

ICS 233 – Spring 2007

Computer Architecture & Assembly Language

Assignment 4: Integer Multiplication and Division, Floating-Point

Due: Saturday, April 21, 2007

- (3 pts)** Using the refined **signed** multiplication hardware, show the multiplication of:
Multiplicand = **00101101** by Multiplier = **11010110**
The result of the multiplication should be a 16 bit signed number in HI and LO registers. Eight iterations are required because there are 8 bits in the multiplier. Show the steps.
- (3 pts)** Using the refined division hardware (slides 24-25), show the **unsigned** division of:
Dividend = **11101101** by Divisor = **00110110**
The result of the division should be stored in the Remainder and Quotient registers. Eight iterations are required. Show the steps.
- (2 pts)** What is the decimal value of the following single-precision floating-point numbers?
 - 1010 1101 0001 0100 0000 0000 0000 0000** (binary)
 - 0100 0110 1100 1000 0000 0000 0000 0000** (binary)
- (2 pts)** Show the IEEE 754 binary representation for: -75.4 in ...
 - Single Precision
 - Double precision
- (4 pts)** $x = 1100\ 0110\ 1101\ 1000\ 0000\ 0000\ 0000\ 0000$ (binary)
and $y = 0011\ 1110\ 1110\ 0000\ 0000\ 0000\ 0000\ 0000$ (binary)
are single-precision 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)** 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?