

# Computing Machinery I

## Assignment 6

### File I/O and Floating-Point Numbers

Write an ARMv8 assembly language program to compute the function  $\arctan(x)$  using the series expansion shown below. Use double precision floating-point numbers. The program will read a series of input values from a file whose name is specified at the command line. The input values will be in binary format; each number will be double precision (and thus each is 8 bytes long). Read from the file using system I/O (i.e. generate an exception using the *svc* instruction). Process the input values one at a time using a loop (be sure to detect end-of-file correctly), calculate  $\arctan(x)$ , and then use *printf()* to print out the input value and its corresponding output values in table form (i.e. in columns, with column headings) to the screen (standard output). Print out all values with a precision of 10 decimal digits to the right of the decimal point.

You can compute the function  $\arctan(x)$  according to the following series expansion:

$$\arctan(x) = x - \frac{x^3}{3} + \frac{x^5}{5} - \frac{x^7}{7} + \dots$$

where  $x$  is a real number input to the function and  $|x| < 1$ . Continue to accumulate terms in the series until the absolute value of the term is less than  $1.0\text{e-}13$ .

Run your program using the input binary file supplied on D2L. Capture its execution using the *script* UNIX command, and name the output file *script.txt*.

### New Skills need for this Assignment:

- Use of system I/O (exceptions) to open and read an input binary file
- Understanding and use of floating-point single and double formats
- Use of floating-point instructions to do simple calculations
- Use of floating-point comparison instructions

### Submit the following:

1. Your assembly source code and script via electronic submission. Use the *Assignment 6* Dropbox Folder in D2L to submit electronically. Your TA will assemble and run your program to test it. Name your program *a6.asm* and the script as *script.txt*.

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## Assignment 6 Grading

**Student:** \_\_\_\_\_

Command line arguments	2	_____	
Loop to read in data	2	_____	
File I/O using exceptions	4	_____	
arctan(x) routine	6	_____	
Screen output using printf()	2	_____	
Correct use of floating-point instructions	2	_____	
Script showing I/O	2	_____	
Complete documentation and commenting	4	_____	
Formatting (use of columns and white space)	4	_____	
Design quality	2	_____	
<b>Total</b>	<b>30</b>	_____	_____ %