Complete the following problems. Be sure to show your work for partial credit.

1. Given the following two binary numbers: 11111100 and 01110000
   (a) Which of the two is larger in unsigned binary?
   (b) Which is larger in two’s complement?
   (c) Which is larger in signed magnitude?

2. Given a very tiny computer that has a word size of 6 bits, what are the smallest negative and largest positive integers this computer can represent in...
   (a) One’s complement?
   (b) Two’s complement?

3. Construct a truth table for the following:
   (a) \(xyz + x\overline{yz} + xy\overline{z}\)
   (b) \((x + y)(x + z)(\overline{x} + z)\)

4. If \(F(w, x, y, z) = xy\overline{z} + (wyz + x)\), what is \(\overline{F}\)?

5. Using algebraic manipulation, prove that the following two statement of DeMorgan’s Law are valid: \(\overline{xy} = \overline{x} + \overline{y}\) and \(\overline{x + y} = \overline{x} \cdot \overline{y}\).

6. Using the basic identities of Boolean algebra, show that: \(xy + xz + yz = xy + xz\).

7. Given the truth table below, write \(F\) in sum-of-products form and product-of-sums form.

\[
\begin{array}{ccc|c}
 x & y & z & F \\
 0 & 0 & 0 & 0 \\
 0 & 0 & 1 & 1 \\
 0 & 1 & 0 & 1 \\
 0 & 1 & 1 & 0 \\
 1 & 0 & 0 & 0 \\
 1 & 0 & 1 & 1 \\
 1 & 1 & 0 & 1 \\
 1 & 1 & 1 & 0 \\
\end{array}
\]

8. Construct an XOR operator using...
   (a) ... only AND, OR and NOT gates
   (b) ... only NAND gates

9. Create the K-maps and then simplify the following two functions.
   (a) \(F = \overline{x} \cdot \overline{y} \cdot \overline{z} + x \cdot y \cdot z + x \cdot \overline{y} \cdot \overline{z} + x \cdot y \cdot z\)
   (b) \(F = \overline{y} \cdot \overline{z} + \overline{y} \cdot z + x \cdot y \cdot z\)

10. Given the following K-map, show algebraically how the four terms reduce to one. (Assume the horizontal axis corresponds to \(ab\) and the vertical to \(c\).)

\[
\begin{array}{cccc|c}
 & 00 & 01 & 11 & 10 \\
 0 & 0 & 1 & 1 & 0 \\
 1 & 0 & 1 & 1 & 0 \\
\end{array}
\]