# Lab 6: Dedicate Microprocessor Lab

(2+2 hours)

## Goal

To learn how to implement a dedicated microprocessor.

## Procedure

1. Warm up：Implement the IF-THEN-ELSE example in Lecture 6 in your Basys 3 board. Connect the buttons and switches to the input pins of your module, and connect the leds to your output pins.
2. Manually design and implement on a FPGA a dedicated microprocessor to input one 8-bit value, and then determine whether the input value has an equal number of 0 and 1 bits. The microprocessor outputs a 1 if the input value has the same number of 0’s and 1’s; otherwise, it outputs a 0. For example, the number 10111011 will produce a 0 output; whereas, the number 00110011 will produce a 1 output. The algorithm is shown next. Draw the datapath and the corresponding FSM state diagram, FSM circuit, list the control words.

1 *Count* = 0 // for counting the number of 1 bits

2 INPUT *N*

3 WHILE (*N* ≠ 0){

4 IF (*N*(0) = 1) THEN // least significant bit of *N*

5 *Count* = *Count* + 1

6 END IF

7 *N* = *N* >> 1 // shift *N* right one bit

8 }

9 OUTPUT (*Count* = 4) // output 1 if the test (*Count* = 4) is true

1. Implement the datapath circuit and FSM circuit separately in Verilog module, connect them together by using a top module, and implement it in your Basys3 board. Connect the switches in board to your input pin, and connect the output pin to a LED.