

CS 473
Midterm Exam
October 13, 2004

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 1:20 to finish the exam.

1. (25 points) Floating point conversions.

- (a) Convert the decimal number -27.375 into IEEE floating point format (your final answer should be an eight digit hexadecimal number).
- (b) Why would asking you to convert 73.3 violate my “no unreasonable arithmetic” rule?
- (c) Why is the number 1.57×10^{100} indistinguishable from zero in IEEE floating point?

2. (25 points) Perform the following operation (the operands are floating point numbers in IEEE format). Do the multiplication using the algorithm given in class (*not* by converting to decimal, multiplying, and converting back again), and give your result as an eight digit hexadecimal number.

$$415a0000_{16} \times bfa00000_{16}$$

3. (35 points) Suppose a MIPS’s PC contains 00001024_{16} , instruction memory address 00001024_{16} contains 02573034_{16} , that every register (except \$0!) contains that register’s number plus 10_{10} (so \$1 contains 11_{10} , \$2 contains 12_{10} and so forth until \$31 contains 41_{10}), and that every word-aligned four-byte word of memory contains that word’s byte address plus 1000_{10} (so 00000000 contains 1000_{10} , 00000004 contains 1004_{10} , and so forth).

If the machine executes one instruction, what is the value that will appear on every wire (data and control) on the figure on the following page in the course of the instruction’s execution?

4. (15 points) Most computers use branch arithmetic similar to the MIPS: the target of a branch is the address of the instruction following the branch instruction, plus an offset from that instruction (in the case of the MIPS, this is $PC+4+offset$).

One exception to this rule is the Sparc, whose branch target is $PC+offset$.

Draw the branch part of the datapath from Figure 5.11, modified to use the Sparc-style branch offset.

Question 3:

