CS270 Recitation 1
"Number Crunching"

This recitation will help you prepare for the quiz next section.
Some answers can be checked on the website referenced at the bottom of the assignment.

Question 1: What is the minimum number of bits required to represent the 54 fourteeners in the Colorado mountains? If you have exactly the minimum number of bits, how many bit patterns are unused?

Minimum number of bits: _____

Number of unused bit patterns: _____

Question 2: What is the range of unsigned integers that can be stored using 7 bits? What is the range for signed integers represented in 1's and 2's complement, with the same number of bits?

Range of unsigned integers: ____ to ____

Range of signed integers: ____ to ____ (1's complement)

Range of signed integers: ____ to ____ (2's complement)

Question 3: Show the 2's complement addition of -32 plus 12, with both numbers in binary using 8 bits. Hint: make sure that the resulting binary number corresponds to the correct answer.

_____ (-32) + _____ (12) = _____ (-20)

Question 4: Show the 2's complement subtraction of 10 minus 8, with both numbers in binary using 8 bits. Hint: make sure that the resulting binary number corresponds to the correct answer.

_____ (10) + _____ (-8) = _____ (2)

Question 5: Show the results of the following bitwise operations (using the same number of bits as shown in each problem):

NOT(0b10101100)   = _____

0b10000010 OR 0b01110110   = _____

0b10000111 AND 0b10111010   = _____

0b10001000 XOR 0b01011111   = _____

NOT(0b11011110 XOR 0b01100000)   = _____

Question 6: Show the results of the following bitwise operations:

~(0x3456& 0xDCBA) = 0x_____

(0xFF00 ^ 0x2244) | 0x1357= 0x_____

Question 7: (OPTIONAL) Given a string of digits representing a number in an arbitrary radix r, you must be able to convert it to a decimal integer. To help you practice, we have provided you with a program that generates a random 5-digit number and a random radix between 2 and 16 and asks you to convert this number into a decimal number step by step. To run it, enter the following command in a terminal:

```
~cs270/a2i
```

Question 8: (OPTIONAL) Now we do the opposite. Given a number in decimal, you must be able to convert it to an arbitrary radix r. To help you practice, we have provided you with a program that generates a random 5-digit number and a random radix between 2 and 16 and asks you to convert this number into the given radix. To run it, enter the following command in a terminal:

```
~cs270/i2a <mode>
```

You must replace `<mode>` with one of `easy`, `medium`, or `hard`. In the `easy` mode, you will only have to enter the least significant digit of the given number in the radix-r representation. In the `medium` mode, you will convert the entire number, but the program will help you a bit. In the `hard` mode, you will have to do everything.

Website for two's complement math: www.planetcalc.com/747