University of California at Santa Barbara

ECE 154A Computer Organization

Homework #3

Due at 11:00 pm November 6th, 2012

HOME WORK COVER SHEET

Name (Last, First)

Formatting guidelines:

1) A completed cover sheet must accompany all homework assignments
2) All homework must be stapled. Paper clips, folded corners, etc. are unacceptable.
3) All work must be eligible and clearly organized
4) No credit will be given for problems without necessary work

Turning-in homework:

1) Homework must be handed in homework box on 3rd floor HFH
2) No late homeworks will be accepted
1. (40 points)

Consider circular linked list with N > 0 elements and the pointer p pointing to some element of that list.

Part A:  (30 points) Convert the “listcheck” C function into MIPS assembly code. Use only core MIPS instructions from the green card and provide comments for your code. Assume that parameters *p and N are passed in $a0, $a1 MIPS registers, correspondingly, that return value is passed in $v0, that you should not worry about the function call conventions (i.e. register savings etc.), and that next of any element of the list always points to some other element from that linked list.

```c
struct mylist {
    double doubledummy;
    int intdummy;
    struct mylist *next;
};

int listcheck (struct mylist *p, int N) {
    struct mylist *curp = p->next;
    int i = 1, count =0;
    while (i <= N && count < 2) {
        if (p == curp) count++;
        curp = curp->next;
        i++;
    }
    if (count == 1) return 1;
    else return 0;
}
```

Part B:  (10 points) Briefly describe in English what the code does.
2. (40 points)

To solve these problems you would need to know the basics for floating point arithmetic operations. Very good information with examples (in addition to the textbook) can be found at http://pages.cs.wisc.edu/~cs354-1/cs354/karen.notes/flpt.apprec.html

Part A: Consider the following numbers

(a) -1609.5  
(b) 938.8125  
(c) 1/3

(i) (5 points) Write down binary number representation of these numbers

(ii) (5 points) Convert these numbers to IEEE 754 single precision format using round to nearest even scheme

(iii) (5 points) Convert these numbers to IEEE 754 double precision format using round to nearest even scheme

Part B: Consider the following 32-bit data

(a) 0x1148 00F1  
(b) 0xFFFF FFFF

(iv) (5 points) Assuming these data represent IEEE 754 single precision numbers convert them to decimal ones (using scientific notation if needed)

Part C:

(v) (20 points) Consider two numbers written in IEEE 754 single precision format

\[
\begin{array}{c|c|c}
S & \text{EXP} & \text{MANTISSA} \\
0 & 1000 0001 & 0000 0000 0000 0000 0000 000 \\
0 & 1000 0000 & 1111 1111 1111 1111 1111 111
\end{array}
\]

Subtract the second number from the first one using IEEE 754 arithmetic. Here you should assume that there are round, guard and sticky bits as required by IEEE standard. Show all the steps for full credit.
3. (20 points)

Find three numbers, \( a \), \( b \), and \( c \) such that associative law for addition, i.e. \((a+b)+c = a+(b+c)\), holds when performing IEEE 764 double precision arithmetics but does not for IEEE 764 single precision floating point one. For simplicity, neglect round, guard and sticky bits in this problem and write your solution as a binary floating point number with decimal exponent (e.g. such as \(1.0101 \times 2^{-10}\)).