Homework 3 - Boolean Algebra - Gates / Error Detection

Due Wednesday Mon 24 - by end of class. You can turn in parts 4,5,6 on paper - 1,2,3 should be uploaded (Upload source code only).

Points total: 200

Testing you are expected to produce a unit test for each of the following. The test should print out "PASS" if it is successful and run at least 4 examples of good and bad values for each.

1. 50pts - Implement a Luhn Verifier. Implement in your choice of { C, C++, Python, Go, Haskell, F#, Swift, Kotlin }.
2. 35pts - Implement a Verhoeff verifier in { C, C++, Python, Go, Haskell, F#, Swift, Kotlin }. (Go steal the code in C - see link - and give credit, note the license - you want an original that is MIT or 3 clause BSD then copy like crazy). This is the JavaScript(node.js) and Go version that I have on github.com. Search google for "verhoeff algorithm". https://github.com/pschlump/verhoeff_algorithm Java script: https://github.com/yuyudhan/verhoeff.git Do not copy this - it is proprietary code - No LICENSE file at all. Other solutions: License CC Attribution: https://en.wikibooks.org/wiki/Algorithm_Implementation/Checksums/Verhoeff_Algorithm Look at the LICENSE - is it OK to use? What is a BSD 3 calause, an Apache Foundation version 2, a MIT License? Use GOOGLE!
3. 35pts - write a short C Program to calculate the Hamming distance between 0x43 and 0x121.
4. 25pts - Provide the circuit diagram in mixed logic for

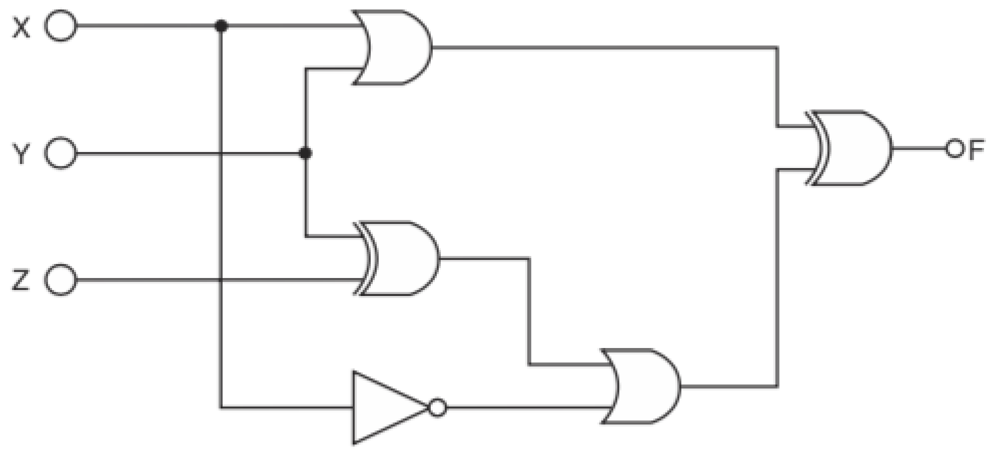
   Dec1 = (A & !B & !C & !D) & !X & Y

   Dec2 = (A & !B & !C & !D) & X & !Y

   Dec3 = (A & !B & !C & !D) & X & Y

   (A&!B&!C&!D) is a commmon sub-expression in the hardware.

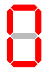
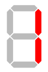
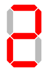
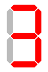
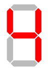
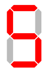
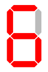
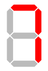
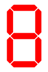
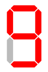
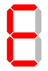
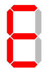
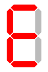
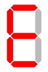
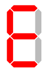
5. 25pts - Derive the truth table for:

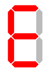

X
Y
Z
F

6. 30pts - Given the following truth table show the circuit for: An examlle of a 7 segment decoder is: 74ls47 7-segment LED decoder - see https://buzztech.in/bcd-to-seven-segment-decoder-program-in-vhdl/ Do note that it will not handle 10...15 the same way - it is not decoded to an E.

   I, J, K, L are inputs

   a, b, c, d, e, f, g are outputs

Decimal Digit	Hex	I	J	K	L		a	b	c	d	e	f	g	Display Pattern
0	0x0	0	0	0	0		1	1	1	1	1	1	0	
1	0x1	0	0	0	1		0	1	1	0	0	0	0	
2	0x2	0	0	1	0		1	1	0	1	1	0	1	
3	0x3	0	0	1	1		1	1	1	1	0	0	1	
4	0x4	0	1	0	0		0	1	1	0	0	1	1	
5	0x5	0	1	0	1		1	0	1	1	0	1	1	
6	0x6	0	1	1	0		1	0	1	1	1	1	1	
7	0x7	0	1	1	1		1	1	1	0	0	0	0	
8	0x8	1	0	0	0		1	1	1	1	1	1	1	
9	0x9	1	0	0	1		1	1	1	1	0	1	1	
10	0xA	1	0	1	0		1	0	0	1	1	1	1	
11	0xB	1	0	1	1		1	0	0	1	1	1	1	
12	0xC	1	1	0	0		1	0	0	1	1	1	1	
13	0xD	1	1	0	1		1	0	0	1	1	1	1	
14	0xE	1	1	1	0		1	0	0	1	1	1	1	

Decimal Digit	Hex	I	J	K	L		a	b	c	d	e	f	g	Display Pattern
15	0xF	1	1	1	1		1	0	0	1	1	1	1	

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