

CS 2733/2731, Computer Organization II
Spring Semester, 2003
First Examination

1. Convert the (decimal) number -76 to 16-bit two's complement binary. (The binary representation for 76 is 1001100.) **(10)**
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2. Consider the following MIPS code fragment: **(25)**

```
        .data
A:      .word 47, 23, 89, 52, 43, 0, 0, 0, 0, 0,
        .text
# insert MIPS instructions here.
```

For insertion at the comment, write MIPS instructions that will do the following:

- (a) Store the address of A into \$s0.
 - (b) Use a loop to print the first 5 values of the array A, each separated by a blank, so that 47 23 89 52 43 should be printed.
(You must use a loop for credit. If you like, you may take advantage of the fact that the first five values are followed by 0's. Recall that one uses 1 in \$v0 to print an `int` and 4 in \$v0 to print a string. Your MIPS code should do what is asked for above and *nothing more*.)
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3. Write a *single* MIPS function F that does all of the following **(25)**
- (a) F saves register \$ra on the stack.
 - (b) F doubles its input parameter and returns the doubled value.
 - (c) F restores the register \$ra saved above.
 - (d) F restores the stack.
 - (e) F returns.

Separately show a call to F with input parameter 19.

Note: You should just give code for the call to F and for the definition of the function F that do the above items and *nothing more*. You should follow MIPS parameter conventions.

(10)

4. The MIPS assembler can use actual machine instruction to create other *pseudo-instructions*. In each case below, show how the given instruction could be rendered using one of the following actual hardware instructions: `add`, `addi`, `slt`, `beq`, and `bne`):

- (a) `move $s1, $s2` # `$s1 = $s2`
 (b) `li $s3, 200` # `$s3 = 200`
 (c) `b Loop` # unconditional branch

5. The MIPS assembler instruction `lui` (Load Upper Immediate) will load an immediate constant into the upper 16 bits of a register. Thus `lui $s3, 0x4f` will load the hexadecimal number `0x4f` (which is 79 decimal) into the upper 16 bits of register `$s3`. Show how to use two instructions to load the hexadecimal constant `0x034407ff` into the register `$s3`.

6. Consider the following logic gate constructed out of CMOS transistors. (20)
- (a) In case A is a 1 (voltage high) and B is also a 1, what will be the output at C? Explain your answer in terms of the diagram and the properties of the transistors. (Show which switches are open (don't conduct current), which are closed (conduct current), and explain why the output at C is what it is.)
- (b) Say what kind of logic gate this represents.

