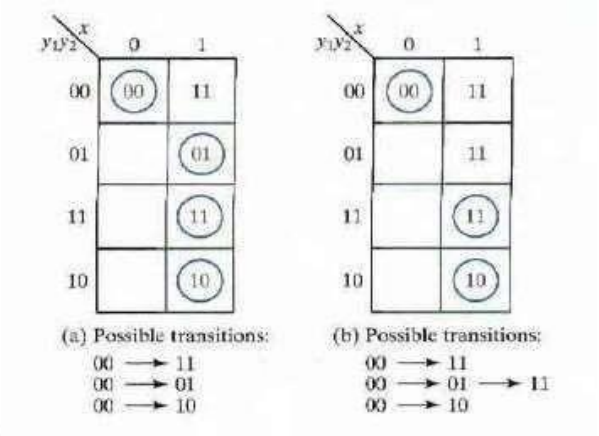

Fig: 4.6 - Examples of Critical Races

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Races may be avoided by making a proper binary assignment to the state variables. The state variables 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 flow table. Races can be avoided by directing the circuit through intermediate unstable states with a unique state-variable change. When a circuit goes through a unique sequence of unstable states, it is said to have a cycle.

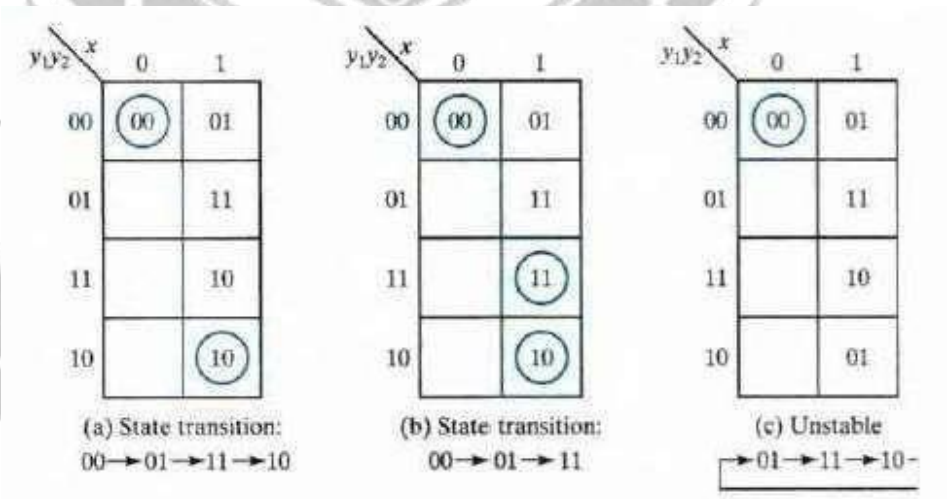

Fig: 4.7 - Examples of cycles

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