Lab 7: Binary and Decimal Numbers

Objective

To demonstrate the count sequence of binary number and the binary-coded decimal (BCD) representation.

Apparatus

7493 4-bit ripple counter
CADET trainer
Dual-trace Oscilloscope

Procedure

Binary Count

1. Turn off the power switch.
2. Connect the IC type 7493 as shown in Fig. 1.
3. Turn the power on and observe the four logic indicators/LED. The 4-bit number in the out is incremented by one for every pulse generated by pushing the pushbutton.
4. Disconnect the input of the counter at pin 14 and connect it to the Function Generator (lead TTL).
5. Set frequency selector to “time 1” (1 Hz). This will provide an automatic binary count.
6. Increase the frequency of the clock to 10 kHz or higher and connect its output to an oscilloscope. Observe the clock output on the oscilloscope and sketch its waveform.

BCD Count

1. Turn off the power switch.
2. Connect the IC type 7493 as shown in Fig. 2.
3. Turn the power on and observe the four logic indicator lamps/LEDs. The 4-bit number in the indicators is incremented by one for every pulse generated by pushing the pushbutton following the sequence 0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 1, 2, 3, ….
4. Disconnect the input of the counter and connect it to TTL output of the function generator. Set frequency selector to “time 1” (1 Hz). This will provide an automatic binary count.

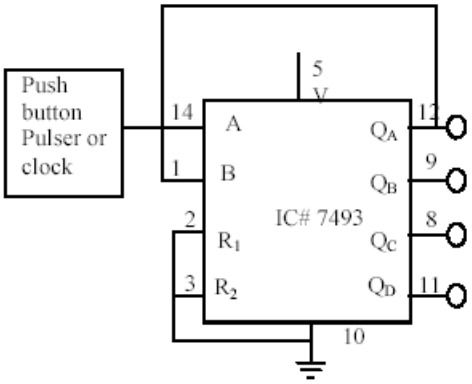

Fig. 1 Binary counter

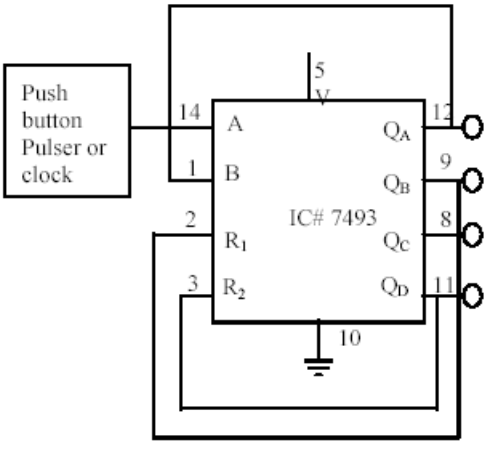

Fig. 2 BCD counter

Other Counts

R1 and R2 are the reset inputs of the IC type 7493. By connecting one or two outputs to the reset inputs R1 and R2, the counter can count from 0 to a variety of final count. In Figure 2, if R1 is connected to QA instead of QB, the resulting count will be from 0000 to 1000, which is the one less than 1001 (QD=1 and QA=1).

Count	Binary	
0	0000	
1	0001	
2	0010	
	….	
	….	
7	0111	
8	1000	
9 →0	1001→0000	Resets the counter (R1=QA, R2=QD)
1	0001	
2	0010	

Utilizing your knowledge of how R1 and R2 affect the final count, find out which outputs should be connected to the resets inputs to count 0000 to the following counts:

a. 0101
b. 0111
c. 1011

1. Turn of the power switch.
2. Connect the 7493 IC to count from 0 to one of the final counts given above.
3. Verify the count by applying pulses from the pushbuttons and observing the output count in the logic indicators/LEDs.