EGC220 Practice Problems for Exam 1

Some possibly useful relations:

$a + ab = a$	$a(a + b) = a$
$a + \bar{a}b = a + b$	$a(\bar{a} + b) = ab$
$ab + a\bar{b} = a$	$(a + b)(a + \bar{b}) = a$
$ab + a\bar{b}c = ab + ac$	$(a + b)(a + \bar{b} + c) = (a + b)(a + c)$
$ab + \bar{a}c + bc = ab + \bar{a}c$	$(a + b)(\bar{a} + c)(b + c) = (a + b)(\bar{a} + c)$

1. Circle T (true) or F (false) for each of these Boolean equations.

(a). $T \quad F \qquad A + 1 = A$

(b). $T \quad F \qquad A + BC = (A + B)(B + C)$

(c). $T \quad F \qquad \bar{A} \oplus \bar{B} = A \oplus B$

(d). $T \quad F \qquad A(BC) = (AB)C$

(e). $T \quad F \qquad \overline{A + B + C} = \bar{A} \cdot \bar{B} \cdot \bar{C}$

2. Evaluate the following:

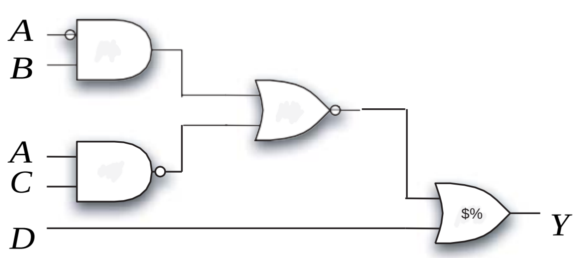
2(a). Convert to hex: 11001001.1011_2 =

2(b). Convert to decimal: 110101.01_2 =

2(c). Convert to binary: 98.25_{10} =

2(d). Convert to decimal: $2A.4_{16}$ =

3. Write the Boolean expression equivalent to the following logic circuit. Do not simplify!



4(a). Draw the logic circuit realization of the following Boolean expression as stated. Do not simplify! You may draw inverters explicitly or use inversion bubbles, as you choose.

$$Y = f(A, B, C) = \overline{(A + B)}(\overline{B} + C)$$

4(b). Write the complete truth table for the Boolean expression of 4(a).

4(c). Convert the Boolean equation of 4(a) to its DeMorgan equivalent.

4(d). Draw the logic circuit for the DeMorgan equivalent Boolean equation you found in 4(c). You may use inverters or inversion bubbles, as you choose.

5. Simplify the following Boolean expression as far as possible, using the postulates and theorems of Boolean algebra. *DO NOT* use a Karnaugh map except possibly to check your work. You do not have to justify each step by stating the theorem or postulate used, but you must show each step in your simplification.

$$f(w, x, y) = \bar{w}xy + wx + \bar{w}y + w\bar{x}y$$

6. Simplify the following expression using the postulates and theorems of Boolean algebra. Eliminate all group complements. Justify each step by stating or referring to the Boolean theorem or postulate you use. Don't skip any steps! Do NOT use a Karnaugh map to simplify the expressions.

$$(\overline{ABC})(A + C)(A + \overline{C})$$

Hint: Remember DeMorgan's theorem!

7. Given $Y = f(w, x, y, z) = \sum m(0, 1, 3, 5, 13)$,

7(a). Write the complete truth table for $Y = f(w,x,y,z)$.

7(b). Write $Y = f(w,x,y,z)$ in canonical POS form. (Do not use shorthand (Σ or Π) notation in your final answer.)

7(c). Write $Y = f(w,x,y,z)$ in shorthand SOP canonical form. (Use Σ or Π notation in your final answer.)

7(d). Write $Y = f(w,x,y,z)$ in canonical SOP form. (Do not use shorthand (Σ or Π notation) in your final answer.)

8. For $Y = f(w,x,y,z) = \Pi M(0,1,3,5,13)$ as given in Problem 7,
8(a). Fully label and complete the Karnaugh map below with Y as given above. Then derive a minimized POS expression for $Y = f(w, x, y, z)$.

8(b). Fully label and complete the Karnaugh map below with Y as given above. Then derive a minimized SOP expression for Y.

9. For $Y = f(w, x, y, z) = \Pi M(0, 1, 2, 3, 5, 8, 9, 13)$

(a). Fully label and complete the Karnaugh map below with Y as given above. Then derive a minimized POS expression for $Y = f(w, x, y, z)$.

(b). Fully label and complete the Karnaugh map below with Y as given above. Then derive a minimized SOP expression for Y.

10 Combinational Logic:

Design a circuit that counts the number of 1's present in 3 inputs A, B and C. Its output is a two-bit number X_1X_0, representing that count in binary. Assume active-HIGH logic.

(a) Write the truth table for this circuit.

(b). Find the minimized logic equations for outputs X_1 and X_0; use a K-map if needed.

(c). Draw the corresponding logic diagram for this circuit. Label all inputs and outputs.