CSC 230 Lab 1 Number Systems

I. Lab Environment

- Need a cardkey to access the lab. The cardkey can be purchased at the bookstore for a non-refundable $10 fee.
- Need a csc account to access the course website and computers in the lab. Email itsupport@csc.uvic.ca if you have difficulties to log on to the machines in the lab.
- **TA Office hours:** 1:30-2:30 pm on Friday at ECS 253.
- ECS 249 is the only lab with hardware/software provided for this course. Suggest you start your assignment early.
- **"H"** drive is your network space in the "csc" server. Store all your work in "H" drive and keep a back up copy using other portable devices (such as a flash memory or a floppy disk). Files stored in the "C" drive might be erased over night.
- Printing credit can be purchased on line at https://www.csc.uvic.ca/PrintPagePurchasing/

II. Number Systems

In the computer system, we need to know how many bits (storage space) are used. For example, let's count the number of students in the lab. In decimal number system, we just need two digits. In binary number system, how many bits do we need? Let's do counting up in decimal, binary and hexadecimal. Here is the conversion table:

Decimal (2 digits)	Binary (5 bits)	Hexadecimal (2 digits)
0	0b00000	0x00
1	0b00001	0x01
2	0b00010	0x02
3	0b00011	0x03
4	0b00100	0x04
5	0b00101	0x05
6	0b00110	0x06
7	0b00111	0x07
8	0b01000	0x08
9	0b01001	0x09
10	0b01010	0x0A
11	0b01011	0x0B
12	0b01100	0x0C
13	0b01101	0x0D
14	0b01110	0x0E
15	0b01111	0x0F
16	0b10000	0x10
17	0b10001	0x11
18	0b10010	0x12
19	0b10011	0x13
20	0b10100	0x14
21	0b10101	0x15
22	0b10110	0x16
23	0b10111	0x17

III. Exercises

1. Why did we use 5 bits in the above table? Can we instead use only 4-bits?
2. How many different values can be represented by 6 bits?
3. There are 105 students registered in CSc 230, what is the minimum number of bits needed to represent this number (assume it is an unsigned number)?
4. Convert the following positive integer numbers (may use the **Horner's Algorithm** on p14 of your textbook: Some Assembly Required: Assembly Language Programming with the AVR Microcontroller):
   - 0b1001101 to decimal
   - 63 to binary
   - 27 to binary
   - 323 to binary
   - 1012 to binary
   - 1012 to octal
   - 0x1E to decimal:
   - 0x1E to octal:
   - 0x66 to decimal:
   - 0x1F5 to decimal
   - 0x1170 to decimal
   - 39 to hexadecimal
   - 51 to hexadecimal
   - 158 to hexadecimal
   - 1032 to hexadecimal
5. Convert negative integer numbers using 2's complement notation
   - -63 to binary and then to Hex (12 bits)
   - -45 to binary and then to Octal (6 bits)
   - -13 to binary (5 bits)
   - 0b101011 to decimal
   - 0b10110 to decimal
   - 0b001110 to decimal
   - 0b110100 to decimal
6. What are the minimum and maximum values represented by a 4-bit binary number: a) as an unsigned number? B) as a 2's complement number? How about 8 bits, 16 bits, 12 bits?
7. What is the result of bit-wise AND operation of: 0b10110010 with 0b11110000?
8. What is the result of Shift-Left operation on 0b01011100? What will the result of Shift-right?
9. What is the result if a toggle mask of 0b11111111 is applied on byte 0b10110100?
10. What is the mask to be used if we want to clear bits 2, 3, 5 and 7 of a byte?

Submit answers to questions 1, 2, 3 and 6 in a text file named lab1.txt using Connex. It is due at 5:00pm on January 12, 2017 (Thursday). Clearly write your name, student number at the top.