Computer Organization
Lab 1: 32-bit ALU

Due: 2020/4/16

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

a. Please use Xilinx or ModelSim as your HDL simulator.(ModelSim is preferred)
b. Please attach student IDs as comments at the top of each file.
c. Please zip the archive and name it as "ID.zip" (e.g., 0516XXX.zip or 0516XXX_0516XXX.zip) before uploading to e3
d. Testbench module is provided.
e. Any work by fraud will absolutely get a zero point.
f. 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".

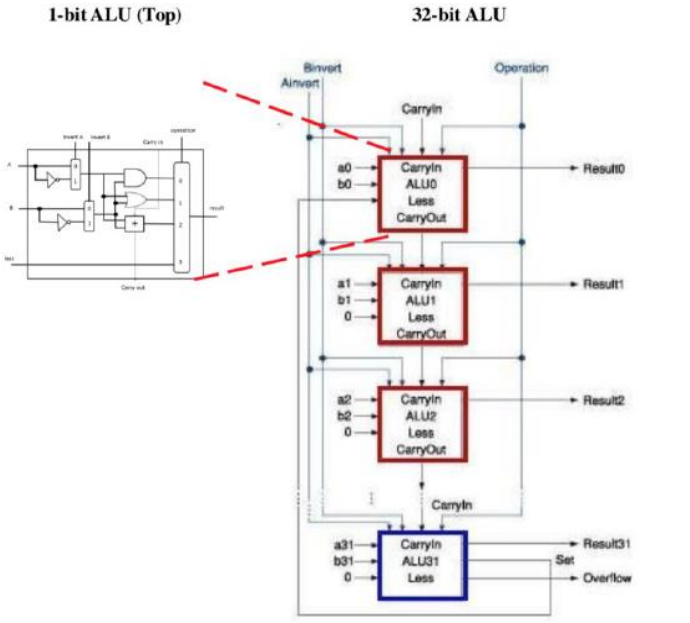
g. instruction set: basic operation instruction (60%)

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



Blue frame is 1-bit ALU (Bottom)

4. Grade

a. **Total:** 100 points (plagiarism will get 0 point)

b. **Report:** 10 points

c. **Late submission:** Score * 0.8 before 4/30 .

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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!
**********************************************************
```