

Computer Project #11 -- SPARC Floating Point Operations

Assignment Overview:

This assignment develops familiarity with SPARC floating point operations. You will develop the assembly language functions described below, which represent a subset of the functions available in a math library.

It is worth 40 points (4% of course grade), and must be completed no later than 11:59 PM on Thursday, April 25.

Assignment Specifications:

- 1) The math library subset will consist of the following functions:

```
double absolute( double X );
double modulo( double X, double Y );
double factorial( unsigned N );
double power( double X, unsigned N );
double sine( double X );
```

Function "absolute" will compute and return the absolute value of X.

Function "modulo" will compute and return the remainder of X divided by Y, where the remainder has the same sign as X and has a magnitude less than the magnitude of Y. If Y is equal to zero, the function will return the double precision value "Not A Number".

Function "factorial" will compute and return the factorial of N.

Function "power" will compute and return X raised to the Nth power.

Function "sine" will compute and return the value of the sine of X, where X is measured in radians.

Function "sine" will use the power series approximation method (described below) to compute the sine of X. The computed values will be accurate to at least eight fractional digits.

If overflow occurs during the computations inside any of the functions, that function will return the double precision value "Infinity".

- 2) The functions in the support module will not call any C library functions (such as "printf", "fabs", "fmod", "pow", "sin" or "cos").

The functions in the support module (as well as any other support functions you choose to develop) will be implemented in assembly language.

- 3) You will develop a driver to test your implementation of the functions in the support module. The C source code for the driver must be in a separate file. All output will be appropriately labeled.

Your driver will not be interactive. If your driver accepts any input, you will supply that input in a text file named "proj11.tests".

## Assignment Deliverables:

The deliverables for this assignment are:

```
proj11.makefile  -- the makefile which produces "proj11"
proj11.support.s  -- the source code for your support module
proj11.driver.c   -- the source code for your driver module
proj11.tests      -- the input to your driver, if needed
```

Be sure to submit your files for grading via the "handin" program.

## Assignment Notes:

1) For your convenience, the following file is available:

```
/user/cse320/Projects/project11.support.h
```

That file contains the function declarations listed above.

2) Please note that the floating point registers are global; they are not windowed via the "SAVE" and "RESTORE" instructions.

3) The conventions used for passing floating point parameters between subprograms are similar to those used for integer parameters: all arguments (including floating point operands) are passed to functions in the integer registers, which are managed using the "save/restore" convention. However, a floating point value is returned from a function in register f0, rather than register i0/o0.

4) A power series can be used to approximate the value of many trigonometric functions.

Using "!" to represent the factorial function, the sine of a value can be approximated using:

$$\text{sine}(X) = X - (X / 3!) + (X / 5!) - (X / 7!) + (X / 9!) - \dots$$

An individual term in this power series can be expressed as:

$$\frac{(-1)^k X^{2k+1}}{(2k+1)!}$$

where "k" represents the position in the power series (k = 0, 1, 2, ....).