

# Computer Organization

## Lab 1: 32-bit ALU

**Due: 2019/7/19**

### 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 LAB will help you understand the CPU architecture. LAB 1 will be reused; you will use this module in later LABs. The function of testbench is to read input data automatically and output erroneous data. Please unzip the files in the same folder.

### 2. Homework Requirement

- Please use Xilinx or ModelSim as your HDL simulator.(ModelSim is preferred)
- Please **attach student IDs as comments** at the top of each file.
- Please zip the archive and **name it as "ID.zip"** (e.g., 0516XXX.zip or 0516XXX\_0516XXX.zip) before uploading to e3
- Testbench module is provided.
- Any work by fraud will absolutely get a zero point.**
- The names of top module and IO ports must be named as follows:

**Top module: alu.v**

```
module alu(  
    clk, // system clock (input) rst_n, // negative reset (input)  
    src1, // 32 bits source 1 (input)  
    src2, // 32 bits source 2 (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".**

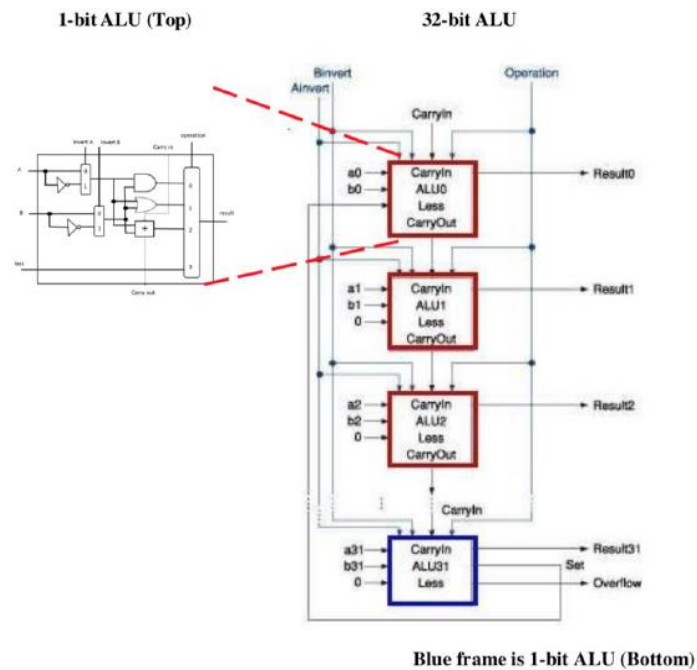
**g. instruction set: basic operation instruction (60%)**

ALU Action	Name	ALU Control Input
And	And	0000
OR	Or	0001
Add	Addition	0010
Sub	Subtraction	0110
Nor	Nor	1100
Slt	Set less than	0111

**h. zcv three control signal : zero、carry out、 overflow (30%)**

1. “zero” must be set when the result is 0.
2. “cout” must be set when there is a carry out.
3. “overflow” must be set when overflow.

### 3. Architecture Diagram



### 4. Grade

- a. **Total:** 100 points (plagiarism will get 0 point)
- b. **Report:** 10 points
- c. **Late submission:** Score \* 0.8 before 7/26. After 7/26, you will get 0

Please put all the .txt files and project in the same folder, after simulation finishes, you will get some information.

```
Simulator is doing circuit initialization process.
Finished circuit initialization process.
*****
Congratulation! All data are correct!
*****
```