

# Assignment I

# JOHNSON COUNTER

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**Abstract—This Manual shows the design and Implementantion of four bit Johnson counter with 7474 IC's.**

## I. COMPONENTS

S.No	Component	Number
1.	Arduino	1
2.	Bread Board	1
3.	Jumper Wires(M-M)	Required
4.	LED	4
5.	7474	2

## II. INTRODUCTION

- 1) Johnson counters are used to store or process or count the number of events occurred within the circuit.
- 2) It is designed with a group of flip-flops, where the inverted output from the last flip-flop is connected to the input of the first flip-flop.
- 3) In Johnson counter  
No. of states = No. of flip-flop used  
Number of used states =  $2n$   
Number of unused states =  $2n - 2 * n$
- 4) Generally, it is implemented by using D flip-flops or JK flip-flops. Here, It is implemented by D flip-flop.

### III. CIRCUIT DIAGRAM

- 1) The inverted output of the last flip-flop ' $\bar{Q}_n$ ' is fed back to the first flip-flop in the sequence bit pattern.
- 2) The counter registers cycles in a closed-loop i.e circulates within the circuit.

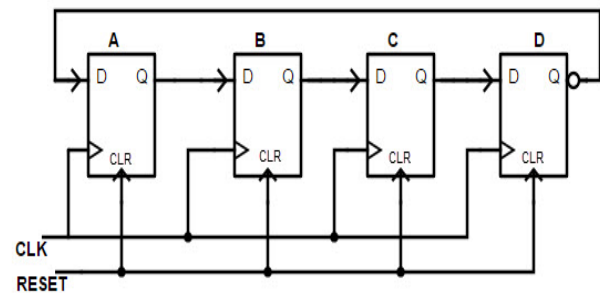


Fig. 1: Four bit Johnson Counter

- 3) Reset pin acts as an on/off switch. So, the flip-flops can be enabled by clicking the Reset switch.
- 4) CLK pin is used to observe the changes in the output of the flip-flops.

## IV. PROCEDURE

- 1) Connect the two 7474 IC's, LED's and Aurdino according to table I
- 2) Observe the states of LED and verify the truth table using the code from the link.

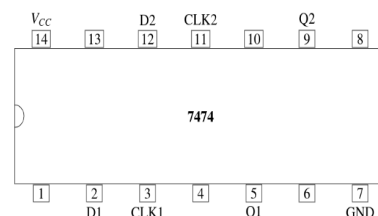


Fig. 2: 7474 IC

<https://github.com/ManojChavva/FWC/blob/main/Assignment1/JohnsonWithIC/code.cpp>

Arduino									GND	Vcc				CLK 13	
7474	2	2,5	5,12	12,9	9				7	14	1	4	10	3	11
7474	8				2	2,5	5,12	12,9	7	14	1	4	10	3	11
LED		LED1		LED2		LED3		LED4							

TABLE I: Connection Table.

## V. TRUTH TABLE

state	$Q_0$	$Q_1$	$Q_2$	$Q_3$
0	0	0	0	0
1	1	0	0	0
2	1	1	0	0
3	1	1	1	0
4	1	1	1	1
5	0	1	1	1
6	0	0	1	1
7	0	0	0	1

Table II: Truth Table.

- The above table state that
- 1) The counter produces the output 0000 when there is no clock input passed(0).
  - 2) The counter produces the output 1000 when the 1st clock pulse is passed to the flip flops.
  - 3) The counter produces the output 1100 when the 2nd clock pulse is
  - 4) The counter produces the output 1110 when the 3rd clock pulse is passed to the flip flops.
  - 5) The counter produces the output 1111 when the 4th clock pulse is passed to the flip flops.
  - 6) The counter produces the output 0111 when the 5th clock pulse is passed to the flip flops.
  - 7) The counter produces the output 0011 when the 6th clock pulse is passed to the flip flops.
  - 8) The counter produces the output 0001 when the 7th clock pulse is passed to the flip flops.

## CONCLUSION

Thus the Johnson counter designed and Implemented.