Homework 1

Note: HW is due at the end of class meeting.

Problem 1.

1. What is 10111111 in decimal if the number of bits is 8 and the format is 1’s complement?
2. What is 10111111 in decimal if the number of bits is 8 and the format is 2’s complement?
3. What is 10111111 in decimal if the number of bits is 8 and the format is sign magnitude?
4. What is 10111111 in decimal if the number of bits is 8 and the format is unsigned binary?
5. What is 68 decimal expressed as a BCD number?
6. What is the unsigned binary number 1011011111.1001 in decimal?
7. What is 2769 decimal express as an unsigned hex number?
8. What is 2769 decimal expressed as an unsigned binary number?
9. What is 2769 decimal expressed as an unsigned octal number (hint: break the binary digits into groups of three and replace them with octal digits 0-7)?
10. What is “Go Gators!” in ASCII code? Note: Only code what is inside the quotes. (hint: see Table A-5 of textbook for ASCII codes)
11. How many possible combinations of numbers are there in 5 bits? 9 bits? 11 bits?
12. What are the largest possible unsigned binary numbers for the bit lengths given in #11?

Problem 2. Design the instruction decoder using AND, OR, and inverter gates to decode the 3-bit op codes (bits D7, D6, D5 of 8-bit instruction) and produce the ADD, SUB, IN, OUT, and MOV control signals (the control signal will be “1” when it asserts)

Assuming the following op codes are used for ADD, SUB, IN, OUT and MOV instructions:

<table>
<thead>
<tr>
<th>Instructions</th>
<th>Op-code (3-bits: D7, D6, D5)</th>
</tr>
</thead>
<tbody>
<tr>
<td>ADD</td>
<td>001</td>
</tr>
<tr>
<td>SUB</td>
<td>011</td>
</tr>
<tr>
<td>IN</td>
<td>101</td>
</tr>
<tr>
<td>OUT</td>
<td>111</td>
</tr>
<tr>
<td>MOV</td>
<td>010</td>
</tr>
</tbody>
</table>

Problem 3. What is the purpose of program counter?

Problem 4. Explain why computers have ready or wait control lines.
**Homework 1**

**Problem 5.** What changes would you suggest to allow the IN instruction to input data from up to 256 different devices (Lecture 1, slide 20)?

**Problem 6.** Describe the instruction execution cycle for the MOV instruction (Lecture 1, slide 20).

**Problem 7.** Discuss the changes that must be made to the sequence controller (Lecture 1, slides 32 and 36) to add a direct address memory reference instruction. This is a three-byte instruction with the first byte the op code, and the next two bytes that address of the data location in memory.