University of California, Berkeley
College of Engineering
Computer Science Division — EECS

Fall 1997 D.A. Patterson

Prerequisite Quiz
September 5, 1997
CS152 Computer Architecture and Engineering

This prerequisite quiz will be used in determining class admissions. The use of calculators or notes is not allowed during this quiz. Good luck!

Your Name:	
SID Number:	
Discussion Section:	

1	
2	
3	
4	
Total	

1. The following program tries to copy words from the address in register `$a0` to the address in register `$a1`, counting the number of words copied in register `$v0`. The program stops copying when it finds a word equal to 0. You do not have to preserve the contents of registers `$v1`, `$a0`, and `$a1`. This terminating word should be copied but not counted.

```
loop: lw    $v1, 0($a0)     # Read next word from source
      addi  $v0,$v0,1       # Increment count words copied
      sw    $v1,0($a1)      # Write to destination
      addi  $a0,$a0,1       # Advance pointer to next source
      addi  $a1,$a1,1       # Advance pointer to next dest
      bne   $v1,$zero,loop  # Loop if word copied != zero
```

There are multiple bugs in this MIPS program; fix them and write below a bug-free version.

2. Here is a series of memory read references given as word addresses: 1, 4, 8, 5, 20, 17, 19, 56, 9, 11, 4, 43, 5, 6, 9, 17. Assuming a direct-mapped cache with 16 one-word blocks that is initially empty, label each reference in the list as a hit or a miss and show the final contents of the cache. Use the notation "M[i]" to mean the word in memory at address i.

Reference Address	Hit or Miss?
1	
4	
8	
5	
20	
17	
19	
56	
9	
11	
4	
43	
5	
6	
9	
17	

Cache Line	Contents
0	
1	
2	
3	
4	
5	
6	
7	
8	
9	
10	
11	
12	
13	
14	
15	

3. Assume that X consists of 3 bits, x2 x1 x0. Write four logic functions, using the logical sum of products notation, that are true if and only if:

- X contains only one 1

- X contains an even number of 1s (zero is an even number)

- X when interpreted as an unsigned binary number is less than 3

- X when interpreted as a signed (two's complement) number is less than -1

4. Assume the value of register `$t0` is initially 0. Give the contents of register `$t0` (in hexadecimal) after the following commands are executed:

```
addi    $t0, $0, 0x0fff
addiu   $t0, $t0, 0xf000
```