**Max Score = 15 points**

CS 250 2018 Spring Homework 04

This assignment is due at 11:59:00 pm Thursday, February 15, 2018.

Upload your typewritten answer document in either PDF or Word format to Blackboard.

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1. If the bit string 0xC0E80000 stored in computer memory is interpreted according to the IEEE 754 floating point format for single precision, what is the equivalent base 10 number in normalized scientific format?  
    Show each step of the conversion process starting with the machine stored bit string (display in groups of 4 bits with spaces); the three bit string fields s|E|M separated by spaces and including the hidden bit, the decimal value of the actual exponent, the value in base 2 scientific number format, the binary point shift necessary for conversion, the conversion to base 10, and the final normalization of the base 10 scientific format number.

Step1: convert them to 4 bits bit string

1100 0000 1110 1000 0000 0000 0000 0000

Step2: Separated in s|E|M form

1 | 10000001 | 11010000000000000000000

Step3: 1 is -, 10000001 is 129

- | 129 | 11010000000000000000000

Step4: Add hidden bit

- | 129 | 1.11010000000000000000000

Step5: base 2 number

Base = 129 -127 (bias) = 2

So, in base 2 scientific number format, its -1.1101\*2^2

Step6: base 10 number

-1.1101\*2^2 = -111.01\*2^0 = -7.25\*10^0 = -0.725\*10^1

1. Convert 1.1125 x 101 to its corresponding bit string for the IEEE floating point format in single precision and write that result in hexadecimal notation.  
    Show each step of the process: adjust to zero exponent in base 10; convert integer and fractional part to base 2 and exponent radix to 2; normalize mantissa binary point; determine sign, biased exponent, and mantissa fields of IEEE format; write out the bit string showing the three fields s|E|M with a space separating each field; re-write bit string in groups of 4 bits; write bit string in hexadecimal notation.

Step 1: determine sign bit

Sign = +

Step 2: express 1.1125 x 101 using \*10^0:

11.125\*10^0

Step 3: convert integer & fraction of 11.125 to binary

1011.001\*2^0

Step 4: normalize binary rational number and use 2^a  
1.011001\*2^3

Step 5: compute E

E=e+Bias=3+127=130= 10000010

Step 6: strip mantissa of MSB 1. and assemble fields  
0 | 10000010 | 01100100000000000000000

Regroup:  
regrouped 0100 0001 0011 0010 0000 0000 0000 0000  
in hex 0x 8 1 3 2 0 0 0 0  
or Ox81320000

1. A computer has 16 registers that can supply operand bit strings to the computational circuits of the processor. For this computer all operands are 32 bits in size. Answer the following questions about a multiplexer that provides a path for data (bit strings) in the registers to reach the computational circuits (arithmetic/logic unit) of the processor.
   1. How many address bits are needed to have a multiplexer select one of the registers to provide an operand bit string?

Sqrt(32) = 5

* 1. How many input data buses does this multiplexer have?  
     32
  2. How many data input wires does this multiplexer have?  
     32+5 = 37

1. What is the name of the signal that tells a register that it is time to pay attention to its inputs?

Clock

1. What are the two-principal computer organizational designs and how do they differ in memory organization and flexibility?  
   The Harvard And Von Neumann architecture

Harvard Architecture uses two memories to separately hold programs and data. It has advantages to optimize memory units to store specific type (either program or data). But its inflexible because instruction memory can’t store data and data memory cant store instruction.

Von Neumann architecture use single memory to hold both program and data. Its more flexible and the owner can decide how much memory assigns to programs and how much goes to data.

1. The set of operations that a processor provides represents a tradeoff among what sorts of issues?

More built-in operations mean more convenience to programmers but also means more hardware (larger chip size, more complicated design, more power used, more heat produced, etc.)