HO CHI MINH UNIVERSITY OF TECHNOLOGY

FACULTY OF COMPUTER SCIENCE AND ENGINEERING

COMPUTER ARCHITECTURE

Practical session - Week 6

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Question 1. Given the following program with MIPS assembly.

```
.data
        s_a: .float 1.1
        s_b: .float 2.2

.text
        la $t0, s_a
        lwc1 $f0, 0($t0)
        la $t0, s_b
        lwc1 $f1, 0($t0)
        add.s $f2, $f1, $f0

        li $v0, 10
        syscall
```

Students run the program and answer the following question

1. Explain the function of lwc1, add.s instructions.
2. Can we use lw to load value for $f0 register? Explain.
3. Is the result that is stored in $f2 is 3.3 . If it is not, explain.
4. Analyze the value that are stored in $f0, $f1, $f2 based on IEEE 754 standard.

Answer:

1. lwc1: load the 32 bits into the register $f0 (coprocessor 1) (single precision)
   add.s: add operation (single precision)
2. No, lw is only used for regular registers.
3. Yes, though it's approximately 3.3.
4. $f0 : 0x3f8ccccd(hex) = 1.1 (dec)
   $f1 : 0x400ccccd(hex) = 2.2 (dec)
   $f2 : 0x40533334(hex) = 3.3 (dec)

Question 2. Given the following program with MIPS assembly.
Students run the program and answer the following question
1. List the differences between this program and the program on Question 1.

```
.data
        d_a: .double 1.1
        d_b: .double 2.2

.text
        la $t0, d_a
        ldc1 $f0, 0($t0)
        la $t0, d_b
        ldc1 $f1, 0($t0)
        add.d $f2, $f1, $f0

        li $v0, 10
        syscall
```

2. Is the result that is stored in $f2 is 3.3 . If it is not, explain.
3. Analyze the value that are stored in $f0, $f1, $f2 based on IEEE 754 standard.
4. Correct the program to add 2 double number 1.5 and 2.25

Answer:

1. data: double precision != single precision(float)
   ldc1(load double, 64 bits into 2 registers) != lwc1 (load float,32 bits into 1 register)
   add.d (add double) != add.s (add float)

2. Not, the program crashed at ldc1 $f1 because only the even numbered register is specified in a double precision instruction; the odd numbered register of the pair is included automatically, so that $f1 can't be loaded the value and so does $f2.

3. $f0 : 0x9999999a , $f1 : 0x3ff19999 (these 2 regs used for storing double value d_a)
   $f2: no value due to add.d $f2, $f1, $f0 has odd register ($f1).

4.

```
.data
d_a:            .double 1.5
d_b:            .double 2.25

.text
la              $t0,d_a
ldc1            $f0,0($t0)
la              $t0,d_b
ldc1            $f2,0($t0)
add.d           $f4,$f2,$f0

li $v0,10
syscall
```

mips2.asm

Question 3. Implement a procedure that convert input degree in Fahrenheit to Celsius. If the degree in Celsius higher than 99.5, print "Warning" to terminal, otherwise print "Safe" to terminal.

```
.text

.globl main

main:

li              $v0,4
la              $a0,input
                syscall

li              $v0,6
                syscall


l.s             $f1,n1
sub.s           $f0,$f0,$f1

l.s             $f2,n2
mul.s           $f0,$f0,$f2

l.s             $f3,n3
div.s           $f0,$f0,$f3

li              $v0,2
mov.s           $f12,$f0
                syscall


l.s             $f4,cond
c.lt.s          $f4,$f0
bc1t            warn
safe:
li              $v0,4
la              $a0,succ
                syscall
j               end

```

```
38 warn:
39 li          $v0,4
40 la          $a0,label
41             syscall
42 end:
43
44 .data
45 input:       .asciiz "input "
46 n1:          .float  32.0
47 n2:          .float  5.0
48 n3:          .float  9.0
49 cond:        .float  99.5
50 label:       .asciiz "\nWarning "
51 succ:        .asciiz "\nSafe"
```

q3.asm