

PHYS 319 Midterm

February 12, 2015

Name _____ Student Number _____

You are free to refer to the provided information package, but no other reference materials.

1. For each of the following C language expressions, assumed to be issued one after another, provide the values, in **BOTH hexadecimal AND binary**, of the variable x (which is an unsigned char).

	HEXADECIMAL	BINARY
a) <code>x = 72; x &= ~255</code>	0x_____	0b_____
b) <code>x = 37; x = -1;</code>	0x_____	0b_____
c) <code>x = 9 >> 3;</code>	0x_____	0b_____
d) <code>x = 57/6;</code>	0x_____	0b_____

(/4)

2. Below is the assembly code produced by a compiler from a short C program for an MSP430 Launchpad. Examine the assembly code and 1) add comments to each line of code to explain the function; 2) Explain in a sentence or two what the program does (hint: $23168 = \text{WDTPW} + \text{WDTHOLD}$).

main:

```
    mov    #23168, &__WDTCTL ;  
    mov.b  #1, &__P1DIR    ;
```

.L9:

```
    mov.b  &__P1IN, r15    ;  
    and    #8, r15         ;  
    jne    .L9             ;
```

.L6:

```
    mov.b  &__P1IN, r15    ;  
    and    #8, r15         ;  
    jeq    .L6             ;  
    xor.b  #1, &__P1OUT    ;  
    jmp    .L9             ;
```

(/10)

3. Write a **complete**, well annotated program in C, that will operate the MSP430G2553 as a stand-alone parallel-output ADC. Pin P1.1 is a trigger input: a high to low transition detected on this pin should cause the program to read the analog voltage value on P1.0, and then place the digital result on pins P1.2-1.7 and P2.0-P2.3. It uses P2.4 as a 'data valid' flag. P2.4 is low when the values on the output pins have been set. The program should begin by configuring necessary registers (eg P1DIR, ADC10CTL0 etc), then it should set P2.4 to High to indicate that the output pins do not have any meaning, and put the CPU to sleep until awoken by a high to low transition on pin P1.1 triggering an interrupt. The interrupt handler should:
- a) set P2.4 High
 - b) use the ADC10 to read the analog voltage applied to pin P1.0,
 - c) place the 4 most significant bits of the ADC result on P2.0-P2.3 (P2.3 is most significant), and the lower 6 bits on pins P1.2-P1.7.
 - d) set P2.4 Low to indicate that the output values have been set.
 - e) exit until the next interrupt call the handler again.

The C programs that we examined in the first four weeks of lab sessions are in the reference package. Feel free to write on the back if necessary.