# Practice Problems for Topic 5

## CIS*2030: Structure and Application of Microcomputers

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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 5. 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 5.

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1. Circle only those instructions that are to be used when comparing unsigned data.

   **BHI** **BGT** **BCS** **BLS** **BLE**

2. What is the difference between **BLS** and **BCS**?

3. The CCR contains the value $09. Which, if any, of the following branch instructions are true leading to the branch being taken. In each case, you should show the both the flags and their values that make the condition true.

   a) **BRA** ->

   b) **BEQ** ->

   c) **BGE** ->

   d) **BLE** ->

   e) **BHS** ->

   f) **BLO** ->

   g) **BVS** ->

4. Hand assemble the following branch instruction: **`BRA *`**.

5. Assume the instruction **`BRA AHEAD`** is in memory location **`$9600`** and the label **`AHEAD`** represents the instruction at address **`$9AB0`**. What is the offset for this instruction? (Show the calculation performed by the assembler.)

6. Will the branch be implemented as a short or long branch by an assembler? Why?

7. Write an instruction to branch to label **`HERE`** if unsigned overflow has not occurred. Assume that label **`HERE`** is located 196 bytes away from the conditional branch instruction that you write.

8. Write a sequence of two 68000 instructions that first compares the 32-bit addresses in registers A3 and A4 and then branches to label **`HERE`** if the address in register A3 is less than the address in address register A4.

9. Write a sequence of two 68000 instructions that first compares the byte in D3 to the ASCII character 'C' and then branches to label **`HERE`** if the byte matches the 'C'.

10. Write a sequence of two 68000 instructions that first compares the byte in D2 to -12 in decimal and then branches to label **`HERE`** if the byte is greater.

11. Draw a *Control-Flow Graph (CFG)* for the following C code. (Use the same procedure and style as used in lecture. Ad-hoc implementations will receive a grade of zero.) Remember to employ short-circuit evaluation. Assume that X, Y and Z are unsigned numeric values. [2 marks]

```
if((X >= 15) && (Y>0) && (Z<100))
     W=0
else
     W=1;
```