

# Assignment I

## JOHNSON COUNTER

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*Abstract*—This Manual shows the design and Implementation of four bit Johnson counter.

### I. COMPONENTS

S.No	Component	Number
1.	Arduino	1
2.	Bread Board	1
3.	Jumper Wires(M-M)	6
4.	LED	4

### II. INTRODUCTION

- Johnson counters are used to store or process or count the number of events occurred within the circuit.
- 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.
- In Johnson counter  
 No. of states = No. of flip-flop used  
 Number of used states= $2n$   
 Number of unused states= $2n - 2*n$
- Here, the functionality of D flip flop is used for the program.

### III. CIRCUIT DIAGRAM

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

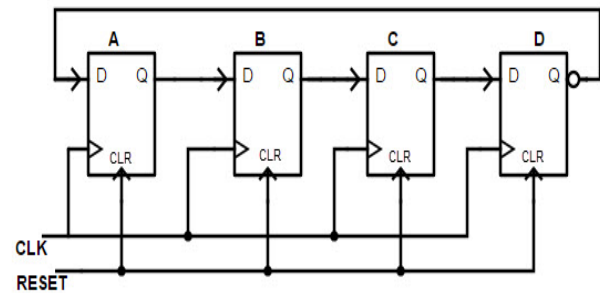


Fig. 1: Four bit Johnson Counter

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

### IV. PROCEDURE

- Connect the 4 LED's and Aurdino according to table I
- Observe the states of LED and verify the truth table using the code from the link.

Arduino	D2	D3	D4	D5	GND
LED's	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.