Post Lab 8 Report

ECEN350

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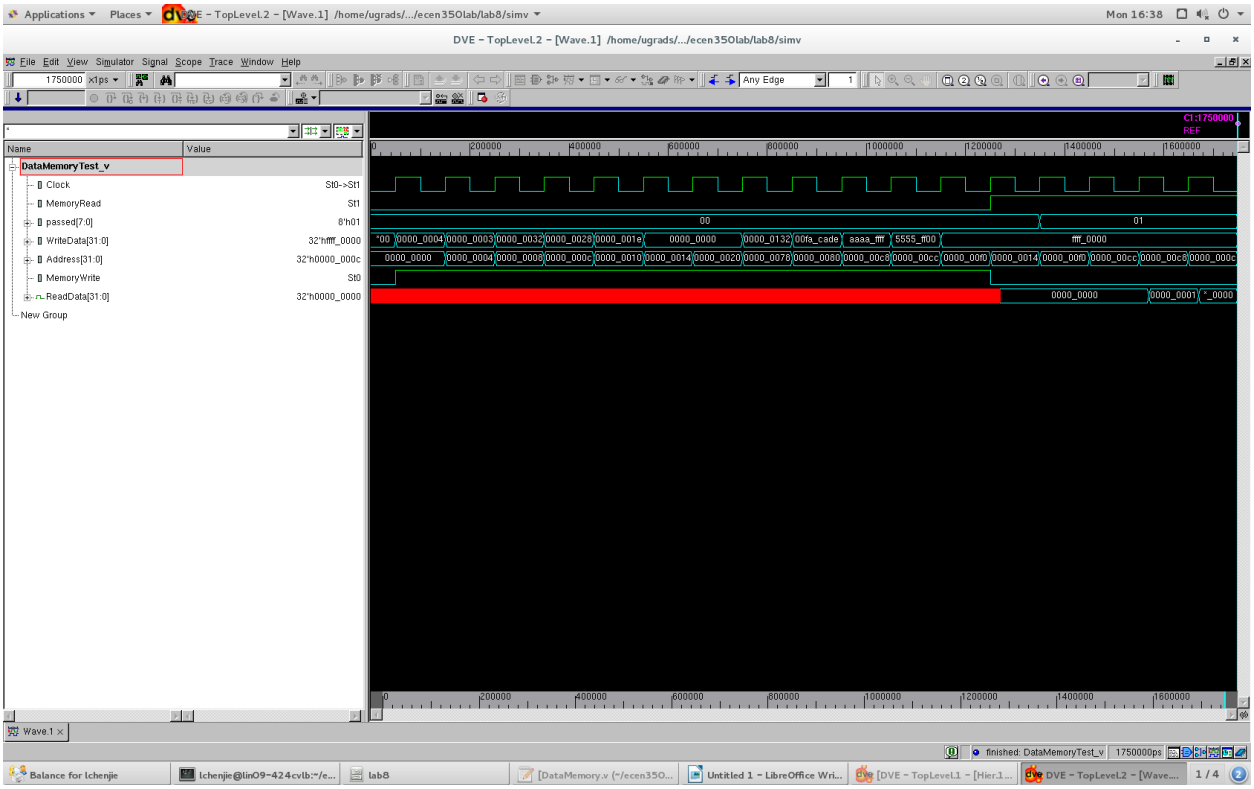
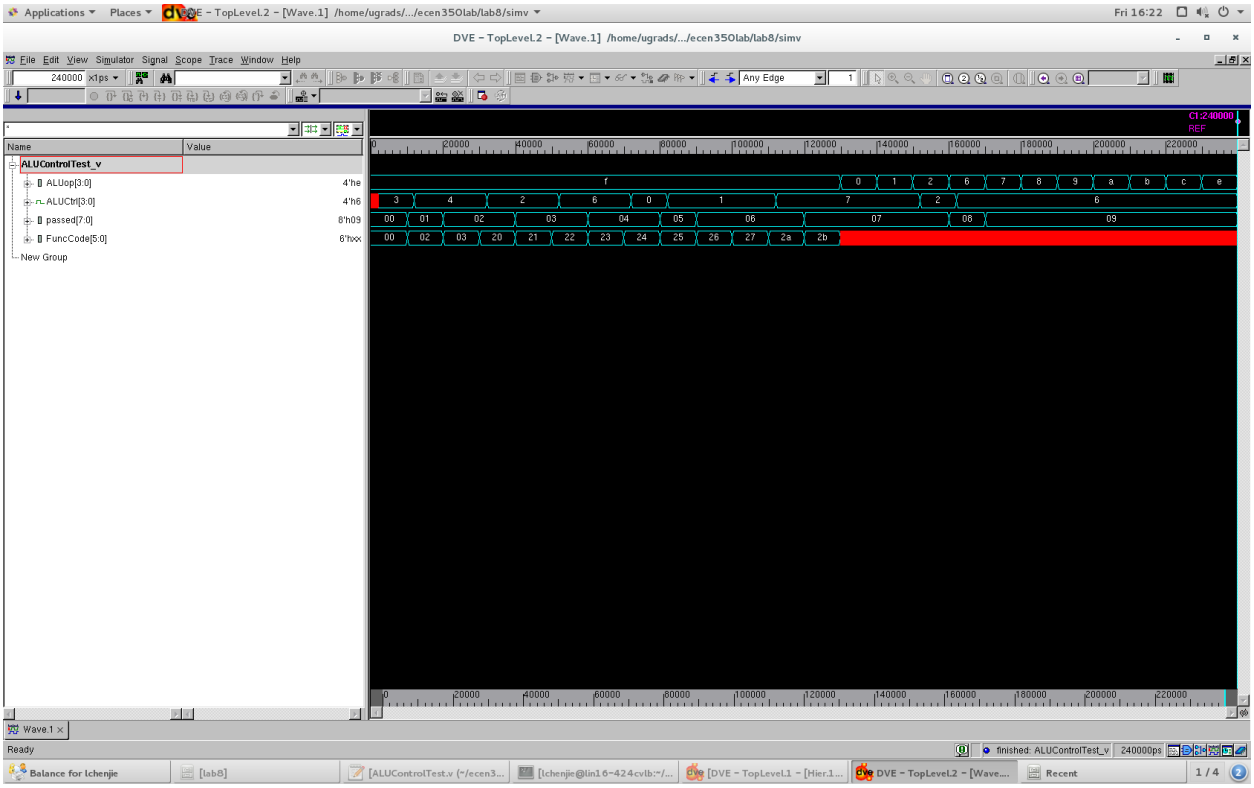
1. Data Memory



