



Digital Electronics (SKEE1223)

Counters

Muhammad Arif Abd Rahim
Muhammad Mun'ím Ahmad Zabidi
Ab Hadi Abd Rahman

Faculty of Electrical Engineering



Common Sequential Circuits

Counters

Registers



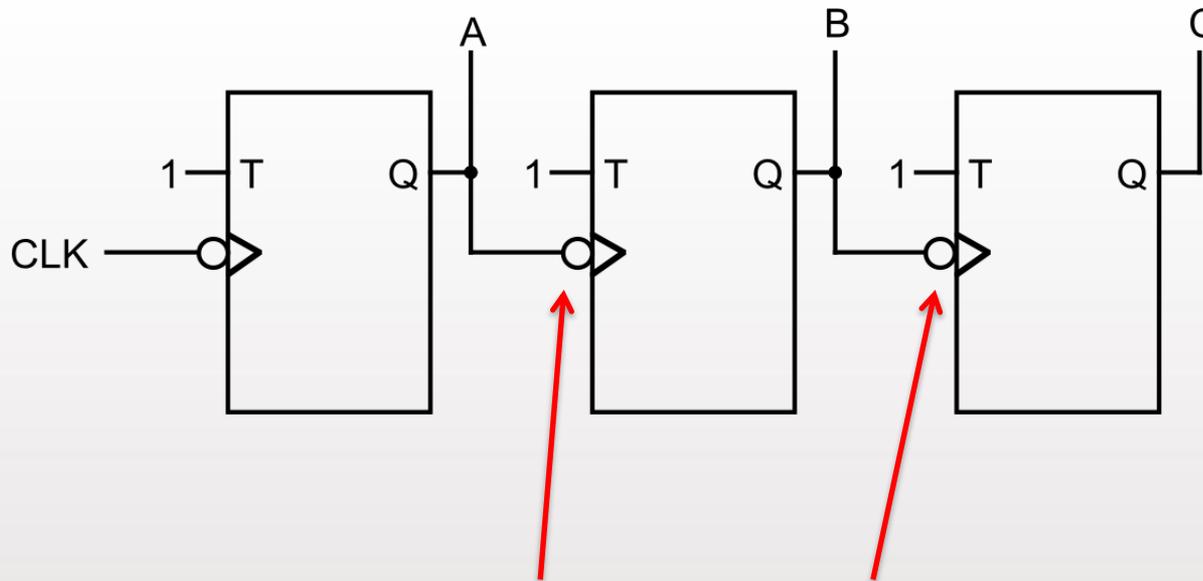
What are Counters?

- Counters are sequential circuits.
- They are used for counting pulses.
- Applications:
 - Frequency counters
 - Digital clocks
 - Time measurement
 - Analog to Digital converters
 - Frequency divider circuits
 - Waveform generators

