# EE334 Computer Architecture Spring 2012

# Homework assignment 3 Sine computation using Taylor Series Due: Feb. 13, 2012

You are to compute Sine X using the Taylor series which has the following form:

$$Cos x=1-\frac{x^{2}}{2!}+\frac{x^{4}}{4!}-\frac{x^{6}}{6!}+…$$

For these computations use floating point (FP) numbers and operations. Use six terms of this series (i.e. the term with *x*10). Using a loop may lead to shorter program.

Your program will read from the console a value (X) and will display the result (Cos X).

A program that converts C to F (using floating point) is included here. This program may help you to understand how FP instructions and data can be used.

For this homework assignment you could work with another student (only teams of two students); if you work with another student a single report is required.

**REPORT**

Please include the following items in your report.

1. Explain how your program works. You may use a flow chart, pseudo C program, or other way to explain the program.
2. Show examples that test your code
3. Conclusion. Explain what you learned here and what was difficult about this assignment.
4. Send the code to: Nick Zhang (zzhang@eecs.wsu.edu)
5. Please include your program code along with SPIM translation to assembly (addresses, instruction code –hexadecimal, instruction,…) Please show how some instructions (pseudo instructions) are translated. Remember that we are interested on the real instructions. These are the instructions that are executed by the processor. Please identify the format (R, I, J) of each instruction. An example is shown below

[0x00400018] 0x3c011001 I lui $1, 4097 [data1] ; 26: l.s $f0,data1 #load data

[0x0040001c] 0xc4200044 I lwc1 $f0, 68($1) [data1] pseudo instruction

[0x00400028] 0x46020002 R mul.s $f0, $f0, $f2 ; 29: mul.s $f0,$f0,$f2 # [0x0040002c] 0x46040300 R add.s $f12, $f0, $f4 ; 30: add.s $f12,$f0,$f4 # add 32

Using simulator setting (toolbar: simulator then setting) display the floating point in hexadecimal. After executing your program please pick two floating point registers that have been modified (i.e. they are not

set to zero) and get their binary value. With the binary value figure out their decimal equivalent ( MIPS uses the IEEE 754 FP Standard

).

**REPORT IS DUE:** February 13, 2012 at 9:10am in class. {late reports will get 20 points off per day}.

############### TEMP\_CONV.S FILE #####################

## this program asks user for temperature in Celsius, ##

## converts to Fahrenheit, and prints the result. ##

## ##

## f0 - reads in Celsius ##

## f12 - holds Fahrenheit result ##

## a0 - points to output strings ##

########################################################

 .text

 .globl \_\_start

\_\_start:

 la $a0,prompt # print prompt on terminal

 li $v0,4

 syscall

 li $v0,6 # syscall 6 reads a FP number in $f0

 syscall

 l.s $f2, conv # load single (f2<--1.8)

 l.s $f4, diff # load single (f4<-- 32)

 mul.s $f0,$f0,$f2 # to convert,multiply by 1.8,

 add.s $f12,$f0,$f4 # add 32

 la $a0,ans1 # print string before result

 li $v0,4

 syscall

 li $v0,2 # print result (fp reg 12)

 syscall

 la $a0,endl # system call to print

 li $v0,4 # out a newline

 syscall

 li $v0,10

 syscall # BYE

#################################################

# #

# data segment #

# #

#################################################

 .data

prompt: .asciiz "Enter temperature (Celsius): "

ans1: .asciiz "The temperature in Fahrenheit is "

endl: .asciiz "\n"

conv: .float 1.8

diff: .float 32.0

## END OF TEMP\_CONV.S FILE