

# CS1356 Introduction to Information Engineering

## Homework 3

Due: Nov 4, 2009 in class

Remember to write your name and student ID

1. Translate the following C program into the machine language of the textbook (Appendix C).

Suppose the translated program is loaded into memory started at address **A0**, and variable a, b, c are assigned to main memory at address **6E**, **6D**, and **6C** respectively.

Give a short explanation for each instruction.

(No credit will be given without explanation.) **30%**

```
int main(){
    char a, b=5, c=3;

    if (b==c) a = b+10;
    else a = c|0x13;
}
```

2. Suppose the following program, written in the machine language of the textbook (Appendix C), is stored in main memory beginning at address **30** (hexadecimal).

- (a) If you trace the program, you will find out this program modifies itself. Self-modifying program, though not encouraged in ordinary use, is an important feature of the stored-program concept. Please indicate which instructions are modified during the program execution? And how are they changed? **20%**
- (b) What task does the program perform? Write a C program to perform the same function as this program does. Use integer arrays A[?] and B[?] for the memory location 00-03 and 10-13. **20%**
- (c) If we want to place the program in main memory beginning at address **A0** (hexadecimal), how should the program be modified? Please write down the modified program with explanations. **30%**
- (d) **BONUS QUESTION:** Memory operations (load/store) are slower than arithmetic/logic operations. Can you rewrite this program to perform the same action with faster instructions? The program size should be less than 15 instructions. Explain the correctness and the performance improvement of your program. **20%**

```
2003
2101
2200
2310
1400
3410
5221
5331
3239
333B
B248
B038
C000
```