Machine Organization and Assembly Language Programming

Problem Set #1

Due: Wednesday April 6th

1. By the due date, you should have read Chapter 1, Chapter 3 (Sections 3.1 to 3.3) and Chapter 2 (Sections 2.1 to 2.5)

2. You should read the "Computers in the Real World" sections at the end of Chapters 1, 2, and 3.

3. Please do the "Assignment #0 – Getting familiar with SPIM". The text of the assignment is on the Web. You DON'T have to turn it in.

4. Convert 511 into a 16-bit two's complement binary number. Give the answer in hexadecimal.

5. Convert -256 into a 16-bit two's complement binary number. Give the answer in hexadecimal.

6. What decimal number does this 32-bit two's complement binary number represent
   1111 1111 1111 1111 1111 1111 1110 0111 ?

7. What binary number does this 32-bit two's complement hexadecimal number represent: 0fff fffe? What decimal number does it represent? (you can use an expression of the form $2^x + y$ for the decimal number if you find it convenient)?

8. What binary number does this 32-bit two's complement hexadecimal number represent: 8000 0004 ? What decimal number does it represent (you can use an expression of the form $2^x + y$ for the decimal number if you find it convenient)?

9. Assume a 16-bit register and a 2's complement representation of integers.

   - What are the largest positive number and the smallest negative number that you can represent (give representations in 2's complement and hexadecimal, and their values in decimal – you can use an expression of the form $2^x + y$)?

   - Give examples of adding two positive numbers with and without overflow and of subtracting a negative number from a positive number with and without overflow. Show the 2's complement representation of the operands and the result in a manner similar to what is done in the book page 171.

   - For this question and the next, do not write MIPS instructions but answer with statements like " Check bit so and so. If 0 then do this else do that".
     How do you test if a number is not negative? How do you test if a number is not positive?

   - How do you test for overflow?