COE 308 – Computer Architecture

Assignment 4: Floating-Point Representation and Arithmetic

Due: Sunday, October 8, 2006

1. **(4 pts)** Bits have no inherent meaning. Given the 32-bit pattern:

   `1010 1101 0001 0000 0000 0000 0000 0010`

   What does it represent, assuming it is …

   a) An unsigned integer?
   b) A 2's complement signed integer?
   c) A single-precision floating-point number?
   d) A MIPS instruction?

2. **(4 pts)** Show the IEEE 754 binary representation for: `-20.71875` in …

   a) Single Precision
   b) Double precision
   c) Repeat parts (**a**) and (**b**) for: `0.2`

3. **(4 pts)** x = `0100 0110 1101 1000 0000 0000 0000 0000` (in binary)
   and y = `1011 1110 1110 0000 0000 0000 0000 0000` (in binary)
   represent single precision IEEE 754 floating-point numbers. Perform the following operations showing all work:

   a) $x + y$
   b) $x * y$

4. **(4 pts)** x = `0101 1111 1011 1110 0100 0000 0000 0000` (in binary)
   and y = `0011 1111 1111 1000 0000 0000 0000 0000` (in binary)
   and z = `1101 1111 1011 1110 0100 0000 0000 0000` (in binary)
   represent single precision IEEE 754 floating-point numbers. Perform the following operations showing all work:

   a) $x + y$
   b) Result of (**a**) + z
   c) Why is the result of (**b**) counterintuitive?

5. **(2 pts)** What is the range (in absolute value) for denormalized numbers in single and double precision?

6. **(2 pts)** IA-32 offers an 80-bit extended precision option with a 1 bit sign, 16-bit exponent, and 63-bit fraction (64-bit significand including the implied 1 before the binary point). Assume that extended precision is similar to single and double precision.

   a) What is the bias in the exponent?

   b) What is the range (in absolute value) of normalized numbers that can be represented by the extended precision option?