Counters

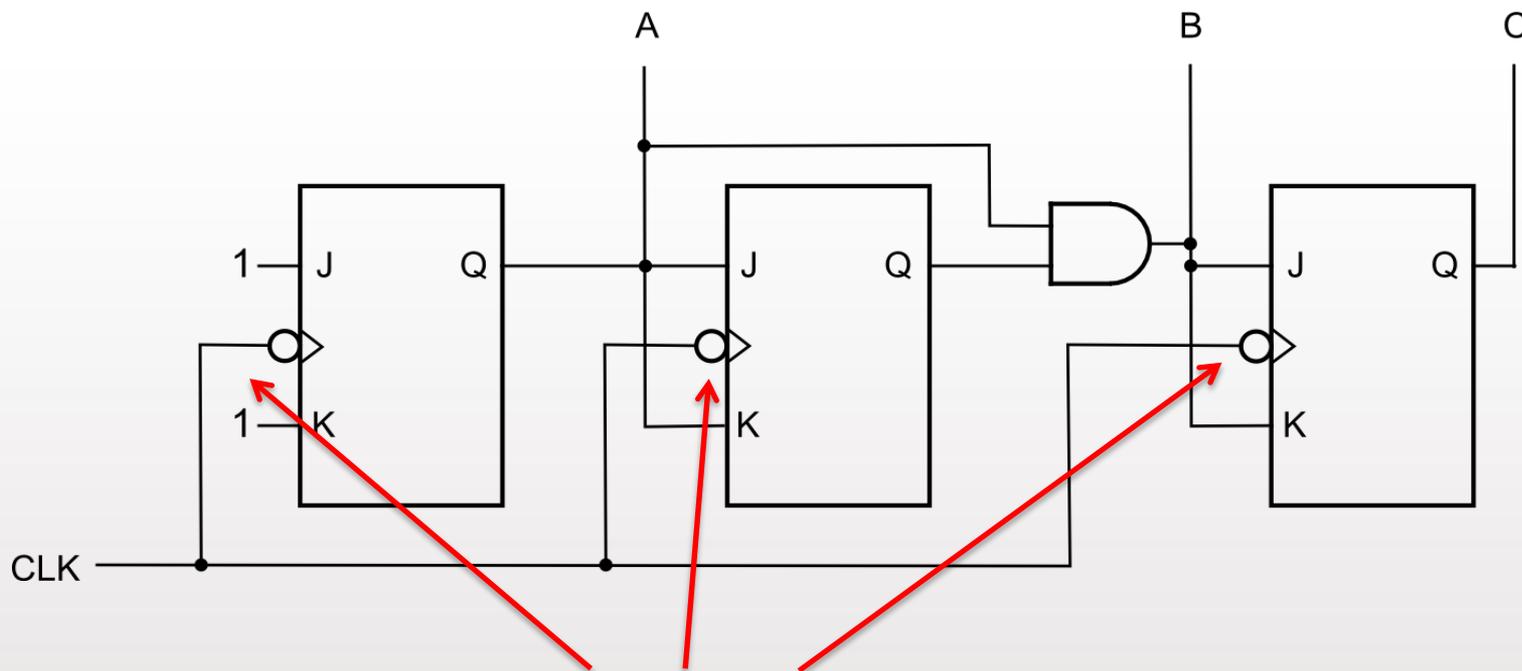
Asynchronous	Synchronous
Clock input comes from output of previous flip-flop	Common clock input for all flip-flop
Outputs changes in a “ripple” manner	Outputs change simultaneously
Simpler connections	Require additional gates

Asynchronous Counter



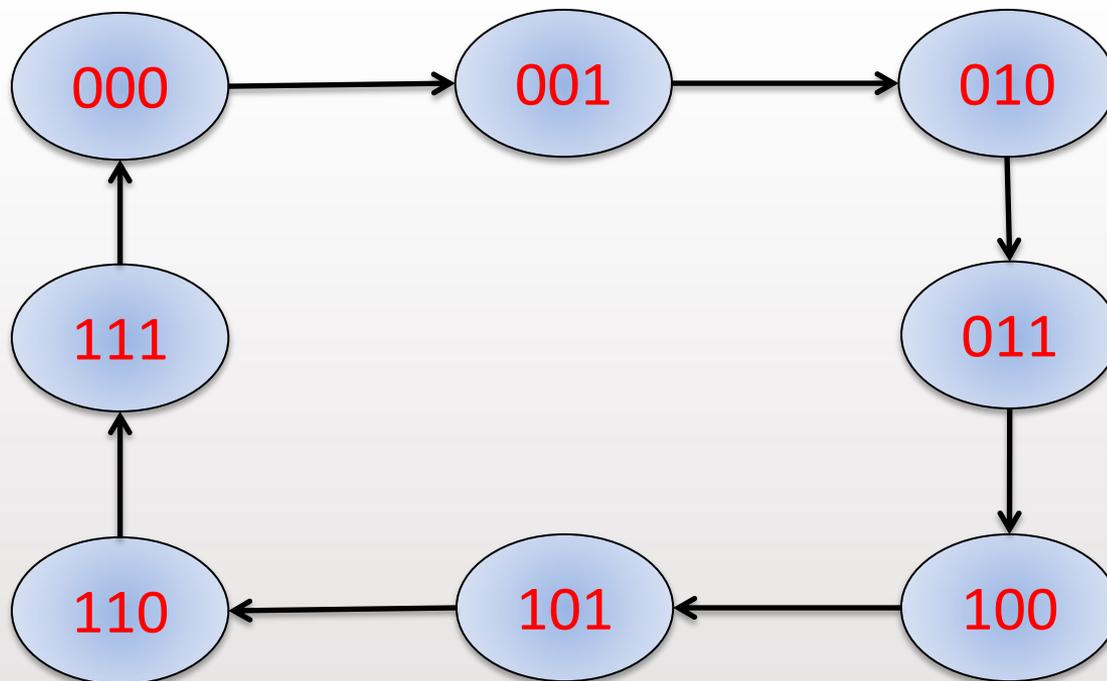
Clock inputs from output of previous flip-flop

