

**UNCC, Department of Electrical and Computer Engineering
ECGR4101/5101, Fall 2005, Homework #3 solution (20 points)**

You will need to refer to the M16C/20/60 Software Manual and M16C C Language Programming Manual to complete this assignment. They are available online through the documentation contained in the SKP16C26 directories link on the course home page.

Answers:

0. How long did this homework take you? **(1 point)**

1. How many bytes are required to represent each of the following data types? **(3.5 points)**

- a. char **(1 byte)**
- b. int **(2 bytes)**
- c. short **(2 bytes)**
- d. long **(4 bytes)**
- e. float **(4 bytes)**
- f. double **(8 bytes)**
- g. long double **(8 bytes)**

2. Is a variable of type int signed or unsigned? **(1 point)**

It is signed.

3. What is the shortest variable, which can hold the integer 1000? **(1 point)**

(int or short or unsigned int)

4. What is the shortest variable, which can hold the integer 200? **(1 point)**

unsigned char

5. What modifier should be used if a variable's value will never change when the program executes? **(1 point)**

const

6. What modifier should be used if a variable may be changed by an interrupt outside of normal program execution? **(1 point)**

volatile

7. List the following C operators in order from highest to lowest priority (precedence): **(2.5 points)**

&& -> + ! || += == & (monadic) & (diadic) %

->, & (monadic), !, %, +, ==, & (diadic), &&, ||, +=

8. What is the value resulting from the C expression $0x47 \wedge 0x81$? **(1 point)**

0xC6

9. Consider the following C program. Identify to which section(s) each variable is allocated. **(3 points)**

```
int a;
int b=2004;
void function1(int arg1) {
int c;
....
}
void function2(int arg2) {
static int d;
...
}
void main(void) {
int e;
```

```
int f=10;
}
```

a. bss (RAM).

b. data (RAM) and data_I (ROM).

c. stack.

d. stack.

e. stack.

f. stack.

10. Write M16C assembly code to implement the following C code. Assume X is in R1, Y is in R2, and Z is in R3. All data is 16 bits. (**4 points for 5 command lines and 2 labels**)

```
if (X==38)
Y = 4; /* code a */
else
Z = X; /* code b */
```

L1:

```
;;; # C_SRC : if (x==38) {
cmp.w #0026H ,R1 ; x
jne L3
;;; # C_SRC : y=4;
mov.w #0004H ,R2 ; y
jmp L6
```

L3:

```
;;; # C_SRC : z=x;
mov.w R1 ,R3 ; z
```

L6: