

## Pre-Lab

1. For this lab, you will be asked to perform arithmetic operations on numbers that are larger than 8-bits. To do this, you should understand the different arithmetic operations supported by the AVR Architecture. List and describe all the different forms of ADD, SUB, and MUL (i.e. ADC, SUBI, MULF, etc.).

ADC: Add with carry.

ADD: Add without carry.

ADIW: Add an immediate value (0 - 63) to a register.

SUB: Subtract and immediate value from a register.

SBC: Subtract two registers using the C flag.

SBCI: Subtracts an immediate value using the C flag from a register.

SBIW: Subtract and immediate from a register and places the result into the register.

MUL: Multiplies two unsigned 8-bit numbers.

MULS: Multiplies two signed 8-bit numbers.

MULSU: Multiple two 8-bit numbers. One signed and one unsigned.

FMUL: Fractional multiply unsigned. Multiplies two 8-bit numbers and multiplies the result by 256.

FMULS: Fractional multiply but with signed numbers.

2. Write pseudo-code that describes a function that will take two 16-bit numbers in data

memory addresses \$0110-\$0111 and \$0121- \$0122 and add them together. The function will then store the resulting 16-bit number at the address \$0100-\$0101. (Hint: The upper address corresponds to the high byte of the number and don't forget about the carry in bit.)

```
r0 = X ; X = 0110
```

```
r1 = Y ; Y = 0121
```

```
ADC r0, r1
```

```
LOW(Z) = r0
```

```
HIGH(Z) = C ; carry bit
```