

# COE 308 – Computer Architecture

## Assignment 3: Floating-Point Representation and Arithmetic

- (4 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)
- (3 pts)** Show the IEEE 754 binary representation for:  $-75.4$  in ...
  - Single Precision
  - Double precision
- (6 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?
- (3 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?