ECE3710 Exam 1 Spring 2013. Name (4 pts)_____

4 pages. Open Book. Open Notes. Closed Internet. Cheating will result in a score of 0.

1. (2 pts) Name the architecture that is characterized by a shared program and data memory _____.
2. (3 pts) Name three different 8-bit microcontroller families.
   (a) _____
   (b) _____
   (c) _____
3. (5 pts) Name 10 criteria that you might use to select a microcontroller (we discussed about 13 in class).
   (a)_____
   (b)_____
   (c)_____
   (d)_____
   (e)_____
   (f)_____
   (g)_____
   (h)_____
   (i)_____
   (j)_____
4. (3 pts) On the 8051, how wide (in bits) are the following:
   (a) The accumulator _____
   (b) The program status word _____
   (c) The program counter _____
5. (2 pt) How much (internal) RAM is available on the original 8051? _____
6. (6 pts) Other than RAM and ROM, the original 8051 has three types of peripheral devices. Name them, and tell how many there are of each.
   (a)_____ number of them:_____
   (b)_____ number of them:_____
   (c)_____ number of them:_____
7. (2 pts) What is the address of the first instruction executed immediately after reset? _____
8. (3 pts) What is the difference between `MOV A,#42H` and `MOV A,42H`?
   _____
   _____
   _____
9. (2 pts) What assembly statement would you use if you want the symbol `count` to be synonymous with 3?
   _____
10. (2 pts) The instruction MUL AB multiplies registers A and B.
    (a) Is the multiplication signed, unsigned or both? _____
    (b) In which register is the least significant byte of the result stored? _____.

11. (2 pts) What does the following sequence of assembly statements do?

```
        cseg
        …
frogs:  db      2
```

(a) Allocates 2 bytes from code memory and names them frogs
(b) Allocates 1 byte from the code memory, names it frogs and initializes it to 2.
(c) Allocates 2 bytes from internal RAM and names them frogs.
(d) Allocates 1 byte from internal RAM, names it frogs and initializes it to 2.
(e) None of the above

12. (4 pts) Assume the following instructions are executed right after a reset:

```
        MOV     PSW,#98H
        MOV     R2,sp
```

What value will be stored? _____ To what address? _____

13. (2 pts) After the instructions in problem 12 are executed, what is the value of:
(a) the carry flag (C)? _____
(b) the auxiliary carry flag (AC)? _____

14. (4 pts) Consider the following instructions:

```
        MOV     A,#87H
        ADD     A,#79H
```

After these instructions have executed,
(a) What is the value of A? _____
(b) What is the value of C? _____
(c) What is the value of AC? _____
(d) What is the value of OV? _____

15. (2 pts) Assume the accumulator is 091_{16}, C=0, AC = 1. What will the accumulator hold after the instruction `DA A` is executed? _____

16. (4 pts) Consider the following assembly code.

```
        CLR     A
        MOV     R7,#3
LOOP1:  MOV     B,#4
LOOP2:  INC     A
        DJNZ    B,LOOP2
        INC     R7
        CJNE    R7,#6,LOOP1
```

What will the values of A, B, R7 and C be when this code has finished executing?
A = _____
B = _____
R7 = _____
C = _____

17. (2 pts) What is the fundamental difference between a call and a jump instruction?
(a) the destination address of the jump is pushed onto the stack
(b) the destination address of the jump is popped from the stack
(c) the address of the CALL instruction is pushed onto the stack
(d) the address of the instruction that follows the CALL is pushed onto the stack

18. (3 pts) Match the jump instructions to their descriptions:
    (a) LJMP ____ Jump to a location in the range (PC-128..PC+127)
    (b) SJMP ____ Jump anywhere in program memory
    (c) AJMP ____ Jump to a location in a 2K block of program memory

19. (3 pts) Consider the following 2 assembly code fragments:

Fragment 1		Fragment 2	
ANL	A,P3	ANL	P3,A
MOV	P3,A	MOV	A,P3

    In what way do these fragments behave differently? (Hint: Don't forget about the port latch.)

    _____
    _____
    _____

20. (6 pts) Write a single instruction to:
    (a) toggle pins P1.0 – P1.1 _____
    (b) select register bank 3 _____
    (c) complement (toggle) the overflow flag _____

21. (4 pts) An original 8051 has a 6 MHz crystal.
    (a) What is the period of a machine cycle? _____
    (b) How long will it take to execute the delay loop, below? _____

```
        MOV     R2,#2
        MOV     R3,#141
LOOP:   DJNZ    R3,LOOP
        DJNZ    R2,LOOP
```

22. (5 pts) Analyze the following subroutine (Hint: assume the input is a signed number):

```
;       Subroutine foo
;       description: left as an exercise for the student
;       input: A
;       output: A
foo:    JNB     ACC.7, done
        CPL     A
        INC     A
done:   RET
```

    Describe what this function does and suggest a better name for it.

    _____
    _____
    _____

23. (3 pts) Which bit address is used for the following instructions?
    (a) SETB P1.1 Bit address = _____
    (a) CLR ACC.7 Bit address = _____
    (a) CPL PSW.3 Bit address = _____

24. (6 pts) A listing file contains the line shown below.

```
(address)  (code)
167E B414F6     CJNE   A,#20,foo
```

Assume the accumulator contains 10H when this instruction is executed.
(a) Will the branch be taken or not?

_____

(b) What will the carry flag be after the instruction is executed?

_____

(c) What is the address (in code memory space) of `foo`?

_____

25. (6 pts) Write a code fragment to subtract the 16-bit value {R5,R4} from {R7,R6}, leaving the result in {R3,R2} and setting the carry flag if a borrow occurs. (7 instructions)

26. (4 pts) The code below purports to convert a 3-bit number (in the accumulator) into a bit mask (e.g. 0 → 00000001, 1 → 00000010, 7 → 10000000), but there is a problem. Find it and show the correction(s) below. Do not use DPTR.

```
get_mask:

        MOVC    A,@A+PC

        RET

bit_table:

        db 01H, 02H, 04H, 08H, 10H, 20H, 40H, 80H
```

27. (6 pts) Write a code fragment to divide a 16-bit unsigned value in {R3,R2} by 2. (Hint: shift the value right except for its sign bit, which should be loaded with 0). (7 instructions)

Extra Credit. (3 pts)
Write code to jump to the address in registers {B,A} without using DPTR.