CS 60B Midterm #1 — September 20, 1993

Your name _____

login c60b–_____

Discussion section number _____

TA's name _____

This exam is worth 15 points, or 15% of your total course grade. The exam contains five substantive questions, plus the following:

Question 0 (1 point): Fill out this front page correctly and put your name and login correctly at the top of each of the following pages.

This booklet contains five numbered pages including the cover page. Put all answers on these pages, please; don't hand in stray pieces of paper. This is an open book exam.

When writing procedures, write straightforward code. Do not try to make your program slightly more efficient at the cost of making it impossible to read and understand.

When writing procedures, don't put in error checks. Assume that you will be given arguments of the correct type.

Our expectation is that many of you will not complete one or two of these questions. If you find one question especially difficult, leave it for later; start with the ones you find easier.

0		/1
1		/2
2		/2
3		/3
4		/3
5		/4
total		/15

1

Question 1 (2 points):

(a) Convert the hexadecimal value `0xba3f` into octal (base 8).

(b) What are the largest and smallest twos-complement integers that can be represented in one byte?

Question 2 (2 points): An ice cream shop has 20 flavors available. You can get a large or a small serving, and it can be served in a cup, a sugar cone, or a waffle cone. (Only one flavor per serving.)

(a) How many different servings can you order? How many bits does it take to encode them?

(b) Suppose you want to encode the flavor, the size, and the container as three separate fields, similar to the fields in the MIPS instruction format. How many bits will each field require? How many bits altogether?

Question 3 (3 points): Translate the following C procedure into MIPS assembler. It multiplies two integers, pretending that there is no built-in multiplication operation.

Note: Every instruction line in the C program corresponds to exactly one MIPS assembler instruction! (Not counting the variable declarations.) So you don't have to think hard about the overall program; just translate each C instruction.

```
int mult(int a, int b) {     /* assume a is in $4, b in $5 */
    int value;               /* use $2 for value */

    value = 0;

    if (a < 0) {             /* this test takes two MIPS instructions */
        a = -a;
        b = -b;
    }

    while (a != 0) {
        value += b;
        a--;
    }                        /* this line counts: jump back to the while */

    return value;            /* This is the jr $31 */
}
```

Question 4 (3 points): The formula for the number of combinations of n items taken r at a time is

$$\binom{n}{r} = \frac{n!}{r!(n-r)!}$$

(The notation $n!$ means n factorial.)

Write a C function `combs` that takes two integer arguments `n` and `r`, returning the value of this formula.

Question 5 (4 points): Write a C function `strsame` that takes two character strings (i.e., arrays of characters) as arguments. It should return a nonzero (true) integer value if the two strings are equal ignoring spaces:

`strsame("tell me why", "   tell    m ewhy")` returns true.

`strsame("tell me why", "tell me what")` returns false (zero).