

# Computer Architecture

## HW3: 32-bit ALU

**Due: 2019/11/29**

### 1. Goal

The goal of this LAB is to implement a 32-bit ALU (Arithmetic Logic Unit). ALU is the basic computing component of a CPU. Its operations include AND, OR, addition, subtraction, etc. This homework will help you understand the CPU architecture. The function of testbench is to read input data automatically and output erroneous data.

### 2. HW Requirement

- Please use Xilinx ISE or ModelSim as your HDL simulator. (ModelSim is preferred, we will test your result on ModelSim)
- Please zip the archive (not including testcase and testbench.v) and name it as "ID.zip" (e.g., R08922XXX.zip).
- Plagiarism will get 0 point
- The names of top module and IO ports **must** be named as follows:

Top module: alu.v

```
module alu(
    rst_n,           // negative reset (input)
    src1,            // 32 bits source 1 (input)
    src2,            // 32 bits source2 (input)
    ALU_control,     // 4 bits ALU control input (input)
    result,          // 32 bits result(output)
    zero,            // 1 bit when the output is 0, zero must be set (output)
    cout,            // 1 bit carry out (output)
    overflow         // 1 bit overflow(output)
);
```

ALU starts to work when the signal rst\_n is 1, and then catches the data from src1 and src2.

In order to have a good coding style, please obey the rules below:

- . One module in one file.
- . Module name and file name must be the same.

For example: The file "alu.v" only contains the module "alu".

e. instruction set: basic operation instruction (60%)

ALU action	Name	ALU control input
And	And	0000
Or	Or	0001
Add	Addition	0010
Sub	Subtract	0110
Nor	Nor	1100
Slt	Set less than	0111

zcv three control signal : zero 、 carry out 、 overflow (40%)

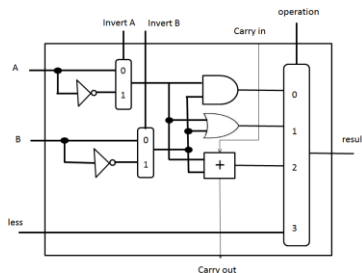
zero must be set when the result is 0.

cout must be set when carry out.

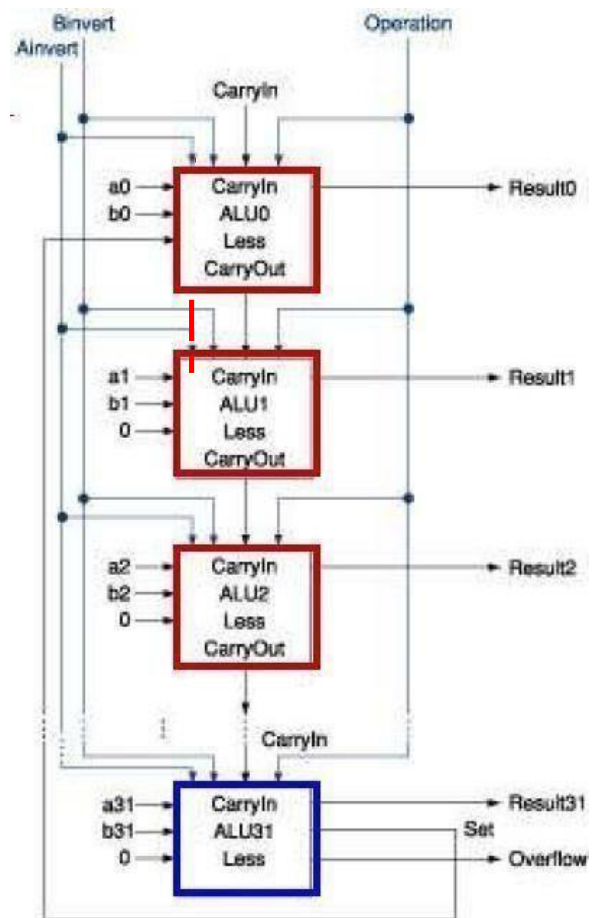
overflow must be set when overflow.

### 3. Architecture diagram

1-bit ALU (Top)



32-bit ALU



Blue frame is 1-bit ALU (Bottom)

## **5. Grade**

- a. Total: 100 points (plagiarism will get 0 point)
- b. Late submission: 0 points

## **6. Hand in**

Please upload the assignment to ceiba

## **7. Q&A**

For any questions regarding hw3, please contact 廖英僑(ying.chiao.liao@gmail.com), 范航熏(rr1155001100@gmail.com), 賴振東(eogkdlty@gmail.com)