Computer Architecture   Due: March 1, 2018   Spring 2018

Homework #2-1

Problem 1

3.14 Calculate the time necessary to perform a multiply using the approach given in Figures 3.3 and 3.4 if an integer is 8 bits wide and each step of the operation takes four time units. Assume that in step 1a an addition is always performed—either the multiplicand will be added, or a zero will be. Also assume that the registers have already been initialized (you are just counting how long it takes to do the multiplication loop itself). If this is being done in hardware, the shifts of the multiplicand and multiplier can be done simultaneously. If this is being done in software, they will have to be done one after the other. Solve for each case.

96 for hardware

160 for hardware

Problem 2

3.23 Write down the binary representation of the decimal number 63.25 assuming the IEEE 754 single precision format.

$63.25 \times 10^0 = 111111.01 \times 2^0 \rightarrow 1.11111 01 \times 2^5$

sign = positive, exp = 127 + 5 = 132

Final bit pattern = 0 1000 0100 1111 1010 0000 0000 0000 0000

= 0100 0010 0111 1101 0000 0000 0000 0000 = 0x427D0000

Problem 3

3.24 Write down the binary representation of the decimal number 63.25 assuming the IEEE 754 double precision format.

$63.25 \times 10^0 = 111111.01 \times 2^0 \rightarrow 1.11111 01 \times 2^5$

sign = positive, exp = 1023 + 5 = 1028

Binary pattern = 0 10000000100 1111101000000000000000000000000000

00000000000000000000

= 0x404FA00000000000

Problem 4

3.41 Using the IEEE 754 floating point format, write down the bit pattern that would represent −1/4. Can you represent −1/4 exactly?

↳ −0.25

1 01111101 0000 0000 00000000 0000 000

= 0xbe800000