Practice Problems for Topic 6

CIS*2030: Structure and Application of Microcomputers

The practice problems below are important, but will *not* be marked. Their purpose is to ensure that you understand the major concepts covered in Topic 6. Doing these problems by yourself is imperative, as a portion of the marks on the midterm and final exam will be based on questions related to Topic 6.

---

1. Write a single 68000 instruction to complements bits 0, 3, 4, 8, 12, and 15 in register D6 while leaving all other bits unchanged.

2. Write a single 68000 instruction to mask out (i.e., clear) the least significant bit and most-significant bit in the longword in D3.

3. Write a single 68000 instruction to multiply the 32-bit unsigned value in D0 by 0.125. Of course, since fractional multiplication is not available you must think of an alternative way to perform this task.

4. Repeat the previous question, but this time assume that the value is signed.

5. If data register D7 contains $12345678, use a single 68000 rotate instruction to change the value in D7 to $12347856.

Use the following information for questions 6-9

Below, you will find an example of what is often referred to as *self-modifying* code. Such code is often frowned upon, as it is frequently used to disguise the true operation of a program; that said, the code below is harmless.

```
00001000                             1          ORG     $1000
00001000  4280                       2  START:  CLR.L   D0
00001002  720A                       3          MOVE.L  #10,D1
00001004  43F9 0000102C              4          LEA     LIST,A1
0000100A  1419                       5  LOOP    MOVE.B  (A1)+,D2
0000100C  0039 0040 00001024         6          ORI.B   #%01000000,OPCODE+2
00001014  E21A                       7          ROR.B   #1,D2
00001016  6400 000A                  8          BCC     OPCODE
0000101A  0239 00BF 00001024         9          ANDI.B  #%10111111,OPCODE+2
00001022  E31A                      10  OPCODE  ROL.B   #1,D2
00001024  D002                      11          ADD.B   D2,D0
00001026  5301                      12          SUB.B   #1,D1
00001028  66E0                      13          BNE     LOOP
0000102A  60FE                      14          BRA     *
0000102C                            15
0000102C= 00 01 01 02 03 05 ...     16  LIST    DC.B    0, 1, 1, 2, 3, 5, 8, 13,
21, 34
00001036                            17          END     START

Symbol-name          Value
-------------------------
LIST                 102C
LOOP                 100A
OPCODE               1022
START                1000
```

6. In a single sentence, explain what the program does. Hint: Carefully consider the instruction format of the ADD and SUB instructions by examining their data sheets in the appendix of your textbook.

7. What is the (high-level) purpose of the conditional branch instruction on line 8 of the listing file?

8. What is the purpose of the logical instruction on line 6 of the listing file?

9. What is the purpose of the logical instruction on line 9 of the listing file?