

COE 308 – Computer Architecture

Assignment 4: Floating-Point Representation and Arithmetic

Due: Wednesday, March 22, 2006

- (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 ...
 - An unsigned integer?
 - A 2's complement signed integer?
 - A single-precision floating-point number?
 - A MIPS instruction?
- (4 pts)** Show the IEEE 754 binary representation for: -20.71875 in ...
 - Single Precision
 - Double precision
 - Repeat parts (a) and (b) for: 0.2
- (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:
 - $x + y$
 - $x * y$
- (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:
 - $x + y$
 - Result of (a) + z
 - Why is the result of (b) counterintuitive?
- (2 pts)** What is the range (in absolute value) for denormalized numbers in single and double precision?
- (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.
 - What is the bias in the exponent?
 - What is the range (in absolute value) of normalized numbers that can be represented by the extended precision option?