CSCI 2321 (Principles of Computer Design), Spring 2002

Homework 6

Assigned: April 22, 2002.

Due: April 29, 2002, by the start of class. *Not accepted late.*

Credit: 30 points.

1 (Optional) figures to print

Some of the problems ask you to modify figures from the textbook. For these problems you may find it useful to print a copy of the figure. To save you the trouble of photocopying the relevant figures or finding them on the authors' Web site, here are they are in your choice of printable formats. All figures below are copyrighted.[1]

- Figure 5.33, PDF[2] or PostScript[3].
- Figure 5.42, PDF[4] or PostScript[5].

2 Problems

1. (5 points) Suppose that at the beginning of a clock cycle the following is true:

   - The program counter (PC) has a value of 4.
   - Memory location 4 contains the binary representation of the MIPS assembler instruction `add $t0, $t1, $t2`.
   - Register `$t1` contains 8.
   - Register `$t2` contains -2.

   Trace through what happens during execution of this instruction by the multicycle implementation described in section 5.4:

   - How many cycles are required for execution of this instruction?
   - For each cycle, what are the values of the control signals in the table of Figure 5.34 (p. 384)? You may omit any whose values don't matter.
   - For each cycle, which state elements' values change at the end of the cycle, and to what? State elements include the register file, the memory, and the PC, IR, MDR, A, B, and ALUOut registers.

2. (5 points) Suppose that at the beginning of a clock cycle the following is true:

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[2] `http://www.cs.trinity.edu/~bmassing/CS2321_2002spring/Homeworks/HW06/Problems/F0533.pdf`
[3] `http://www.cs.trinity.edu/~bmassing/CS2321_2002spring/Homeworks/HW06/Problems/F0533.ps`
[4] `http://www.cs.trinity.edu/~bmassing/CS2321_2002spring/Homeworks/HW06/Problems/F0542.pdf`
[5] `http://www.cs.trinity.edu/~bmassing/CS2321_2002spring/Homeworks/HW06/Problems/F0542.ps`

- The program counter (PC) has a value of 8.
- Memory location 8 contains the binary representation of the MIPS assembler instruction `lw $t0, 8($t1)`.
- Register `$t1` contains 16.
- The 32-bit value stored starting at memory location 24 is -10.

Trace through what happens during execution of this instruction by the multicycle implementation described in section 5.4, as in the preceding problem.

3. (10 points) Do problem 5.15 on p. 429 of the textbook. (See Section 1 above if you want to print copies of the relevant figures.)

4. (10 points) Do problem 5.17 on p. 429 of the textbook. (See Section 1 above if you want to print copies of the relevant figures.)