Homework 2

Due Apr 10 by 5pm **Points** 100 **Submitting** a file upload **File Types** circ, pdf, txt, zip, tar, and tgz
Available after Apr 3 at 12am

Submit online via Canvas.

We accept only the following file formats:

- .circ
- .pdf
- .txt
- and zip, tar, tgz of these

Q1 (55pts)

Build a circuit Q1.circ that takes the month and day (each represented as two BCD digits), and outputs a 1 if and only if that day actually exists in the 2015 calendar.

For example:

- 0 3 3 2 → 0 (because there is no March 32), but
- 1 2 1 6 → 1 (because there is a Dec 16)

Use only the basic gates (with negated inputs if you want) and basic I/O (i.e., no plexer modules or such). You may use subcircuits if you wish, as long as they are built from basic gates. If you do so, give the subcircuits semantically meaningful shapes and labels.

As with programming software, be principled and elegant.

One aspect of "principled" means: should the user enter illegal input (such as a 4-bit value that is NOT a valid BCD digit), you should politely fail (e.g., via asserting an "ERROR" output), rather than giving bizarre and incorrect output.

Objective: you should be able to work with binary and hex, without even thinking about it. For the problems below, **assume 16-bit words.**

Q2 (15pts)

Convert the following hexadecimal numbers to unsigned binary:

- A. 0xA033
- B. 0x0CED
- C. 0x12FF
- D. 0x2200
- E. 0xF003

Q3. (15pts)

Convert the following decimal numbers to two's complement hex:

- A. 257
- B. -17,213
- C. 21,934

- D. -918
- E. 41

Q4. (15pts)

Perform the following bitwise logical operations. Express your answers in hex.

- A. 0x7819 AND 0x829A
- B. 0xA281 OR 0xF037
- C. NOT ((NOT 0x5478) AND (NOT 0xFEED))
- D. 0x8814 XOR 0x93FA
- E. 0x2871 NOR (NOT 0xCAFE)

Some Rubric

Criteria	Ratings	Pts
Q1: Correctness view longer description		40 pts
Q1: Clarity and Transparency view longer description		6 pts
Q1: Neatness view longer description		3 pts
Q1: Appropriate Abstraction view longer description		3 pts
Q1: Simple Design view longer description		3 pts
Q2 view longer description		15 pts
Q3 view longer description		15 pts
Q4 view longer description		15 pts

Total Points: 100