CAO HW4

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1a

The lower 16 bits are put into the sign extender, which in this instruction is:
0000 1000 0010 0101.
The sign bit is copied to fill the remaining 16 bits, thus the output of the sign extend unit will be:
0000 0000 0000 0000 0000 1000 0010 0101.
At the input of the Adder, this value will be shifted left two bits, thus the value will become:
0000 0000 0000 0000 0010 0000 1001 0100

The shift left 2 unit will take the lower 26 bits of the instruction and shift these left two bits. The input for this unit is:
1 1000 0010 0000 1000 0010 0101
Shifted left twice to produce:
1 1000 0010 0000 1000 0010 0101 00

This will be the output of the shift left 2 unit. The Jump address will be calculated from concatenating PC+4 to this address. The current PC value is not given so we cannot calculate the upper four bits.

1b

RegDst	1
ALUSRc	0
MemtoReg	0
RegWrite	1
MemRead	0
MemWrite	0
Branch	0
ALUOp1	1
ALUOp2	0

1c

As this is an R-format instruction, the new PC value will just be PC+4.

1d

The instruction fetched from the instruction memory is:

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or $at, $t4, $v0
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The values in these registers are provided. $t4 = R12 = 16 and $v0 = R2 = -128. These are the inputs to the main ALU.
16 | -128 = -112 = 0xFFFFFF90 = 1111 1111 1111 1111 1111 111 1001 0000.

The inputs for the Adder are (as given in 1a) 0x00002094, from the shift left 2 unit. The other input comes from the PC+4. Thus the adder performs the calculation 0x00002094 + (PC + 4).

2a