

## Spring 2012 CS61C Final

Your Name: \_\_\_\_\_

SOLUTION

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Login: cs61c-\_\_\_\_\_

This exam is worth 110 points, or about 20% of your total course grade.

The exam contains 8 questions.

This booklet contains 12 numbered pages including the cover page. Put all answers on these pages, please; don't hand in stray pieces of paper.

You will receive 5 points for properly filling out your name, TA, and login (login must be filled in properly on every page of the exam). This is the exam's 0<sup>th</sup> question.

Question	MIN	MAX	Points(Minutes)	AVG	STDEV Score
0	4	5	5(0)	5	0.1
1	2	15	15(10)	7.7	3.0
2	0	10	10(10)	6.0	2.3
3	0	9	10(9)	5.3	1.8
4	0	14	14(11)	8.2	4.0
5	0	16	16(15)	9.5	4.1
6	0	14	14(11)	7.6	3.7
7	0	10	10(9)	6.6	3.2
8	0	16	16(15)	7.7	3.5
Total	11	100	110(90)	63.5	16.6

# Potpourri: Mostly True or False. (ALAN C)

The different parts of this question are independent.

a. Simplify the following boolean expression.

$$\overline{(\bar{a} + b)(\bar{b} + c)(\bar{c} + d)} + (\bar{a} + d)$$

11

$$((a \Rightarrow b)(b \Rightarrow c)(c \Rightarrow d)) \Rightarrow (a \Rightarrow d)$$

11

1

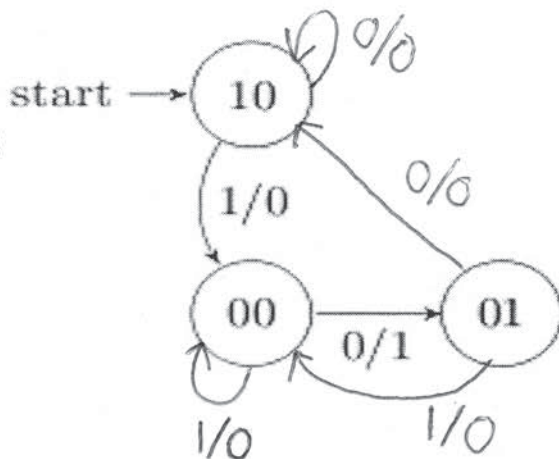
1pt: promising start

2pts: minor error

3pts: correct answer

Full credit was also given to  $\bar{a} + d$ , as many students misread the question as  $(\bar{a} + b)(\bar{b} + c)(\bar{c} + d) + \bar{a} + d$

b. Suppose we feed in digits of a number to a finite state machine most significant bit first (e.g. it would see 1 first if we input 1000). Complete the below diagram so that it outputs 1 exactly when the number is divisible by 2, but not by 4. Assume that the machine's starting state is such that it has seen more than four 0's.



1pt. per transition

1 point was taken for using an extra state

c. How many unique gates with  $n$  input bits and  $m$  output bits are there?

$$\# \text{ unique } f: \mathbb{F}_2^n \rightarrow \mathbb{F}_2^m = (2^m)^{2^n}$$

3pts: correct answer

1pt: mix up  $m, n$

d. Circle all modifications to the IEEE754 float standard that would change the proportion of floats with values between -1 and 1.

- ☒ - changing the exponent bias value
- ☒ - increasing the number of exponent bits
- ☒ - removing the implicit leading one
- ☐ - getting rid of denorm values

1pt. for circling each

e. A program tries to load a word at address X that causes a TLB miss but not a page fault or protection violations.

True or False: A TLB miss means that the page table does not contain a valid mapping for virtual page corresponding to the address X

True or False: There is no need to look up the page table because there is no page fault

True or False: The word that the program is trying to load is present in physical memory.

# Don't MIPS the Point! (PAUL)

```
typedef struct {
    int val;
    struct node* next;
} node;
```

/\* Removes the first node after cur with a value of x and return a pointer to it. You may assume cur is not null.\*/

```
node* removeNext(node *cur, int x) {
    node* next = cur->next;
    if (next) { //have a next node?
        if (next->val == x) { //remove the next if its val is x
            cur->next = next->next;
        } else { //otherwise, keep searching for node to remove
            return removeNext(next, x);
        }
    }
    return next;
}
```

a) Use the above definition of a linked list node. Fill in the blanks below so that the assembly code does the equivalent of the C removeNext. Assume no delayed branches.

```
0 removeNext:
1     addiu $sp $sp -4
2     sw $ra 0($sp)
3     lw $v0 4($a0)          #v0 = next
4     beq $v0 $0 done        #done if next is null
5     lw $t1 0($v0)
6     bne $a1 $t1 recurse    #recurse if not equal to x
7     lw $t2 4($v0)
8     sw $t2 4($a0)          #cur->next = next->next
9     done:
10    lw $ra 0($sp)
11    addiu $sp $sp 4
12    jr $ra                 #return
13 recurse:
14    move $a0 $v0           #set arguments for recursive call
15    jal removeNext        #recurse
16    j done
```

1pt per line  
-2pt if lines 3, 7, 8 correct except for a consistently wrong offset (i.e. 1pt for all 3)

b) Say we change line 15's jal to j. Which lines, if any, can we remove so that removeNext still works properly without editing any other line? List the line numbers. 1, 2, 10, 11, 16

c) Say we want a function remove which does the same as removeNext, except the first node is also a target for removal, and the return type is void. Fill in the prototype below so that it could work properly.

void remove(node\*\* cur, int x);

1pt

1pt

2pts for all 5, 1pt if correct lines minus incorrect lines  
4 is at least 2