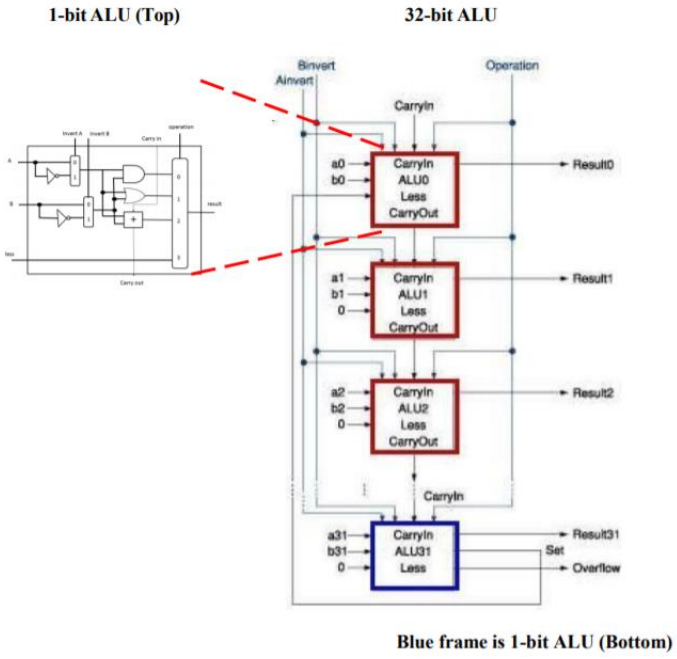
Computer Organization

Architecture diagrams:



總共設計了 3 個 module，分別是 alu, alu_top, alu_bottom。

Hardware module analysis:

```
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)
          //bonus_control, // 3 bits bonus 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)
        );
```

```
module alu_top(
                src1,       //1 bit source 1 (input)
                src2,       //1 bit source 2 (input)
                less,       //1 bit less     (input)
                A_invert,   //1 bit A_invert (input)
                B_invert,   //1 bit B_invert (input)
                cin,        //1 bit carry in (input)
                operation,  //operation      (input)
                result,     //1 bit result   (output)
                cout       //1 bit carry out(output)
                );
```

```
module alu_bottom(
                  src1,       //1 bit source 1 (input)
                  src2,       //1 bit source 2 (input)
                  less,       //1 bit less     (input)
                  A_invert,   //1 bit A_invert (input)
                  B_invert,   //1 bit B_invert (input)
                  cin,        //1 bit carry in (input)
                  operation,  //operation      (input)
                  result,     //1 bit result   (output)
                  set,
                  cout
                  );
```

在 alu 中分別呼叫了 31 個 alu_top 以及 1 個 alu_bottom，其中 alu_top 負責除了 MSB 的運算，alu_bottom 則是負責 MSB 的運算，alu 則是將所有的控制值(ex:運算的 controll、invert 與否等)傳進 alu_top 以及 alu_bottom。

Experiment result: