EECE.3170: Microprocessor Systems Design I

Fall 2019

Homework 6

Due **Friday, 12/6/19**

Notes:

- All of your work should be submitted using the appropriate link in Blackboard.
- While typed solutions are preferred, handwritten solutions are acceptable. However, your handwritten work must be scanned and submitted electronically.
- Your submission must be in a single file. Archive files will not be accepted—if you're scanning handwritten pages, combine all pages in a Word document or PDF file.
- This assignment is worth 100 points.

For each of the following complex operations, write a sequence of PIC 16F1829 instructions that performs an equivalent operation. Assume that X, Y, and Z are 16-bit values split into individual bytes as shown in the following cblock directive, which defines two additional variables you can use:

```
cblock 0x70
     XH, XL    ; High and low bytes of X
     YH, YL    ; High and low bytes of Y
     ZH, ZL    ; High and low bytes of Z
     TEMP      ; Temporary byte, if needed
     COUNT     ; Loop counter, if needed
endc
```

Each question on this assignment is worth 20 points.

1. Perform the 16-bit addition: X = Y + Z. Do not change Y or Z when performing this operation.

2. Perform the 16-bit subtraction: X = Y – Z. Do not change Y or Z when performing this operation.

3. Perform a 16-bit arithmetic right shift: X = Y >> ZL. (Note that, because the shift amount is no greater than 15, a single byte is sufficient to hold that value.) Do not change Y or ZL when performing this operation.

4. Given an 8-bit variable, YL, perform the multiplication:

   YL = YL * 10

Hint: Note that multiplication by a constant amount can be broken into a series of shift and add operations. For example, in general:

- X * 2 can be implemented by shifting X to the left by 1 (X << 1)
- X * 5 can be implemented as (X * 4) + X = (X << 2) + X

5. Given two 8-bit variables stored in XL and YL, copy the value of bit position YL within variable XL into the carry flag. For example:
   - If XL = 0x03 and YL = 0x00, set C to the value of bit 0 within XL.
     - Since XL = 0x03 = 0000 0011$_2$, C = 1
   - If XL = 0xC2 and YL = 0x04, set C to the value of bit 4 within XL.
     - Since XL = 0xC2 = 1100 0011$_2$, C = 0

Note that:

- This operation is very similar to the bit test (BT) instruction in the x86 architecture.
- Since YL is not a constant, you cannot use the value of YL directly in any of the PIC bit test instructions (for example, `btfsc XL, YL` is not a valid instruction).
- Your code should not modify either XL or YL.