Lab 6: Arithmetic, Bitstrings

CS 350: Computer Org. & Asm. Lang. Pgm'g

Due: Sat Mar 30, 11:59 pm

This lab includes written problems and a programming problem. To submit copy your written and programming problem solutions to a folder, include your name in the folder, zip it, and submit the zipped file.

Problems [50 = 30 + 20 points total]

Written Problems [30 points]

1. [3 points] What is (hexadecimal) CED3 – 17A4? (Showing your work may earn partial credit if your answer is wrong.)
2. [6 = 2 * 3 points] (Arithmetic on bitstrings represented by hex numbers)

2a. Take hex `7D00` and `01DB`, convert them to 16-bit strings *b1* and *b2* and do *b1* – *b2* in 2's complement. If we call the result bitstring *d*, then convert *d* back to a 4-digit hex number. Show *b1*, *b2*, *d*, and the final hex result. (For *b1* and *b2*, include any leading zero bits.)

2b. Take the 16's complement negative of `01DB` by calculating its 15's complement negative and adding 1. Let's call the resulting hex number *y*. (To take the 15's complement negative, subtract each digit from $\texttt{F}_{16}$.) Then add `7D00` and *y* in hex and give the result. Show *y* and the final result[1].

3. [6 = 2 * 3 points] (Converting decimal real number to binary scientific)

3a. What is the result of converting decimal 29.3125 to binary scientific? (Showing your work may earn partial credit if your answer is wrong.)

3b. Repeat, on decimal 39/128

4. [9 = 3 * 3 points] (Binary real numbers and IEEE format)

4a. Convert binary `-0.0000110111` into binary scientific.

4b. Convert the result of part (a) to IEEE single-precision format. (Show the result in binary and in hexadecimal)

4c. Repeat part (b) on your binary scientific result from problem 3(b).

5. [6 = 2 * 3 points] (Convert from decimal real to IEEE floating-point)

5a. What is the result of converting 36.8125 to binary scientific form?

5b. What is the result of converting your answer from part (a) into IEEE single-precision format? Give the answer in binary and in hex.

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[1] Note *y* should equal -*b2* converted to hex, and the final sum here will match the final sum from (a).

Programming Problem [20 points]

The goal of your assignment is a program that repeatedly reads in an 8-digit hex number (representing a 32-bit string) plus two endpoints and calculates and prints the hex representation of the bitstring selected by the endpoints.

- For example, take input hex `0123ABCD` and endpoints `1` and `7`.
- First you build a mask `0...0 1111 1110` (notice the 1's in positions 1 through 7).
- Then you take the bitwise AND of `0123ABCD` and the mask.
  - For our example …`CD` represents …`1100 1101`. (We're taking bits 1–7, so positions 8–31 aren't relevant.)
  - The bitwise AND of this and our mask ...`0 1111 1110` is `00...0` <u>`1100 1100`</u> (I've underlined the bits we selected, in positions 1.. 5.), which is hex `0000 00CC`.
- Then you print out the original value (in hex), the endpoints (in decimal), and the selected bitstring (in hex).
  - For our example, this would be `0123ABCD`, `1`, `7`, and `CC`. (You can omit the leading digits from the result, but you should include the ones in the original value.)
- Then you prompt the user for another value and repeat the process above, stopping when the value read in is zero.

Write the program by completing the skeleton implementation in the file `Lab_06_skel.c`. (The skeleton won't compile on its own.) Study the skeleton and replace the parts marked `STUB` with actual code. Also, remove any `STUB`-related comments.

