

Computer Science 61C

Midterm 1 - Fall 1995

Professor Harvey, B

Your Name _____

login cs61c-____

Discussion section number _____

TA's name _____

This exam is worth 25 points, or 18.7% of your total course grade. The exam contains eight 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 six 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.

Page 1

Question 1 (2 points):

(a) Convert 0xca50 to binary.

(b) Convert the value 0xffff7 to decimal, interpreting it as a signed 16-bit integer.

Question 2 (2 points):

Give an example of two four-bit twos-complement integers such that adding them produces a carry out of the leftmost bit, but not an overflow.

Question 3 (3 points):

Why does the R format use two separate six-bit fields (opcode and function) to specify the operation, instead of a single 12-bit field?

Question 4 (3 points):

The MIPS instruction BLTZ and BGEZ both have opcode 1; they are distinguished by the RT field, which is 0 for BLTZ and 1 for BGEZ. Why is the RT field used to specify the instruction instead of the function field as usual?

Question 5 (4 points):

Given the following C definitions:

```
struct thing {
    char th_type;
    union {
        char *thu_symbol;
        int thu_number;
        struct {struct thing *thup_car, *thup_cdr;} thu_pair;
        struct {int thuf_argcount; struct thing *(*thuf_func)();} thu_prim;
        struct {int thuv_size; struct thing ** thuv_array;} thu_vector;
    } th_union;
};

#define th_size th_union.thu_vector.thuv_size
#define th_array th_union.thu_vector.thuv_array

typedef struct thing *ThingPtr;
```

Write a procedure `CopyVector` that takes two arguments, both of which are `ThingPtr`s that point to vectors of the same size. (You may assume that the arguments are correct without testing.) The procedure must copy the elements (the `ThingPtr`s in the array) from the second vector to the first.

Question 6 (5 points):

Convert the following fragment of a C program to MAL. The program computes the hash function for a string:

```
int hash, size;
char ch, *p;

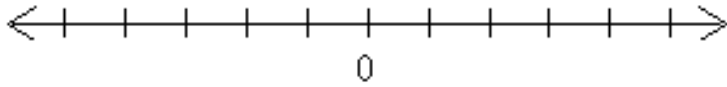
while (ch= *p++)
    hash = ((hash << 3) + ch) % size;
```

Assume that all of the variables are in registers, as follows:

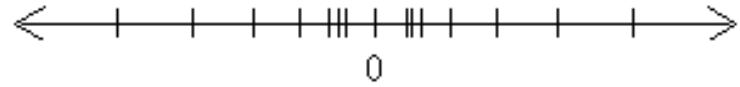
```
$16 hash
$17 size
$18 ch
$19 p
```

Question 7 (2 points):

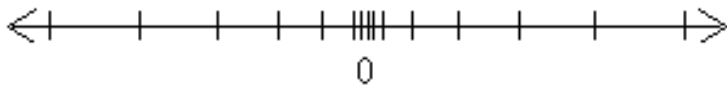
Which of the following pictures most closely represents the distribution of floating point numbers on the real number line? (not to scale)



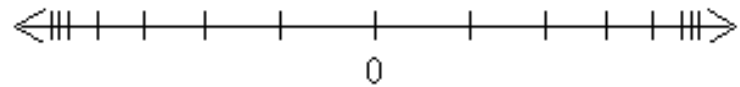
evenly spaced



gap near zero, then less dense
as distance from zero increases



less dense as distance
from zero increases



more dense as distance
from zero increases

Question 8 (3 points):

Draw a logic circuit that takes two input bits A and B, and produces an output that's true (i.e., 1) if and only if A and B are equal (both 0, or both 1). Use AND, OR, and NOT gates as the building blocks.



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