Final Project – Progress Report 3

CS 385 – Computer Architecture

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**Tasks:**

Daniel Kostecki:

* Gate level conversions in the regfile
* Regfile implementation in project
* Report and adjusted diagrams
* Code comments
* Testing program

Thi Nguyen:

* 16-bit implementation of multiplexors using 4x1 mux
* Regfile D-flip-flops
* CPU module
* Main Control Unit
* I-type operations for Report 2
* Testing program

Sonia Leonato Soiras:

* ALU conversions to 16-bit
* Gate level conversions in the ALU (4x1 mux and 2x1 mux)
* Truth table
* Code debugging
* Testing program

**Descriptions:**

The instruction set architecture currently in place for our 16-bit machine allows for R-type and I-type instructions. The list of R-type instructions that are currently supported and their respective opcode are and(0000), sub(0001), add(0010), or(0011), and slt(0111). The opcodes of the I-type instructions are addi(0100), lw(0101), sw(0110), beq(1000), bne(1001).

R-type format: I-type format:

|  |  |  |  |
| --- | --- | --- | --- |
| Op | Rs | Rt | Address/Value |
| 4 | 2 | 2 | 8 |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Op | Rs | Rt | Rd | Unused |
| 4 | 2 | 2 | 2 | 6 |

The format of the instructions is dependent on the type if instruction. For example, in the r-type format we first get the op code (listed above). This is followed by the two registers which are being used. The final register is the destination. Because we have a 4-bit opcode followed by 3 2-bit registers this leaves us with 6-bits at the end of every r-type that is unused. For the i-type format this changes. The op code is still 4-bit, and there are still two registers (rs being used and rt being destination) but this is followed by an 8-bit value or address.

**Logic Diagrams/Truth Tables:**

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Instr** | **RegDst** | **ALUSrc** | **MemReg** | **RegWrite** | **MemWrite** | **Branch** | **ALUCtrl** |
| **add** | 1 | 0 | 0 | 1 | 0 | 00 | 010 |
| **sub** | 1 | 0 | 0 | 1 | 0 | 00 | 110 |
| **and** | 1 | 0 | 0 | 1 | 0 | 00 | 000 |
| **or** | 1 | 0 | 0 | 1 | 0 | 00 | 001 |
| **slt** | 1 | 0 | 0 | 1 | 0 | 00 | 111 |
| **lw** | 0 | 1 | 1 | 1 | 0 | 00 | 010 |
| **sw** | 0 | 1 | 0 | 0 | 1 | 00 | 010 |
| **beq** | 0 | 0 | 0 | 0 | 0 | 01 | 110 |
| **bne** | 0 | 0 | 0 | 0 | 0 | 10 | 110 |
| **addi** | 0 | 1 | 0 | 1 | 0 | 00 | 010 |

**Verilog Code:**

**Test results**