CSC 230 Assignment 1
Spring 2017

This assignment has two parts:

1) **Quiz Part:** Complete the Assignment 1 problem set on conneX (in the Tests & Quizzes section). The problem set is to be completed online and only requires you to supply the final answer. **Complete it on conneX by January 21, 2017 well before 11:50 pm.**

2) **Programming Part:** Submit only your code (no executables) file on conneX. Be sure to include your name and student number. **Submit it on conneX well before 11:50 pm January 28, 2017.**

Assignment 1: Part 1 - Quiz

Note: Answer these questions without electronic tools: Treat the questions as if they were conducted during an exam. As you will be inputting these answer into a 'Quiz' on conneX, please include only the digits of the appropriate number system. In particular, do not precede your answers with '0x' or '0b' or follow your answers with base indicators, like subscript 2 or 10.

1. A processor uses 24 bits for its memory addressing. How many possible distinct locations (in decimal) can the computer address?
2. How is the memory address $(7234)_{10}$ represented in binary (base 2)?
3. How is the memory address $(7234)_{10}$ represented in hexadecimal (base 16)?
4. What is the maximum 2's complement integer that can be stored in a memory location that stores 16 bits of data? (Give your answer in decimal.)
5. What is the minimum 2's complement (or largest negative) integer that can be stored in a memory location that stores 16 bits of data? (Give your answer in decimal.)
6. Convert the numeral 0x4C32CB directly to binary.
7. Convert 1520_{10} into the 2's complement 16-bit binary representation.
8. Convert -352_{10} into the 2's complement 16-bit binary representation.
9. Convert the octal value 1037_8 into binary
10. Convert the octal value 1037_8 into Hexadecimal
11. Given two binary numbers 0b10111010 and 0b01001001, perform a bit wise AND operation. Provide the result in binary.
12. Given two binary numbers 0b10111010 and 0b01001001, perform a bit wise OR operation. Provide the result in binary.

13. Given two binary numbers 0b10111010 and 0b01001001, perform a bit wise XOR operation. Provide the result in binary.
14. Given the hexadecimal number 0xA9BC, perform a bit wise NOT operation (complement). Provide the result in hexadecimal.
15. When a binary shift operation is performed binary data can be shifted right or left and a '0' is brought to fill vacated positions while the bit that is shifted out is discarded. Shift the 8-bit binary number that is equivalent to 0x18 right two, give the result in binary.
16. When a binary rotate operation is performed binary data can be shifted right or left: the bit that is shifted out from one end will be brought back in on the other end. Rotate the 8-bit binary number that is equivalent to 0x5B right two, give the result in binary.
17. For an 8-bit (byte) sized binary number, what mask and operation would you use to clear the lower nibble without changing the upper nibble?
    a. Mask (in binary)
    b. Operation
18. (Use the simulator, AVR Studio, to assist with this question.) Use the assembler to determine the machine language version of the following instructions, write your answers in binary:
    a. ldi r16, 15
    b. add r16, r16
    c. rjmp PC-1

Assignment 1: Part 2 Programming

Please note for all programing assignments, ***you must include your name and student number.*** Make sure the submitted work is yours and not someone else.

Programming Problem #1: Adding

(Similar to Page 68, #3) Write an assembly program that adds three (byte sized) numbers together. The input for the program is to be located in R16, R17 and R18, and the final output 'result' is to be stored in data memory, starting at location 0x200. The program must begin by loading (immediate) the three numbers into three distinct registers, r16, r17 and r18. The sum is to be calculated in register r0 using ADD instructions and then transferred to a memory location called result (which is in the .dseg starting at location 0x200). The CLR instruction may need to be used. To test your program, initialize the input registers with some values (i.e. 27, 41, 15) and verify that after your program completes that the correct sum and stores it in the result memory location.

Please submit your code for this question as "A1_Add.asm" on the Assignment1 link under Assignments on conneX.

Programming Problem #2: Storing Hexadecimal Numbers

Write an assembly language program that uses a loop to write decrementing hexadecimal numbers into consecutive memory locations in the data memory, starting at memory address 0x200. The starting number, which is less than 0x50 and will be found in register R16, needs to be stored in the first data memory location. Then the number will be decremented by 1 and stored in the next consecutive memory location. This process of decrementing and storing will continue until the number 0 is the final value stored.

Please submit your code for this question as "A1_Hex.asm" on the Assignment1 link under Assignments on conneX.