CS 473
Midterm Exam
March 4, 2005

The following exam is open book and open notes. You may feel free to use whatever additional reference material you wish, but **no electronic aids** are allowed. Please note the following instructions. There will be a ten point deduction for failure to comply with them:

- start each problem on a new sheet of paper

- write your social security number, but not your name, on each sheet of paper you turn in

- show your work whenever appropriate. There can be no partial credit unless I see how answers were arrived

- be succinct. You may lose points for facts that, while true, are not relevant to the question at hand

You have until 10:20 to finish the exam. The questions are equally weighted. Some of the questions (2, 3 and 4) might be more easily answered on the exam paper; you may do so and turn in those pages (but remember to put your SSN on them if you do!).

1. Floating Point

    (a) Convert the following decimal number to IEEE floating point format:

    ```
    13.375
    ```

    Your final answer should be an eight digit hexadecimal number.

    (b) Use the floating point multiplication algorithm to multiply the following two IEEE floating point numbers :

    ```
    0x3fc00000×0xc0980000
    ```

    Your final answer should be an eight digit hexadecimal number.

    (c) Convert the following IEEE floating pont number into "human-readable" decimal.

    ```
    0xc0980000
    ```

    Your final answer should be in the same form as the "13.375" in part 1a.

2. Suppose the following sequence of instructions is to be executed on a MIPS processor.

    ```
    lui $2, 100
    lw  $1, 100($2)
    add $2, $3, $4
    sub $5, $1, $2
    lw  $7, 100($5)
    sw  $7, 200($5)
    ```

    (a) Use circles and arrows to show all the dependences between these instructions.

    (b) Draw a timing chart showing the execution. Assume all possible forwarding and all necessary stalls occur as needed. Be sure to use arrows showing forwarding in your answer.

3. In the following figure (reproduced from page 307 of the text and modified by me for this question) address `0x00040000` has just been read from the instruction memory, and the instruction `0x20f00200` has been returned . Show the value that appears on every line in the diagram as the instruction is executed. Use our standard assumptions for register contents, ie that every register `$i` except `$0` returns a value of `i+10` when it is read for the first time.
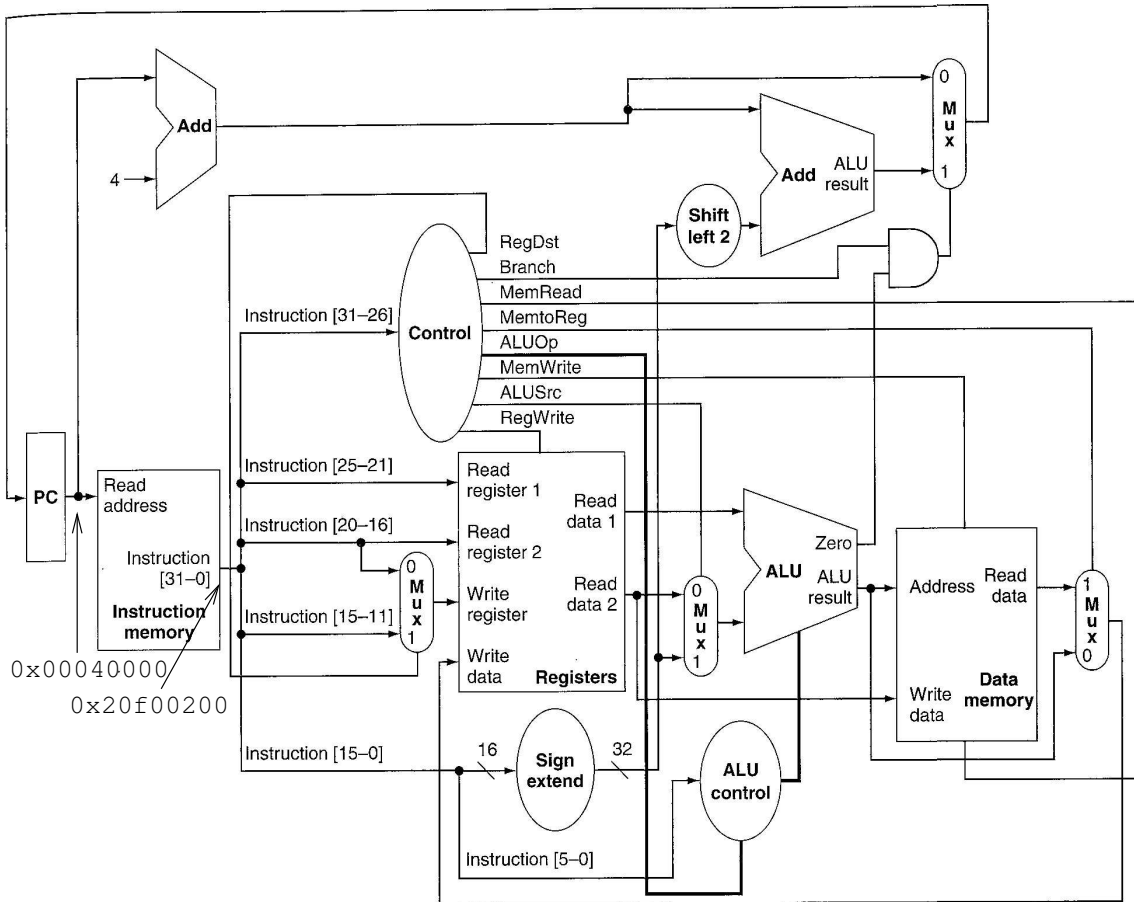
4. We've made the comment in class that if we had a pair of instructions like this:

```
lw $2, 100($6)
sw $2, 400($5)
```

(in which the sw writes the same register out to memory that the lw has fetched) can execute without stalling by forwarding the register contents from the first instruction to the first. On figure on the next page (reproduced from page 427 of the book), modify the datapaths so this forwarding can actually take place.