Boolean Logic through AVR-Assembly

G V V Sharma*

Contents

***Abstract*—This manual shows how to program the 7447 BCD-Seven segment display decoder through AVR-Assembly.**

1 Components

Component	Value	Quantity
Resistor	220 Ohm	1
Arduino	UNO	1
Seven Segment Display		1
Decoder	7447	1
Jumper Wires	M-M	20
Breadboard		1

2 Boolean Operations

1. Verify the AND,OR and XOR operations in assembly using the following code and making pin connections according to Table 1.

```
wget https://raw.githubusercontent.com/gadepall
    /arduino/master/assembly/7447/count/codes/
    and_or_xor.asm
```

7447	D	C	B	A
Arduino	5	4	3	2

TABLE 1

2. Suppose R20=0b00000010, R16=0b00000001. Explain the following routine

```
loopw: lsl r16    ;left shift
       dec r20    ;counter --
       brne loopw ;if counter != 0
       ret
```

Solution: The routine shifts R16 by 2 bits to the left (the count in R20=2). At the end of the routine, R16=0b00000100.

3. What do the following instructions do?

```
rcall loopw
out PORTD,r16  ;writing output to pins 2,3,4,5
```

Solution: rcall calls for execution of the **loopw** routine, which shifts R16 by 2 bits to the left and writes R16 to the display through PORTD.

4. Use the following routine for finding the complement of a number.

```
wget https://raw.githubusercontent.com/gadepall
    /arduino/master/assembly/7447/count/codes/
    complement.asm
```

5. Write an assembly program for implementing the following equations. Note that ZYXW is the input nibble and DCBA is the output nibble. Display DCBA on the seven segment display for each input ZYXW from 0-9.

$$A = W' \tag{2.1}$$

$$B = WX'Z' + W'X \tag{2.2}$$

$$C = WXY' + X'Y + W'Y \tag{2.3}$$

$$D = WXY + W'Z \tag{2.4}$$

6. Repeat the above exercise by getting ZYXW as manual inputs to the arduino from the GND and 5V pins on the breadboard.

*The author is with the Department of Electrical Engineering, Indian Institute of Technology, Hyderabad 502285 India e-mail: gadepall@iith.ac.in.