

Homework 1

Due Date: Thursday, January 19, 2006, 2:00

Your Name: _____

Question 1 Is SPARC big- or little- Endian? _____

When a word of data is stored in memory, which byte is stored in the first byte (i.e., in the byte with the lowest address)? _____

Question 2a A halfword aligned address must be divisible by what? _____

What must any halfword aligned address end with (in binary)? _____

Question 2b A word aligned address must be divisible by what? _____

What must any word aligned address end with (in binary)? _____

Question 2c A doubleword aligned address must be divisible by what? _____

What must any doubleword aligned address end with (in binary)? _____

Question 3 *Do not use a calculator for this question.*

What is this binary value, in hex?

0101 1100 0011 1011 1010 0010 0100 1001

What is this hex value, in binary?

84AF DC3B

Question 4 Using 32-bit unsigned numbers, which is the largest number that can be represented? Give it in hex and in decimal. How do we often write this number as an expression? (for example, $2K+4$).

_____ (in hex)

_____ (in decimal)

_____ (as an expression)

Question 5 Using 32-bit signed numbers, which is the largest number that can be represented?

_____ (in hex)
 _____ (in decimal)
 _____ (as an expression)

Question 6 Using 32-bit signed numbers, which is the smallest number that can be represented?

_____ (in hex)
 _____ (in decimal)
 _____ (as an expression)

Question 7 Using 32-bit signed numbers, how is -1 represented? Give it in hex.

Question 8 How long is each SPARC instruction (ignore “set”)?

in bits? _____

in bytes? _____

in words? _____

Question 9 There are four sets of 8 registers in the SPARC. What are they called?

Question 10 In the full SPARC architecture, each register is 64 bits long. In the subset we are using, how many bits are we using in each register? _____

Question 11 Some instructions allow the second operand to be either in a register or specified literally, by including a value directly in the instruction. For example:

```
add    %g4, %g7, %o2
add    %g4, 123, %o2
```

When a literal (immediate) value is used, what is the range of allowable values? (Specify in decimal.) _____

How would you describe this value? (Specify signed/unsigned and number of bits.)

Question 12 Consider these SPARC instructions: sll, srl, and sra. What do these letters stand for?

sll: _____

srl: _____

sra: _____

Question 13 Consider the difference between srl and sra... What does srl do? What does sra do? (Hint: your answer should use words like: shift, zero, one, most-significant, least-significant.)

srl: _____

sra: _____

Question 14 When using instructions that alter flow of control (like ble and call), the processor will always execute the instruction in the word following the instruction before the transfer is made. What is this word called?

Filling it is an important optimization, but is sometimes difficult. To just get the program working, you can always put what instruction in this position?

Question 15 Here is code with an annulled branch:

```

cmp      %o7, 100
bge, a   myLoop
add      %o5, 1, %o5

```

If the value of register %o7 is greater than or equal to 100, will %o5 be incremented?

If the value of register %o7 is less than 100, will %o5 be incremented?

Question 16a Show in hex the bytes that this pseudo-op will place in memory?

```
.ascii "hello"
```

Question 16b Show in hex the bytes that this pseudo-op will place in memory?

```
.asciz "abc"
```

Question 17 The instruction “not” is a synthetic instruction. Consider

```
not    %o4,%o5
```

The assembler will produce the same code for this instruction as for what instruction?

Question 18 Which synthetic instruction is used to move a full 32 bit value into a register? Give an example moving 0x12345678 into %g5.

Show the two instructions it will expand into.

Question 19 Consider this SPARC instruction:

```
call printf
```

This instruction saves the address of what instruction?

It puts it in which register before transferring control to the routine called “printf”?

Question 20 Which instruction opens a new register window? _____

Which closes it? _____

Question 21 Assume that a routine named “foo” calls a routine named “bar” using the standard SPARC calling conventions. Where will the code for “foo” place the first argument to be passed? _____

In the code for “bar”, where will that argument be found? _____

Assume “bar” returns a value; where will “bar” put the returned value? _____

Where will “foo” look to find the result? _____

Question 22 There are two stacks involved in the SPARC procedure calling. One concerns the register windows and the other is the in-memory stack of “frames”. Does the in-memory stack grow from lower addresses toward higher, or from higher addresses toward low memory? _____

Question 23 What is the other name for “stack frames”?

Question 24 Each stack frame in the SPARC must be a multiple of how many bytes?

Question 25 Assume that a routine named “foo” calls a routine named “bar” using the standard SPARC calling conventions. Within “bar”, what does %fp point to? What does %sp point to?

%fp points to _____

%sp points to _____

Question 26 When returning from a routine, what instruction is normally placed after the “ret” instruction? _____

Question 27 Assume that a routine named “foo” calls a routine named “bar” using the standard “C” calling conventions. Where will the code for “bar” find any additional arguments (beyond the first 6)? _____

Question 28 Some small routines (called “leaf” routines) may execute especially efficiently by not allocating a new frame on the in-memory stack. Which registers must such a routine leave unchanged when it returns?

Question 29 Assume that you wish to clear the high-order bit in register %g4, without changing any other bits. Show two instructions to achieve this. Assume that %o0 can be used as a “work” register. (Assume “set” counts as 1 instruction. Use AND, OR, etc, not BSET, BCLR, BTOG)

Question 30 Assume that you wish to toggle the high-order bit in register %g4, without changing any other bits. Show two instructions to achieve this. Assume that %o0 can be used as a “work” register. (Assume “set” counts as 1 instruction. Use AND, OR, etc, not BSET, BCLR, BTOG)

Question 31 Assume that you wish to set the high-order bit in register %g4, without changing any other bits. Show two instructions to achieve this. Assume that %o0 can be used as a “work” register. (Assume “set” counts as 1 instruction. Use AND, OR, etc, not BSET, BCLR, BTOG)
