

University of Pittsburgh

CS/COE 447 Spring 2007 Exam 1

There are a total of 100 points. You are allowed to use the Green Card (or a copy of it) that comes with the text.

We can't answer questions like *What do you want for this question?* or *I don't understand this question.* It makes the room too loud, and it isn't fair, since some people would get extra information. Please just use your best judgment.

Show your work for partial credit.

Each question is on its own page, to give you plenty of room. Don't feel you need to fill up each page; just write what you need to.

Good luck!!

1. (10 points)

(a) Translate A092 hex into binary
1010 0000 1001 0020

(b) Translate 0110110001110011 binary into hex
6c73

(c) Translate 43 decimal into binary
 $101011 = 32 + 8 + 2 + 1$

(d) Translate $2^{13} - 1$ decimal into binary
111111111111

2. (15 points) Give the machine code for the following instructions, first in binary and then in hex:

```
      add $s0,$s1,$s2
000000 10001 10010 10000 00000 100000
   0   2   3   2   8   0   2   0
```

```
      lw $t1, 4($t0)
100011 01000 01001 0000000000000100
   8   d   0   9   0   0   0   4
```

```
      andi $t0,$t1,0xf1f1
001100 01001 01000 1111000111110001
   3   1   2   8   f   1   f   1
```

3. (26 points) Suppose memory contains the following values.

Address	Value (+0)	Value (+4)	Value (+8)	Value (+c)
0x10010000	0x00007f23	0x41424344	0x00000f3e	0x00000001

What value (in hex) is placed into which register or memory location by each of the following instructions?

Be sure to show the correct number of hex digits. For example, if a full 8 hex digits are loaded into a register, show all 8 digits.

	register or memory location	hex value
	-----	-----
%li \$t0,0x10010004	\$t0	10010004
%		
%lw \$s0,0(\$t0)	\$s0	41424344
%		
%lw \$s1,8(\$t0)	\$s1	00000001
%		
%lb \$s2,4(\$t0)	\$s2	0000003e
%		
%addi \$s3,\$zero,0x1234	\$s3	00001234
%		
%sw \$s3,0(\$t0)	10010004	00001234
%		
%sb \$s3,12(\$t0)	10010010	34
%		
%lui \$t0,0x1001	\$t0	10010000
%		
%ori \$t1,\$t0,0x0008	\$t1	10010008
%		
%addi \$t4,\$zero,5	\$t4	00000005
%		
%sw \$t4,0(\$t1)	10010008	00000005
%		
%addi \$t4,\$zero,0x1bcd	\$t4	00001bcd
%		
%andi \$t5,\$t4,0x000f	\$t5	0000000d
%		
%sll \$t6,\$t4,8	\$t6	001bcd00

4. (8 points) Consider the following instructions:

```
addi $t1,$zero,0x5e4d
```

```
addi $t2, $t1, 0x287
```

```
ori $t3,$t1, 0x3333
```

What (hex) values are placed in \$t1, \$t2, and \$t3 by this code segment? Please label your answers clearly, and show your work.

```
%  
%  
%$t1 = 0x00005e4d  
%  
%\$t2 = 0x000060d4  
%  
%\$t3 = 0x00007f7f
```

5. 11 points. Question Deleted.

6. (5 points) On the green card, the OPERATION entry for addi is

$$R[rt] = R[rs] + \text{SignExtImm} \quad (2)$$

$$(2) \text{SignExtImm} = \{16\{\text{immediate}[15]\}, \text{immediate}\}$$

What specific binary value is SignExtImm for the instruction

```
addi $t0,$t1,13
```

```
%0000 0000 0000 0000 0000 0000 0000 1101
```

7. Suppose that \$t0, \$t1, and \$t2 have already been assigned values (it doesn't matter which ones). Write MIPS assembly-language instructions to accomplish the following pseudo-code segments.

(a) (10 points)

```
if ($t0 == $t1)
    $t2 = $t0 + $t1;
$t0 = 3;

%       bne $t0,$t1,done
%       add $t2,$t0,$t1
%done: addi $t0,$zero,3
```

(b) (15 points)

```
if ($t0 >= $t1)
    $t2 = $t2 - $t1;
else
    $t2 = $t2 + $t1;
$t0 = 55;

%       slt $t3,$t0,$t1
%       bne $t3,$zero,else
%       sub $t2,$t2,$t1
%       j done
% else:
%       add $t2,$t2,$t1
% done:
%       addi $t0,$zero,55
%
```