Course Code: ETE 205
Course Title: Digital Electronics Lab
Experiment No: 8(Open Ended)
Experiment Name: 5-bit Ring counter using JK flip-flop and display through 7-segment display

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Objective: To design 5-bit ring counter using J-K flip-flop and display the output through 7 segment display.

Apparatus: Tinkercad, Bread Board, switch, power supply, resistor, 7473, 7404, 7493, 4511, 7-segment display, Pushbutton and LEDs.

Theory:

Ring Counter:

Ring counter is a typical application of Shift resister. Ring counter is almost same as the shift counter. The only change is that the output of the last flip-flop is connected to the input of the first flip-flop in case of ring counter but in case of shift resister it is taken as output. Except this all the other things are same.

J-K flip-flop:

The SR Flip Flop or Set-Reset flip flop has lots of advantages. But, it has the following switching problems: When Set 'S' and Reset 'R' inputs are set to 0, this condition is always avoided. When the Set or Reset input changes their state while the enable input is 1, the incorrect latching action occurs. The JK Flip Flop removes these two drawbacks of SR Flip Flop. The JK flip flop is one of the most used flip flops in digital circuits. The JK flip flop is a universal flip flop having two inputs 'J' and 'K'. In SR flip flop, the 'S' and 'R' are the shortened abbreviated letters for Set and Reset, but J and K are not. The J and K are themselves autonomous letters which are chosen to distinguish the flip flop design from other types. The JK flip flop work in the same way as the SR flip flop work. The JK flip flop has 'J' and 'K' flip flop instead of 'S' and 'R'. The only difference between JK flip flop and SR flip flop is that when both inputs of SR flip flop is set to 1, the circuit produces the invalid states as outputs, but in case of JK flip flop, there are no invalid states even if both 'J' and 'K' flip flops are set to 1. The JK Flip Flop is a gated SR flip-flop having the addition of a clock input circuitry. The invalid or illegal output condition occurs when both of the inputs are set to 1 and are prevented by the addition of a clock input circuit. So, the JK flipflop has four possible input combinations, i.e., 1, 0, "no change" and "toggle". The symbol of JK flip flop is the same as SR Bistable Latch except for the addition of a clock input.

7 segment display:

The 7-segment display, also written as “seven segment display”, consists of seven LEDs (hence its name) arranged in a rectangular fashion as shown. Each of the seven LEDs is called a segment because when illuminated the segment forms part of a numerical digit (both Decimal and Hex) to be displayed.

Procedure: (For 5-bit ring counter)

We have concentrated on learning the basics of flip-flop operation. To better understand these experiments some nuances of flip-flops must be understood. Most of the flip- "- flops discussed in the text were level or pulse triggered devices. These devices use the standard flip flop notations. As was noted in the text active LO inputs to ' the flip-flops are designated by a bubble on the input pin. Another type of flip-flop which operates similarly is the edge triggered flip-flop. These devices will have the same basic truth table as the devices we have studied; however, the output will change states only on the positive (LO to HI) or negative (HI to LO) edge of the dock pulses. Edge triggered.

(for 7-segment display)

1. Implemented the logic diagram of the code converter on the bread-board.

a. Connected IC 7493 as a BCD counter.

b. Connected the four outputs of IC 7493 to inputs A, B, C and D.

c. Connected the four outputs of IC 7493 to four LEDs.

d. Connected the seven outputs of IC 4511 to the seven segment LED display to shown below.

2. Applied all combinations of inputs circuits through IC7493 by pushing the bush-button as many inputs. I have observed the input sequence on the 5 indicator LEDs which are connected with the outputs of IC 7493.

3. Verified that the seven-segment display shows the decimal value corresponding to the 5-bit BCD input.

4. Now I have connected IC 7493 as a 5-bit binary counter.

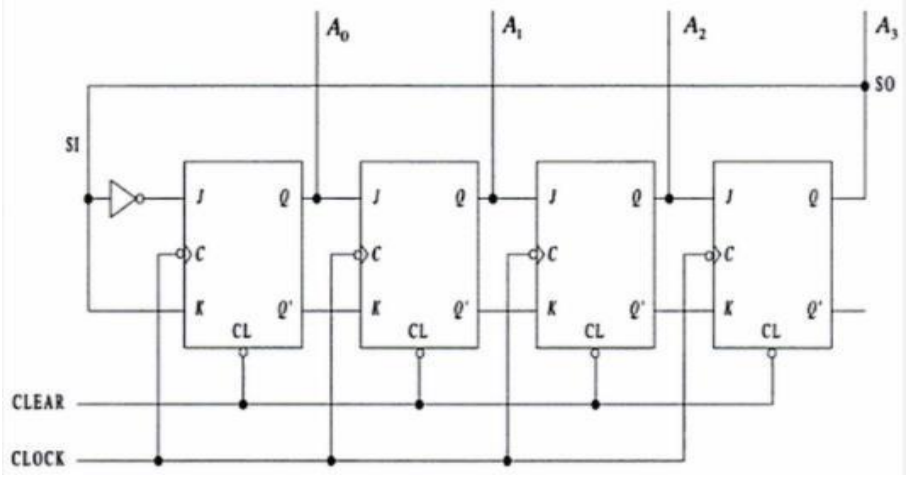
***** Discounted pin 2 from pin 9 and pin 3 from pin 11.

