NYU Tandon School of Engineering

Fall 2023, ECE 6913 Section B Quiz 1

---

1. *Write down the RISC V code for the following tasks:*

Assume Base address of arrays `A, B, C` are in registers `x5, x6, x7`

Assume variables `f, g, i` are in registers `x8, x9, x10`

Implement in RISC V these line of code in C:

(i) `f = g - A[B[C[16]]]`

(ii) `f = g - A[C[8] + B[64]]`

(iii) `A[i] = 8B[4i-41] + 8C[64i+64]`

2. Write a sequence of RISC V instructions that swap `byte 3 (bits 23:16)` with `byte 2 (bits 15:8)` in a 4 byte (32b) long word

3. One possible performance enhancement is to do a shift and add instead of an actual multiplication. Since `7×6`, for example, can be written `(2×2×2+1×6`, we can calculate `9×6` by shifting 6 to the left three times and then adding 6 to that result. Show the best way to calculate $0x2E_{hex} \times 0x3D_{hex}$ using shifts and adds/subtracts. Assume both inputs are 8-bit unsigned integers.

4. Assume a 10-bit floating point representation format where the Exponent Field has 4 bits and the Fraction Field has 5 bits and the sign bit field uses 1 bit

a. What is the representation of **-4.60168×10^{-2}** in this Format
[assume:
$bias = 2^{N-1} - 1 = 2^{4-1} - 1 = 7$ (where N = number of exponent field bits) for normalized representation, `and 1-bias =` **`-6 = bias for denormalized representation`**]. What 10-bit pattern represents the number **−0.125 = −1/8?** What base-10 integer or fraction does this 10-bit floating point representation format of **0101001001** equal to?

b. What is the range of representation for *positive* *normalized* numbers – what is the largest and smallest *normalized* number represented in this format? What is the range of representation for *positive* *denormalized* numbers? – what is the largest and smallest *denormalized* number represented in this format?

5. Using the IEEE 754 (Single Precision) floating-point format, write down the bit pattern that would represent −1/6, -1/7

6. Your company has just bought a new Intel Core i5 dual core processor, and you have been tasked with optimizing your software for this processor. You will run two applications on this dual core, but the resource requirements are not equal. The first application requires 90% of the resources, and the other only 10% of the resources. Assume that when you parallelize a portion of the program, the speedup for that portion is 2.

a. Given that 40% of the first application is parallelizable, how much speedup would you achieve with that application if run in isolation?

b. Given that 99% of the second application is parallelizable, how much speedup would this application observe if run in isolation?

c. Given that 40% of the first application is parallelizable, how much overall system speedup would you observe if you parallelized it?