

King Fahd University of Petroleum and Minerals
College of Computer Sciences and Engineering
Department of Computer Engineering
COE 202 – Digital Logic Design (T161)

Homework # 02 (due date & time: Thursday 13/10/2016 during class period)

***** Show all your work. No credit will be given if work is not shown! *****

Showing all calculations steps (i.e. final answers alone are not acceptable), solve the following:

Problem 1 (20 points): Find the result of the following arithmetic operations:

- i. $(37.5)_{16} + (59.6)_{16}$
- ii. $(37.5)_8 + (59.6)_{16}$
- iii. $(1010)_2 \times (1100)_2$
- iv. $(111100)_2 - (100101)_2$

Problem 2 (10 points): Using algebraic manipulation, prove the identity of each of the following Boolean equations:

- (a) $\overline{AB} + \overline{BC} + AB + \overline{BC} = 1$
- (b) $Y + \overline{XZ} + X\overline{Y} = X + Y + Z$

Problem 3 (10 points): Reduce the following Boolean expressions to indicated number of literals:

- (a) $\overline{X}\overline{Y} + XYZ + \overline{X}Y$ to three literals
- (b) $(AB + \overline{A}\overline{B})(\overline{C}\overline{D} + CD) + \overline{AC}$ to four literals

Problem 4 (10 points): Using DeMorgan's theorem, express the function $F = \overline{A}BC + A\overline{C} + \overline{A}B$

- (a) with only OR and complement operations.
- (b) with only AND and complement operations.

Problem 5 (10 points): Find the complement of the following expressions:

- (a) $\overline{(\overline{X} + \overline{Y})Z}$ (complement should have 3 literals)
- (b) $\overline{(A + B + \overline{C})(\overline{A}B + C)(A + \overline{B}\overline{C})}$ (complement should have 5 literals)

Problem 6 (10 points): Draw the logic diagram for the Boolean expression $\overline{(A + BC + C\overline{D})(\overline{B} + \overline{E}\overline{F})}$.

The diagram should correspond exactly to the expression. Assume that the complements of the inputs are **not** available.

Problem 7 (15 points): For the function $F(A, B, C, D) = \overline{A}C(B + \overline{D})$:

- i. Provide the corresponding truth table.
- ii. Express F in sum of minterms form $\{\Sigma(m_i)\}$.
- iii. Express F in product of Maxterms form $\{\Pi(M_i)\}$.

Problem 8 (10 points):

For the Boolean function $F(A, B, C, D) = \Sigma(m_0, m_2, m_5, m_7, m_{11}, m_{14})$:

- i. Without simplification, write the corresponding algebraic Boolean expression for F .
- ii. Without simplification, write the corresponding product of Maxterms algebraic Boolean expression for F .

Problem 9 (5 points): Using Boolean Algebra, put the sum of minterms function $F(x, y, z) = x'y'z' + xy'z + x'yz' + x'y'z$ into its simplest form.