**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.

1. **0xC0E80000**
2. **C = 1100 0 = 0000 E = 1110 8 = 1000 0 = 0000 0 = 0000 0 = 0000 0 = 0000**
3. **1100 0000 1110 1000 0000 0000 0000 0000**
4. **1 10000001 11010000000000000000000**
5. **Sign bit is negative**
6. **10000001 = 129**
7. **Bias is 127**
8. **11010000000000000000000 = 1\*2-1 + 1\*2-2 + 0\*2-3 + 1\*2-4 + 0\*2-5 + …**
9. **1/2 + 1/4 + 1/16 = 0.8125**
10. **-1 \* (1.8125) \* 2129-127 = -7.25**
11. **-7.25 x 100**

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.
2. **1.1125 x 101 = 11.125**
3. **11.125/23 = 1.390625**
4. **1.390625 \* 23 = 11.125**
5. **127 + 3 = 130**
6. **13010 = 10000010**
7. **.390625 = 0/2 + 1/4 + 1/8 + 0/16 + 0/32 + 1/64 + 0/128 +…**
8. **2-2 + 2-3 + 2-6 = 01100100000000000000000**
9. **0 10000010 01100100000000000000000**
10. **0100 0001 0011 0010 0000 0000 0000 0000**
11. **0100 = 4 0001 = 1 0011 = 3 0010 = 2 0000 = 0 0000 = 0 0000 = 0 0000 = 0**
12. **0x41320000**

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? **If there are 16 registers which is 24 with n being 4. So therefore the number of address bits needed would be 4.**
   2. How many input data buses does this multiplexer have? **There would be a total of 16 data input busses.**
   3. How many data input wires does this multiplexer have? **There would be 32 \* 16 input wires, so there would be 512 data input wires.**
2. What is the name of the signal that tells a register that it is time to pay attention to its inputs? **The name of the signal that tells it when to pay attention is the rising egde.**
3. What are the two principal computer organizational designs and how do they differ in memory organization and flexibility? **There is the Harvard Architecture and Von Neumann Architecture. The difference in memory is that Harvard uses two memories, one to hold programs and another to store data, while the Von Neumann uses one memory to store both programs and data. The difference in flexibility is that because the Harvard uses two separate memories then you cannot use them to store data where programs are stored or store programs where data is stored, while the Von Neumann allows the owner to change how much data is devoted to each and can store them however they wish.**
4. The set of operations that a processor provides represents a tradeoff among what sorts of issues? **The tradeoff is that it can provide convenience for the programmer however it adds more hardware and make the processor design more difficult. This also increases chip size, power consumption, heat dissipation, and cost.**