

CE-1921- Dr. Durant - Quiz 2
Spring 2018, Week 2

1. (1 point) State the maximum memory size allowed by the ARM architecture.
2. (1 point) The 32-bit word 0xDEADBEEF is stored at 0x1400. What byte is stored at 0x1402?
3. (2 points) R5 contains 0x98765432, R6 contains 0x1200, and R7 contains 0x80. Write the instruction that stores the value at R5 at the address R6+R7 (so, you're writing to 0x1280) and also updates R6 to contain this address.
4. (2 points) Discuss the similarities and differences among the following 3 alternative instructions:
 - a. CMP R4,R5
 - b. SUB R3,R4,R5
 - c. SUBS R3,R4,R5
5. (2 points) Which of the following are valid immediate values on ARM?
 - a. 0xB4
 - b. 0x14E
 - c. 0xB40
 - d. 0x8400
 - e. 0x8408
6. (2 points) For the values you indicated as invalid (there is at least 1), explain why.

Answers

1. The address bus is 32 bits wide and is used to address bytes (not 32-bit words). Thus there are 2^{32} bytes or 4 GB in the ARM memory space; this is the maximum memory allowed.
2. 0xAD is stored at address 0x1402. ARM prefers little endian, so the LS byte is stored first (at the lowest address).
3. str r5,[r6],r7 ; wrong answers: [r6,r7] doesn't update r6; [r6,r7]!, updates r6 before use
4. Similarity: all compute R4-R5. Differences: (a) just updates the 4 flags NZVC, (b) just stores the difference in R3, (c) does both
5. Valid: a, c, d. Invalid: b and e
6. Neither of these fit in the 8 bit value right rotated by an even amount format. Recall (see reference sheet) that the rotation amount is 4 bits representing 0-15, but this value is doubled to an even number 0-30 to allow all bits to be accessed in an immediate constant on ARM
 - a. (b) $0x14E = 0xCF \ll 1$, but the rotation (same as shift since nothing falls off left) is odd; cannot be done with an even rotation amount
 - b. (e) $0x8408 = 0x1081 \ll 3$ shows that the span from LSB to MSB is 13 bits, which is more than the maximum of 8 allowed by ARM immediate encoding. So, we can eliminate it even before considering whether it can be done with an *even* rotation.