CMP 334 Practice Exam 1 (Spring 2019)

1 a) Convert 0x9D7A to binary.

b) Convert 0b11010011011011100111 to hexadecimal.

c) Convert 725_{10} to binary.

d) Convert 0b1000111001 to decimal.

e) Convert 1789_{10} to hexadecimal.

f) Convert 0x25AE to decimal.

2 a) Give the truth table (with columns for each sub-formula) for: $(\overline{ac} + a\overline{b}c) \cdot (ab + b\overline{c})$.

b) Draw a circuit for: $(\overline{ac} + a\overline{b}c) \cdot (ab + b\overline{c})$.

3) Given: X = 0xD7 and Y = 0x4B,

a) Convert X and Y to 8-bit binary numbers.

b) Compute the 8-bit sum $\mathbf{X \ddot{+} Y}$ of X and Y.

c) Compute $\ddot{\mathbf{Y}}$ the 8-bit two's complement of Y.

d) Compute the 8-bit difference $\mathbf{X \ddot{-} Y}$ of X and Y. (Use two's complement addition.)

e) Convert $\mathbf{X \ddot{+} Y}$, $\ddot{\mathbf{Y}}$, and, $\mathbf{X \ddot{-} Y}$ to hexadecimal.

f) What are the values of the condition flags upon computing $\mathbf{X \ddot{+} Y}$?

g) What are the values of the condition flags upon computing $\mathbf{X \ddot{-} Y}$?

h) **T** or **F** The unsigned 8-bit sum $\mathbf{X \ddot{+} Y}$ is honest.

i) **T** or **F** The signed 8-bit sum $\mathbf{X \ddot{+} Y}$ is honest.

j) **T** or **F** The unsigned 8-bit difference $\mathbf{X \ddot{-} Y}$ is honest.

k) **T** or **F** The signed 8-bit difference $\mathbf{X \ddot{-} Y}$ is honest.

4) Use the recipe for designing combinational circuits to design a circuit that determines if a 3 bit unsigned integer is prime. (Remember: an integer N is prime if, and only if, exactly 2 distinct positive numbers, 1 and N itself, divide N with a remainder of 0.)

a) Draw a black box for the circuit that specifies its inputs and output.

b) Formalize the informal semantics of this circuit with a truth table.

c) Construct the boolean formula corresponding to the truth table.

d) Draw the circuit corresponding to the boolean formula.

5 a) What does a multiplexer do?

b) Draw the circuit for a **2-way** multiplexer.

c) Build (draw) a **4-way** multiplexer *using 1-bit multiplexers*.

6) For each row in the following table, determine whether the assertion would hold if the indicated operation produced the indicated condition flag values.

operation		flags	assertion	T / F
A $\overset{\cdots}{+}$ B	unsigned	$\overline{Z}N\overline{C}V$	result is honest	
A $\overset{\cdots}{-}$ B	signed	$\overline{ZNCV}$	result is honest	
A $\overset{\cdots}{-}$ B	unsigned	$\overline{Z}N\overline{C}V$	result is honest	
A $\overset{\cdots}{+}$ B	signed	$\overline{Z}\overline{NCV}$	result is honest	
A $\overset{\cdots}{-}$ B	unsigned	$\overline{Z}NCV$	A > B	
A $\overset{\cdots}{-}$ B	signed	$\overline{Z}N\overline{C}V$	A < B	
A $\overset{\cdots}{-}$ B	unsigned	$\overline{ZNCV}$	A = B	
A $\overset{\cdots}{-}$ B	signed	$\overline{ZNC}\overline{V}$	A > B	
A $\overset{\cdots}{-}$ B	unsigned	$\overline{Z}NC\overline{V}$	A < B	
A $\overset{\cdots}{-}$ B	signed	$\overline{ZNCV}$	A ≥ B	
A $\overset{\cdots}{-}$ B	unsigned	$\overline{ZNCV}$	A ≤ B	
A $\overset{\cdots}{-}$ B	signed	$\overline{ZNCV}$	A = B	
A $\overset{\cdots}{-}$ B	unsigned	$\overline{Z}NC\overline{V}$	A ≥ B	
A $\overset{\cdots}{-}$ B	signed	$\overline{ZNCV}$	A ≤ B	