Conversion to Decimal

Lab 3, due Fri Feb 15

CS 350: Computer Organization & Assembler Language Programming

A. Why?

- Two's complement binary is one of the basic ways to store information in a modern computer.

B. Outcomes

At the end of this lab you should be able to:

- Write a simple C program that reads and manipulates arrays of characters.
- Convert the string representation of a 2's complement binary integer to its `int` equivalent.
- Calculate the 2's complement negative of a binary integer represented by a string.

C. Programming Assignment [100 points]

You are to write a C program for dijkstra.cs.iit.edu that repeatedly reads in a string representing a 2's complement binary integer and converts it to its `int` equivalent. Your program should:

1. [3 pts] Print a message giving your name and that this program is for Lab 3 of CS 350.
2. [3 pts] Prompt the user for a bitstring or `q` for quit.
3. [6 pts] Read a string, stopping when it hits white space. (Represent the string as an array of characters and read it using `scanf` with `%s`.)
4. [3 pts] If the string is `"q"`, stop the program.
5. [30 pts][1] Treat the bitstring as a 2's complement binary integer and convert it to decimal. Print the string and its decimal value. E.g., for input `011`, you'd print `3` as the decimal value; for input `101`, you'd print `-3`.

[1] 30 pts: 15 pts for nonnegative values, 15 pts for negative values.

6. [25 pts] Now calculate the 2's complement negative of the bitstring and print that out. E.g., for input `011`, you'd print `101` (and vice versa).
7. [5 pts] Go on to the next input (jump back to step 2 above).

Notes

- [10 pts]: If during step 5 you find that the string includes any character other than '0' or '1', complain to the user, display the character, skip the rest of steps 5 and 6 and go on to the next input (step 2 above).
- [15 pts] Code organization and commenting.

Hints

- To see if a string equals `"q"`, you can use `strcmp`. To see if the first character of a string is `'q'`, you can check index 0 of the character array.
- You can assume the integer will fit into an `int`. If you know how many bytes an `int` takes on dijkstra, then you can figure out the longest allowable bitstring.
- If a bitstring of length n begins with a 1, then one way to calculate the 2's complement value of the string is to treat it as an unsigned binary number and add it to -2^n. E.g., input `101` equals 5 (unsigned), and $5 - 2^3 = -3$, which is what `101` represents in 3-bit 2's complement.
- There are two ways to convert an unsigned bitstring into decimal; one going left-to-right, and one going right-to-left. You can use either way; your choice.