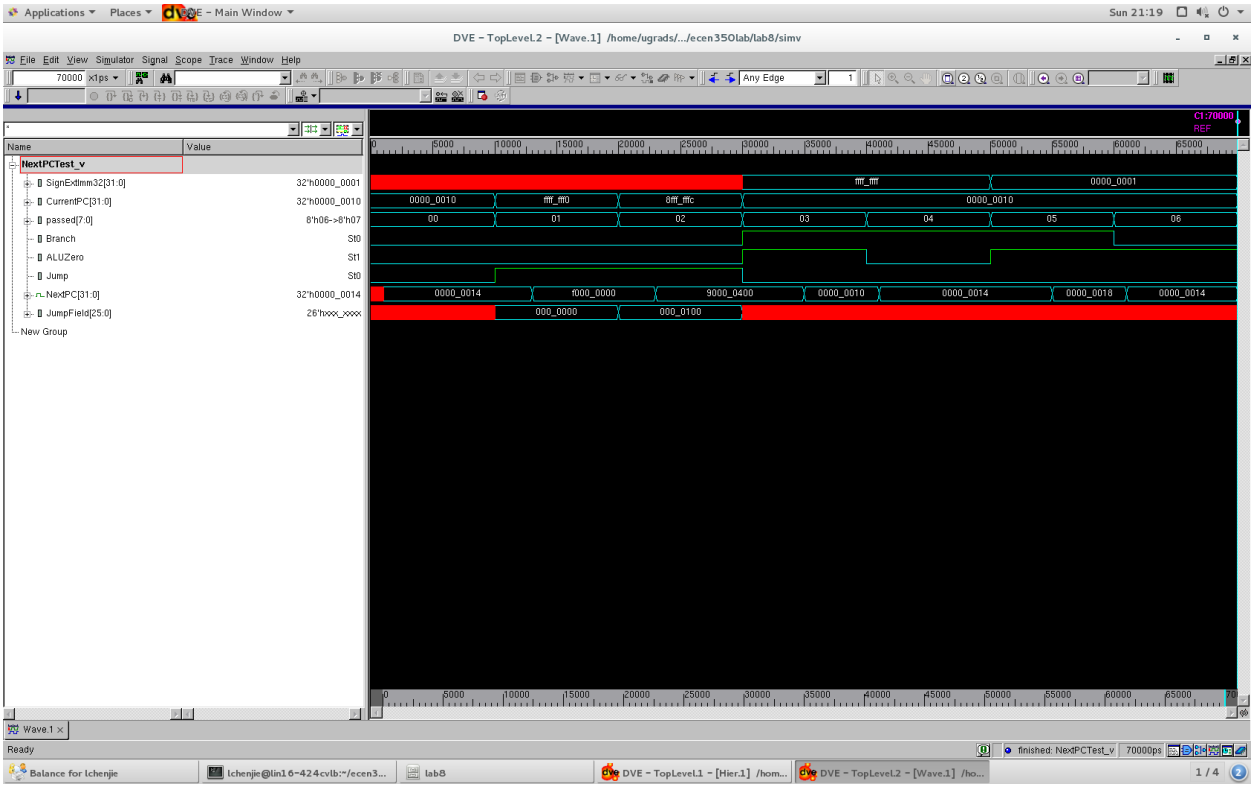
Data memory will only be accessed by sw and lw instructions. The block contains two control units, which are MemRead and MemWrite. Because this design is synthesizable, data will only be written into memory on the negative edge of the clock signal and when MemWrite is 1 . Similarly, data will only be read at the positive edge of the clock signal and when MemRead is 1. According to given test code, when MemWrite is 1, we don't care about the ReadData. So ReadData during that period is X. After that, MemRead flipped to 1 and data will be read after a 20 units time delay. Besides, in this case we only reserve the data memory of size 64 words, which is 2048 bits long, so if the address is beyond this area, errors will occur.

2. ALUCtrl



ALUCtrl works for generating a 4-bit operation code for ALU based on input ALUop code and 6-bit FuncCode. Its basic logic is firstly detecting the given instruction is R-type or not. In this case R-Type instruction ALUop will be 4'b1111. Secondly, if this a R-type instruction, the machine will check the FuncCode. Otherwise, the machine will automatically set ALUCtrl equals ALUop. With the given test bench code, we can see when ALUop is no longer equal to 1111, which is f in hexadecimal, we do not need to care the FuncCode any more. And the ALUCtrl will equals ALUop directly.

3. NextPC



NextPC basically give the address for the next instruction. In most cases, NextPC equals CurrentPC + 4. However, for branch and jump instructions, the Program Counter will point to the destination address according to instruction. Therefore, when control unit: Jump is 1, we firstly shift the immediate field left by 2 bits. and then add the first 4 bits in CurrentPC to form the destination address. We can see for first jump instruction, Immediate Field is 26'b0, so after reformation, the destination address should be 32'b1111_0000_0000_0000_0000_0000_0000_0000, which is hexadecimal is 32'hf0000000. As for Branch instruction, when Branch and ALUZero are both 1, the machine will firstly shift left by 2 and add to the CurrentPC.