Synchronous Counter

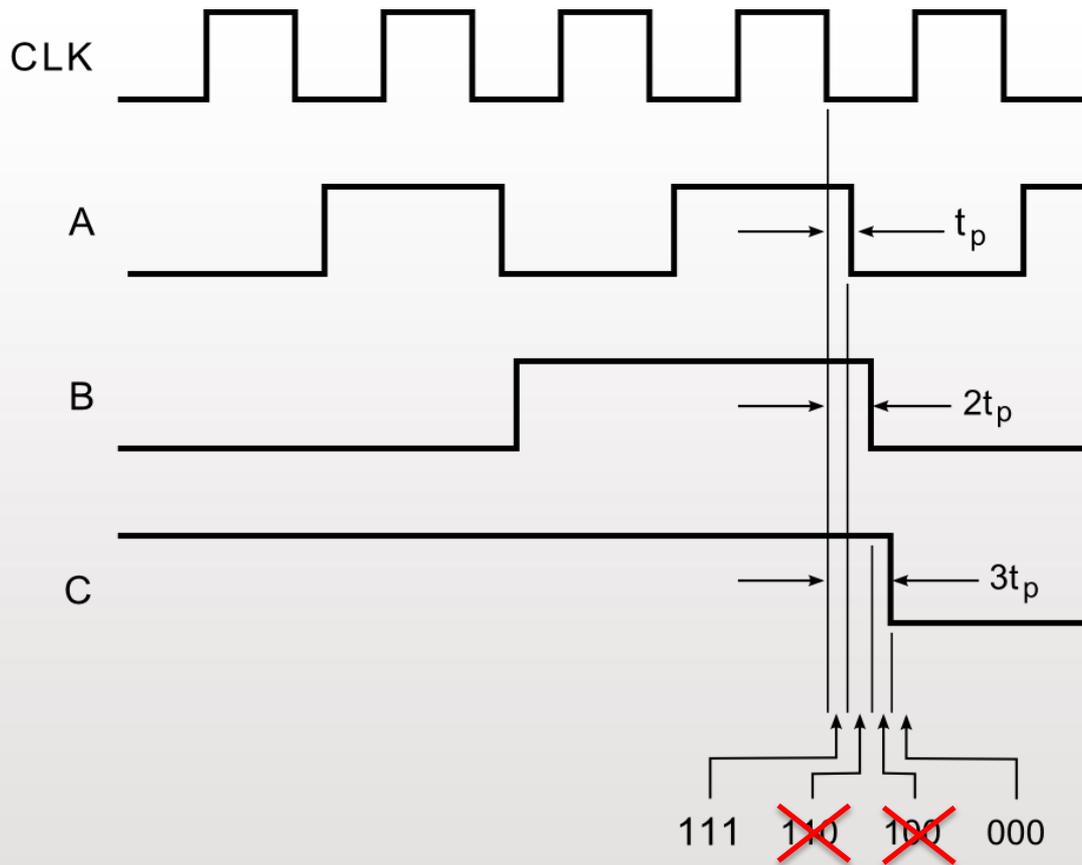


Common clock inputs

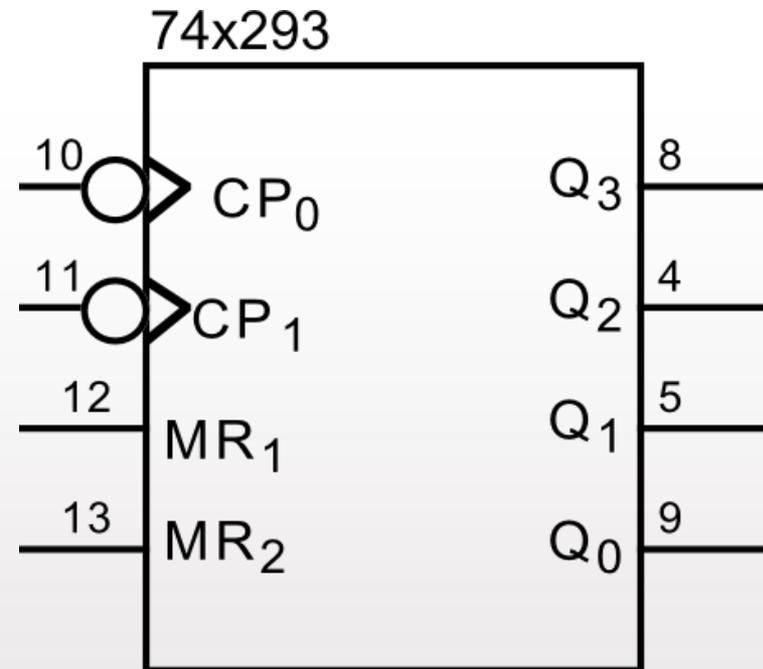
State Diagram for 3-bit Counter



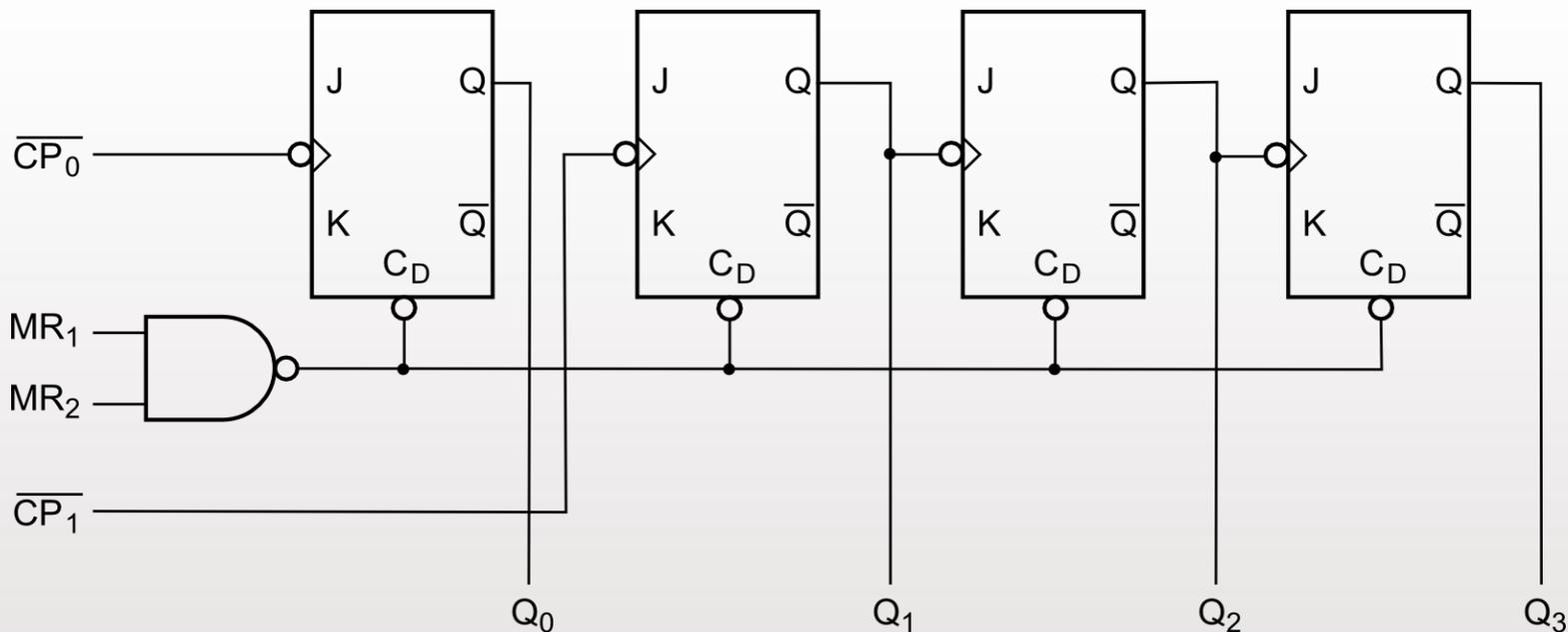
Ripple Outputs



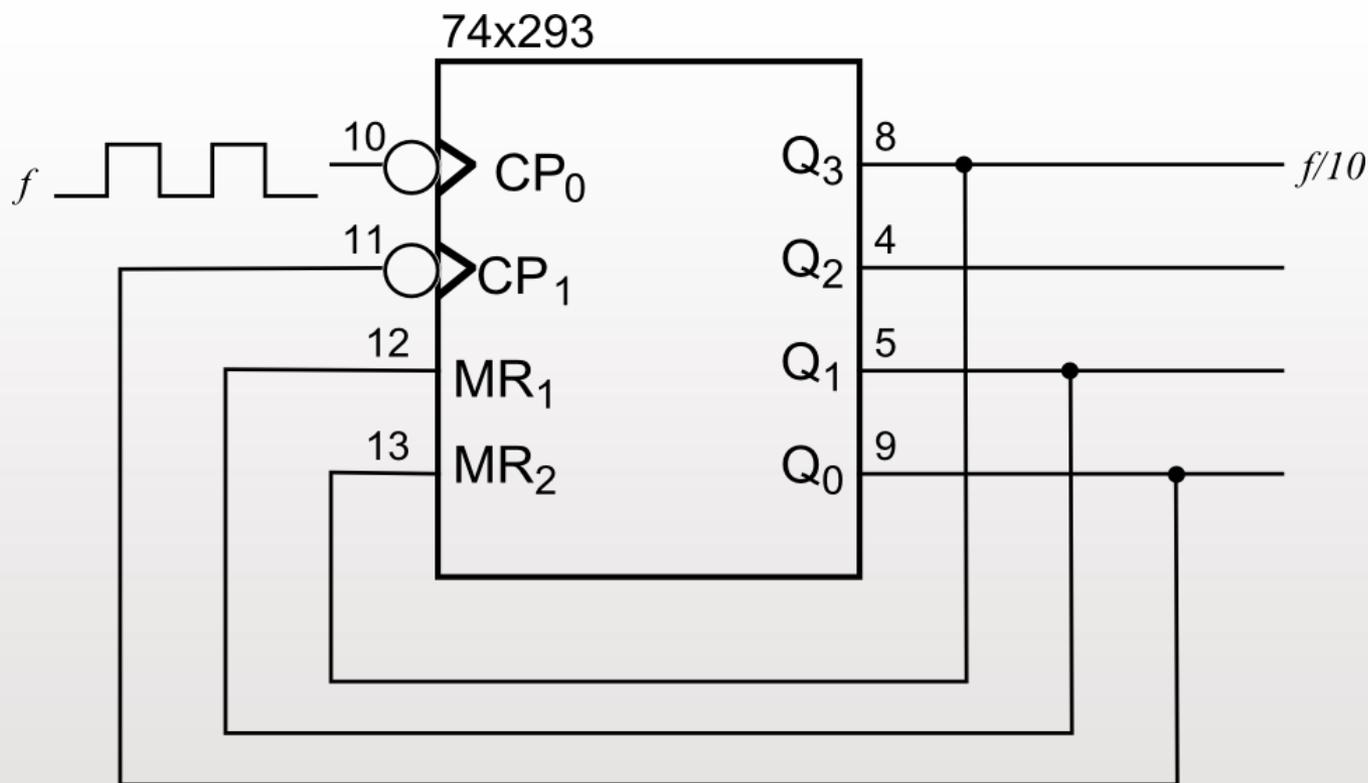
74x293 Asynchronous Counter



74x293 Logic

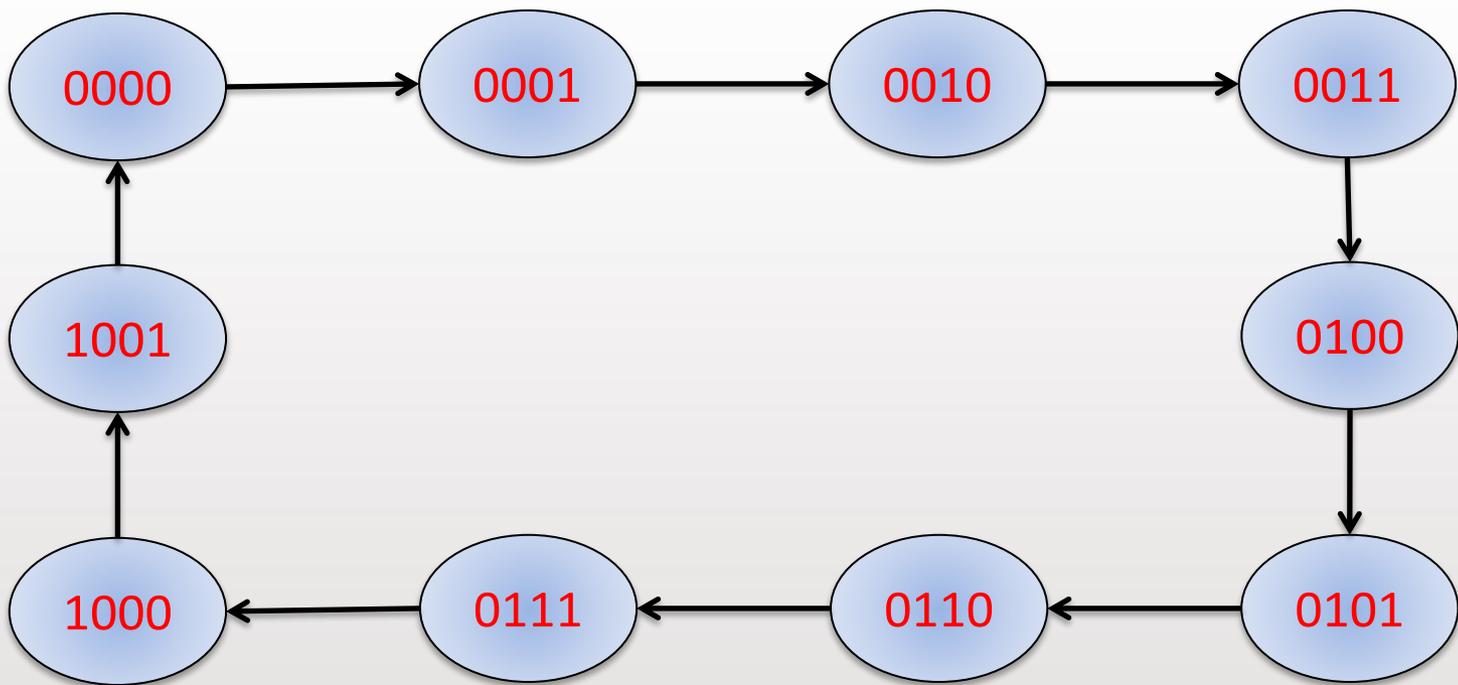


