

CS 473
Midterm Exam
October 12, 2001

Please note the following instructions. There will be a **ten point deduction** for failure to comply with them:

- This exam is open book and open notes. You may feel free to use whatever additional reference material you wish, but **no calculators** are allowed.
- 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, even if it's trivial.
- be succinct. I will take points for facts that, while true, are not relevant to the question at hand

You have until 1:30 to finish the exam. The questions are equally weighted.

1. The following question is in three parts:
 - (a) Convert the number 12.625 from decimal into IEEE floating point. Use the multiplication and division algorithms as appropriate to do the conversions. Express your final result as a 32-bit hexadecimal number, *ie* in the form `abcd1234`.
 - (b) Add the result you got for question 1a to the number represented in IEEE floating point as `c0880000`. Again, express your answer as a 32 bit hexadecimal number.
2. The MIPS pipeline as shown in the text on page 470 (figure 6.30) is only capable of performing `beq` branches. Modify the pipeline so it can perform `bne` instructions as well. This will involve changes to the control unit, the ID/EX and EX/MEM pipeline registers, and the MEM pipeline stage. I've attached a copy of the figure so you can modify it for this question.

3. Consider the following sequence of MIPS instructions:

```
lw    $1, 100($2)
lw    $3, 100($4)
add   $5, $1, $3
lw    $6, 200($7)
add   $8, $5, $6
sw    $8, 300($9)
```

- (a) Draw a timing chart for this code, assuming the standard MIPS pipeline as on page 470. On the chart, show any stalls or forwarding that need to take place to execute the code.
- (b) Modify the code to run as quickly as possible (again, assuming the standard MIPS pipeline).
- (c) Draw another timing chart for your modified code from question 3b. Again, show any stalls or forwarding that need to take place.

4. Consider the following CDC assembly code:

```
X1 <- X1*X3
X5 <- X1-X2
X6 <- X5*X5
X7 <- X0+X6
X0 <- X4*X7
```

Draw a timing chart to show how many cycles this code will take to execute.