**EE213 - TEST II**

NAME _____

Show all your work in the space provided.
Answers with a simple "yes", "no", or a single number are incomplete and will not be given full credit. Answers in the form: ans = $\frac{a+sqrt(b)}{c}$ are fine where appropriate.

**Problem 1.** (5 points) How many bytes would be set aside for a ten-element *int* array (uint array[10])? Would the low-order bytes be in a group and then the high-order bytes, or would they be in byte-pairs? If the array started at location 2020H, where would the 2 bytes of array[5] be found?

**Problem 2.** (5 points) What is a "driver," and what are its advantages?

**Problem 3.** (5 points) When is in-line code preferable to functions?

**Problem 4.** (5 points) Explain how you could handle external interrupts from, for example, twenty different switches. (Draw a mini-diagram).

**Problem 5.** (5 points) What can you do when a (C-language) function needs to return more than one parameter? (Give an example).

**Problem 6.** (5 points) List 3 advantages of using functions instead of writing your code in one giant block.

**Problem 7.** (7 points) Write a short program in C which continually samples P0.2 and writes a 1 to P0.3 if a **falling** edge is seen and writes a 0 otherwise.

**Problem 8.** (5 points) Give a short example of the possible contents of a header file.

**Problem 9.** (5 points) What is an interrupt?

**Problem 10.** (10 points) Write a few lines of ASM code which perform the same task (in the same way) as the following bit of C-code:

```
uchar x;
uint a[10]; /* base address = 0x42, internal*/
for (x=9;x>=0;x–){
      a[x] = x;
}
```

**Problem 11.** (7 points) Given the following test C-program and resulting ASM code, write an ASM function "add":

```
uchar add(uchar x, uchar y){
    return x+y;
}
```

```
stmt level source
   1       #pragma NOREGPARMS
   2       #pragma SMALL
   3       #define uchar unsigned char
   4       uchar fn(uchar x, uchar y){
   5   1      return 0xaa;
   6   1   }
   7       void main(void){
   8   1     uchar x;
   9   1     x = fn(0xbb, 0xcc);
  10   1   }
```

```
                ; FUNCTION fn (BEGIN)
0000 7FAA           MOV     R7,#0AAH
0002            ?C0001:
0002 22             RET
                ; FUNCTION fn (END)

                ; FUNCTION main (BEGIN)
0000 7500BB         MOV     ?fn?BYTE,#0BBH
0003 7500CC         MOV     ?fn?BYTE+01H,#0CCH
0006 1100           ACALL   fn
0008 8F00           MOV     x,R7
                ; FUNCTION main (END)
```

**Problem 12.** (6 points) Say that interrupt 0 is set to priority 0 and interrupt 1 is set to priority 1. Both interrupts are detected at the same time. Given the following polling sequence, describe how the interrupts are serviced (in what order, etc).

INT0 $->$ TIMER0 $->$ INT1 $->$ TIMER1 $->$ SERIAL

**Problem 13.** (20 points) The following figure shows an 8051 connected to a numeric keypad.

a) (10 points) The 8051 can differentiate the press of a single key from all the other keys in the array. Explain why this is the case. (Hint: what's inside the I/O port is important)

b) (10 points) Draw a flowchart for a function which scans this keypad and returns an int, with each bit representing the state of the appropriate switch. Provide enough detail to show you understand exactly how this is done (including patterns that might be written/read, how create integer to return, etc)

**Problem 14.** (10 points) More than two interrupt priority levels may be achieved through software. Briefly explain how you might do this. (A flowchart of an interrupt using more than two priority levels would be helpful).