74x293 as “Decade Counter”



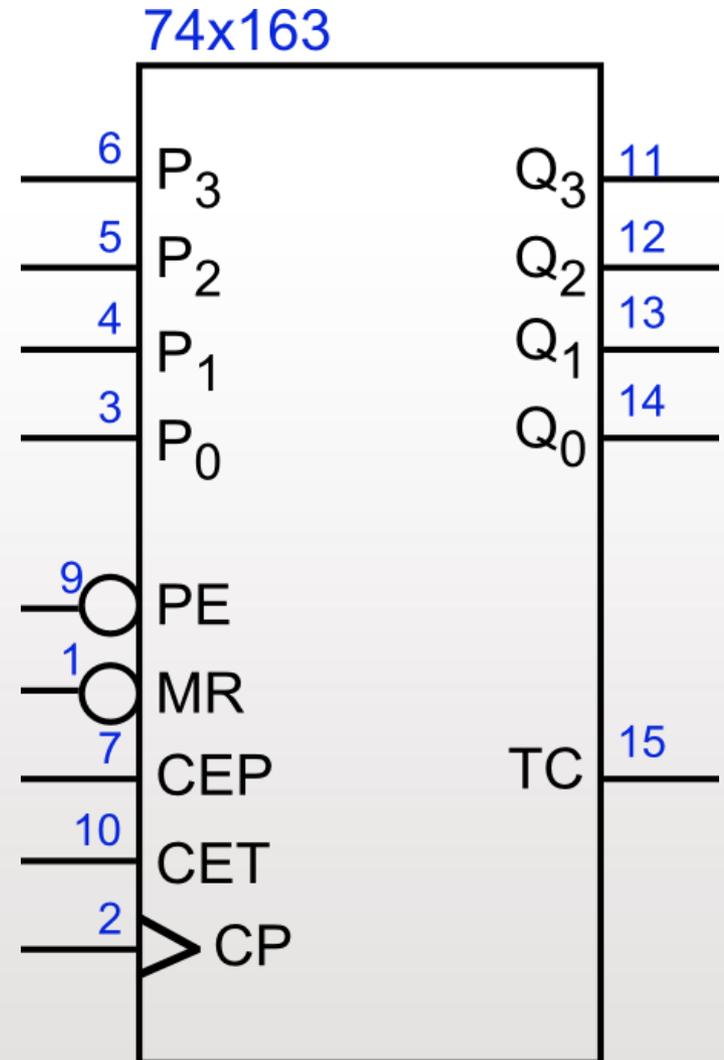


Decade Counter State Diagram



74x163 Synchronous Counter

Pin	Function
\overline{PE}	Parallel load P0-P3 into counter
\overline{MR}	Master reset
CEP, CET	Count enable
TC	Terminal count (1 means count=1111)



74x163 as "Decade Counter"