***** Connected pin 2 and 3 to ground.

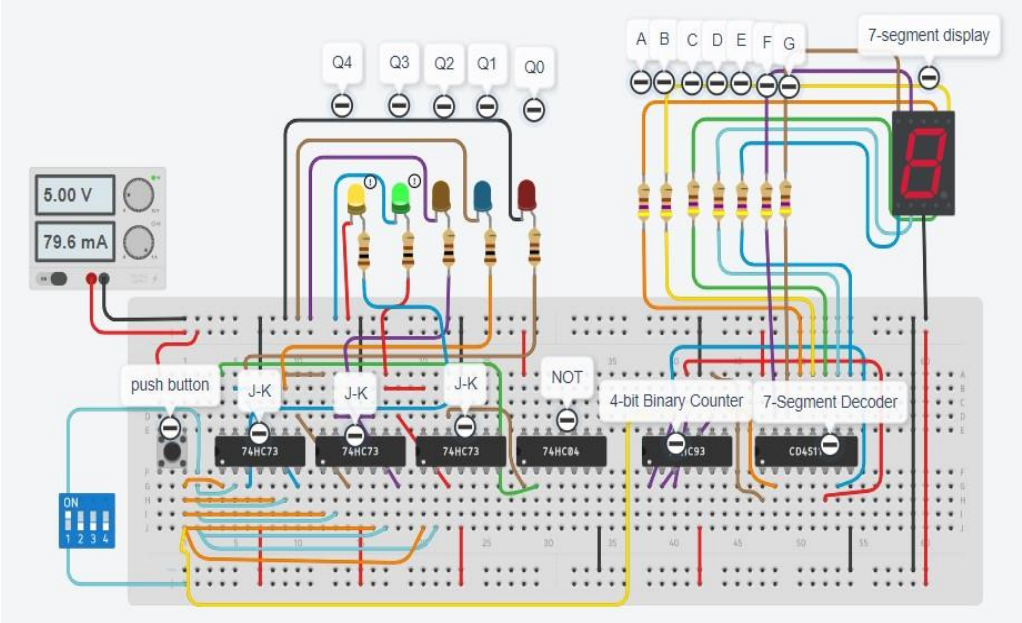
***** Do not change any other connections in your circuit.

5. Applied all combinations of inputs to circuit through IC 7493 by pushing the push-button as many times.

Circuit, Diagram and truth table of 5-bit Ring counter using J-K flip-flop:



It is a 4-bit Ring counter using J-K flip-flop and I have added an extra J-K flip flop with this 4-bit J-K flop and now it is converted 5-bit ring counter.



Status	QE	QD	QC	QB	QA
0	0	0	0	0	0
1	0	0	0	0	1
2	0	0	0	1	1
3	0	0	1	1	1
4	0	1	1	1	1
5	1	1	1	1	1
6	1	1	1	1	0
7	1	1	1	0	0
8	1	1	0	0	0
9	1	0	0	0	0
10	0	0	0	0	0

Report: 1. Truth table and circuit is shown in procedure part. Multiple time checked the circuit. There is no error. Circuit worked well.

Discussion: In this experiment I have showed 5-bit Ring counter using J-K flip-flop and display through 7-segment display using IC4511. From the experiment I observed the input sequence on the 5 indicator LEDs connected with the outputs of corresponding IC7493 and the circuit gave the actual corresponding outputs. I have also implemented binary-to-7-segment decoder by using IC4511 to get the actual output display. I have taken multiple possible input combination to get accurate output and ultimately, I got the accurate results for the experiment. After pushing 10 times the push button it the circuit will show (QA=QB=QC=QD=QE=0) and it will repeat the same results as before the first 10 push then it will repeat again. I attached the truth table and circuit of the experiment. I have not faced any kind of problem. I have drawn the circuit properly so there have not any error. For counting frequency, creating digital clocks and measuring timers and rate ring counter is used in real life example.