

# Assembly

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## I QUESTION

$A = a_1a_0$  and  $B = b_1b_0$  are two 2-bit unsigned binary numbers. If  $F(a_1, a_0, b_1, b_0)$  is a Boolean function such that  $F = 1$  only when  $A > B$ , and  $F = 0$  otherwise, then  $F$  can be minimized to the form

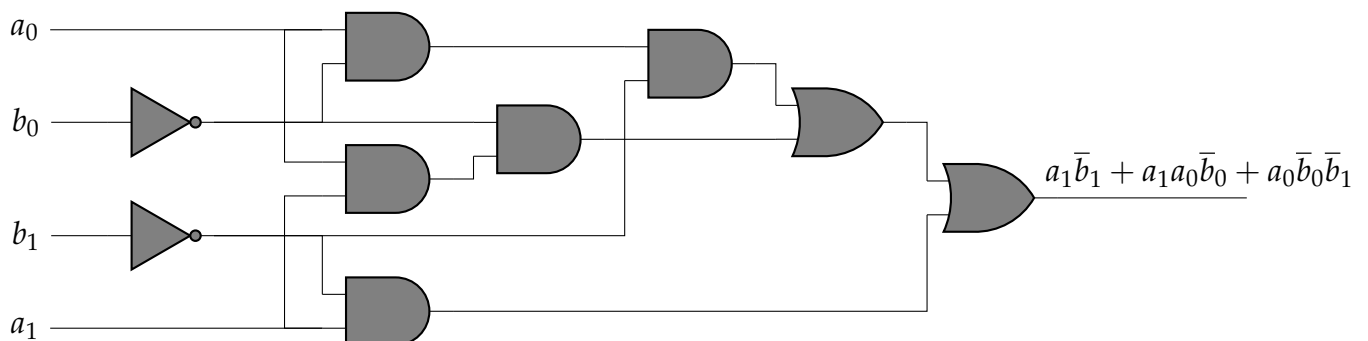
- i.  $a_1\bar{b}_1 + a_1a_0\bar{b}_0$
- ii.  $a_1\bar{b}_1 + a_1a_0\bar{b}_0 + a_0\bar{b}_0\bar{b}_1$
- iii.  $a_1a_0\bar{b}_0 + a_0\bar{b}_0\bar{b}_1$
- iv.  $a_1\bar{b}_1 + a_1a_0\bar{b}_0 + a_0\bar{b}_0b_1$

## II TRUTH TABLE

| $a_1$ | $a_0$ | $b_1$ | $b_0$ | <b>F</b> |
|-------|-------|-------|-------|----------|
| 0     | 0     | 0     | 0     | 0        |
| 0     | 0     | 0     | 1     | 0        |
| 0     | 0     | 1     | 0     | 0        |
| 0     | 0     | 1     | 1     | 0        |
| 0     | 1     | 0     | 0     | 1        |
| 0     | 1     | 0     | 1     | 0        |
| 0     | 1     | 1     | 0     | 0        |
| 0     | 1     | 1     | 1     | 0        |
| 1     | 0     | 0     | 0     | 1        |
| 1     | 0     | 0     | 1     | 1        |
| 1     | 0     | 1     | 0     | 0        |
| 1     | 0     | 1     | 1     | 0        |
| 1     | 1     | 0     | 0     | 1        |
| 1     | 1     | 0     | 1     | 1        |
| 1     | 1     | 1     | 0     | 1        |
| 1     | 1     | 1     | 1     | 0        |

*Truth table for Boolean function 'F'*

## III LOGICAL DIAGRAM



## IV COMPONENTS

| Component    | Values   | Quantity |
|--------------|----------|----------|
| Arduino      | UNO      | 1        |
| Jumper Wires | M-M      | 10       |
| Breadboard   |          | 1        |
| LED          |          | 2        |
| Resistor     | 220 ohms | 1        |

*List of items required*

## V K-MAP IMPLEMENTATION

Using the boolean logic output F can be expressed in terms of the inputs X,Y,Z with the help of the following Kmap.

|          |    |          |    |    |    |
|----------|----|----------|----|----|----|
|          |    | $b_1b_0$ |    |    |    |
|          |    | 00       | 01 | 11 | 10 |
| $a_1a_0$ | 00 | 0        | 0  | 0  | 0  |
|          | 01 | 1        | 0  | 0  | 0  |
|          | 11 | 1        | 1  | 0  | 1  |
|          | 10 | 1        | 1  | 0  | 0  |

Karnaugh map simplification results in  $a_1\bar{b}_1 + a_1a_0\bar{b}_0 + a_0\bar{b}_0\bar{b}_1$

## VI IMPLEMENTATION

| Arduino PIN | INPUT | OUTPUT |
|-------------|-------|--------|
| 2           | a0    |        |
| 3           | a1    |        |
| 4           | b0    |        |
| 5           | b1    |        |
| 8           |       | F      |

*Connections*

Procedure:

- a. Connect the circuit as per the above table.
- b. Connect the output pin to LED.
- c. Connect inputs to Vcc for logic 1, ground for logic 0.
- d. Execute the circuit using the below code.

[https://github.com/shr-  
eyas/FWC/blob/main/Assembly/assembly.asm](https://github.com/shreyas/FWC/blob/main/Assembly/assembly.asm)

- e. Change the values of X, Y, Z in the code and verify the truth table.