A2Q2_eight_bit_johnson_counter

Description:

Johnson Counter, is a synchronous counter. In Johnson Counter, the output of the last flip-flop is connected to first flip-flop's input, and to implement an **8-bit Johnson Counter** we need **8 flip-flops**. It is a **Shift Register Counter**. It uses the feedback of the output in its input. Johnson counter is also known as a **Twisted Ring Counter** because it is a ring with an Inversion.

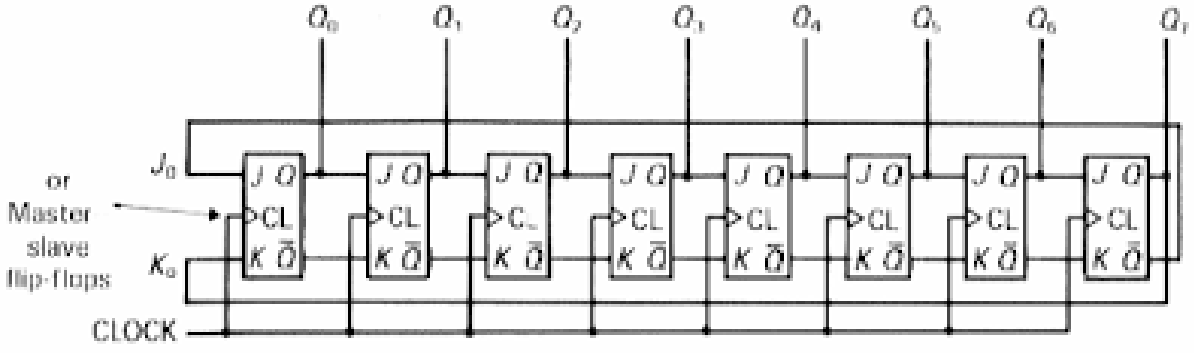
Total number of used and unused states in a 8-bit Johnson Counter are:

- **Number of Used States : 2*8 = 16**
- **Number of Unused States = 2^8 - 2*8 = 256 - 16 = 240**

Johnson Counter, found many real world applications, like:

- As a synchronous decade counter or divider circuit.
- In hardware logic designs, e.g. **ASIC** and **FPGA** design.
- As a square wave generator.
- For dividing the frequency of clock signal by feedback variation.

Circuit-Diagram:



Working:

The working of an **8-bit Johnson Counter is very simple,** as can be observed from the **truth table** given on the next page, the counter starts from **8'b00000000** to go all the way up to **8'b11111111** again returning to **8'b00000000**. However, if the reset is set to **1** at some point in the middle of the cycle, then the counter is set to **8'b00000000** again, and the cycle starts over again.

Truth-Table:

CLK	X0	X1	X2	X3	X4	X5	X6	X7
0	0	0	0	0	0	0	0	0
1	1	0	0	0	0	0	0	0
2	1	1	0	0	0	0	0	0
3	1	1	1	0	0	0	0	0
4	1	1	1	1	0	0	0	0
5	1	1	1	1	1	0	0	0
6	1	1	1	1	1	1	0	0
7	1	1	1	1	1	1	1	0
8	1	1	1	1	1	1	1	1
9	0	1	1	1	1	1	1	1
10	0	0	1	1	1	1	1	1
11	0	0	0	1	1	1	1	1
12	0	0	0	0	1	1	1	1
13	0	0	0	0	0	1	1	1
14	0	0	0	0	0	0	1	1
15	0	0	0	0	0	0	0	1