CS 61C F13 Midterm Review

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Number Representation

For this question, we are using 16-bit numerals. For floating point, use 1 sign bit, 5 exponent bits, and 10 mantissa bits. (Bias = 15)

Indicate in which representation, two's complement or floating point, the numeral is closest to zero:

    1) 0x0000   _____

    2) 0xFFFF   _____

    3) 0x0001   _____

Number Representation (cont.)

For this question, we are using 16-bit numerals. For floating point, use 1 sign bit, 5 exponent bits, and 10 mantissa bits. (Bias = 15)

Indicate in which representation, two's complement or floating point, the numeral is closest to zero:

    4) 0xFFFE   _____

    5) 0x8000   _____

Number Representation (cont.)

We now wish to add the numerals (at left) from top to bottom first in two's complement, and then in floating point.

For each, state which of the following occurs: overflow, underflow, NaN, or no error.

Numbers:
1) 0x0000
2) 0xFFFF
3) 0x0001
4) 0xFFFE
5) 0x8000

C Programming

Given the following declarations:

```
char a[14] = "pointers in C";
char c = 'b';
char *p1 = &c, **p2 = &p1;
```

Which of the following are legal in C?

1) `p1 = a+5;`

2) `&p1 = &a[0];`

3) `p2 = a;`

C Programming (cont.)

Given the following declarations:

```
char a[14] = "pointers in C";
char c = 'b';
char *p1 = &c, **p2 = &p1;
```

Which of the following are legal in C?

4) `*(a+10) = 't'`

5) `*p2 = &c;`

C-to-MIPS

We wish to convert the following code to MIPS without using pseudoinstructions:

```
struct Node { int n; struct Node *next; };


int sum (struct Node *head) {
    if (head == NULL)
        return 0
    else
        return head->n + sum(head->next);
}
```

C-to-MIPS (cont.)

Fill in the blanks (and where it says "maybe some lines here") below:

```
sum: li $v0 0

      _____          # check if head==NULL
      # Maybe some lines here?
      jal sum                  # Recursive call
      # Maybe some lines here?

      _____          # get head->n
      _____          # compute the sum
done: jr $ra
```

Reading MIPS

$a0 = the address of an array. $a1 = array length

```
Mystery:
   move $v0, $0
Label:
#exit if fewer than 2
#elements remaining
   slti $t0, $a1, 2
   bne $t0, $0, Done
   lw $t0, 0($a0)
   lw $t1, 4($a0)
   slt $t2, $t1, $t0
   add $v0, $v0, $t2
```

```
      subi $a1, $a1, 1
      addi $a0, $a0, 4
      j Label
Done:
beq $v0, $0, Return1
      addi $v0, $0, 0
      jr $ra
Return1:
addi $v0, $0, 1
      jr $ra
```

AMAT

Suppose that for 1000 memory references to a direct-mapped, three level cache, we have

- 40 misses in L1$, L1$ hits in 1 cycle
- 10 misses in L2$, L2$ hits in 10 cycles
- 10 misses in L3$, L3$ hits in 100 cycles
- Main memory access costs 1000 cycles

a) What is the local miss rate for L3$?

b) What is the AMAT?

c) What is the AMAT if we didn't have L3$?

Caches

Given a direct mapped cache, initially empty, and the following memory access pattern, what is the hit rate and miss rate if the cache has 8 32-bit blocks? Assume that memory is byte-addressed.

8, 0, 4, 32, 36, 8, 0, 4, 16, 0

Caches

Consider a write-back, direct-mapped cache with 16 byte blocks and 64 KiB of data. Assume a byte-addressed machine with 32-bit addresses.

a) Partition the following address and label each field with its name and size in bits

31		

0

b) Given the address 0xDEADBEEF, what is the value of the index, offset, and tag?

Caches

Consider a write-back, direct-mapped cache with 16 byte blocks and 64 KiB of data. Assume a byte-addressed machine with 32-bit addresses.

c) How many cache management bits are there for each block? List them.

d) What is the total number of bits (data AND cache management) that comprise the cache?

Miscellaneous Questions

Which of the following is *not* a job of the linker?
    1) Relocation
    2) Compute branch offsets
    3) Combine .o files
    4) Resolve external symbols

Fill in the blanks: The dominant form of parallelism in WSCs is _____.
1) SISD   2) MISD   3) SIMD   4) MIMD

Miscellaneous Questions (cont.)

True or false:

- The greatest part of monthly expenses for a datacenter are amortized capital expenses (CAPEX).
- MapReduce can give the wrong answer if a worker crashes.

Miscellaneous Questions (cont.)

You have to finish your project using Amazon EC2 servers. You know the servers will finish the problem in 1hr using 10 machines, but you need to submit within 10 minutes or be late, so you booted 60 machines.

However, even though the cluster booted instantaneously (!!!) you were still late. This scenario indicates your solution lacked what kind of scaling?

That's all!

Good luck on the midterm!

Credits

The following questions were adapted from
    Fa03 midterm 1: C programming
    Fa03 midterm 2: Misc questions
    Sp11 midterm 1: Caches, MISC questions
    Sp11 final: AMAT
    Su11 midterm 1: Reading MIPS
    Fa11 midterm: C-to-MIPS
    Fa12 midterm: Misc questions
    Su13 midterm: Number rep