ECE 375 PRELAB 5

Lab Time: Wednesday 10-12

Tu Lam

QUESTIONS

1. *For this lab, you will be asked to perform arithmetic operations on numbers that are larger than 8 bits. To be successful at this, you will need to understand and utilize many of the various arithmetic operations supported by the AVR 8-bit instruction set. List and describe all of the addition, subtraction, and multiplication instructions (i.e. ADC, SUBI, FMUL, etc.) available in AVR's 8-bit instruction set.*

   Answer: In the world of AVR, there are many ways that AVR can perform the arithmetic and below is all the way it can be done

   a) ADD = addition without any carry (normal addition)

   b) ADIW = addition with a constant value (immediate) with 16-bit(word)

   c) ADC = addition with a carry flag

   d) SUB = normal subtraction between two numbers

   e) SUBI = subtract with a constant value (immediate)

   f) MUL = multiply number by unsigned integers

   g) MULS = multiply but with signed integers

   h) MULSU = multiply signed number with unsinged

2. *Write pseudocode for an 8-bit AVR function that will take two 16-bit numbers (from data memory addresses $0111:$0110 and $0121:$0120), add them together, and then store the 16-bit result (in data memory addresses $0101:$0100). (Note: The syntax "$0111:$0110" is meant to specify that the function will expect little-endian data, where the highest byte of a multi-byte value is stored in the highest address of its range of addresses.)*

   Answer: Pseudo-code

```
LDI   1L,  $0110
LDI   1H, $0111
LDI   2L, $0120
LDI   2H, $0121
ADD   1L, 2L
ADC    1H, 2H
ST     $0100, 1L
ST     $0101, 1H
```

3. *Write pseudocode for an 8-bit AVR function that will take the 16-bit number in $0111:$0110, subtract it from the 16-bit number in $0121:$0120, and then store the 16-bit result into $0101:$0100.*

Answer: Pseudo-code

```
LDI   1L,  $0110
LDI   1H, $0111
LDI   2L, $0120
LDI   2H, $0121
SUB   1L, 2L
SUB    1H, 2H
ST     $0100, 1L
ST     $0101, 1H
```

REFERENCE

Computer Organization and Assembly Language Programming: Embedded Systems Perspective by Ben Lee