EE 2720, Spring 2012

Homework #2

Due Wednesday February 15, in class

Note: DO NOT do problem 5
EE 2720, Homework #2

Note: Please STAPLE your homework.

Problem 1: Using the two's-complement system perform the addition of the 6-bit numbers \( X \) and \( Y \) where \( X = 010100_2 = +20_{10} \) and \( Y = 001111_2 = +15_{10} \). Do you have an overflow or underflow in this case? Justify your answer.

Problem 2: Using the two's-complement system perform the addition of the 6-bit numbers \( X \) and \( Y \) where \( X = 101100_2 = -20_{10} \) and \( Y = 110011_2 = -15_{10} \). Do you have an overflow or underflow in this case? Justify your answer.

Problem 3: Perform the addition \( X + Y \) where \( X \) and \( Y \) are the following 6-bit signed-magnitude numbers:
\( X = 010100_2 = +20_{10} \) and \( Y = 111100_2 = -30_{10} \). Follow the same procedure as the one of the example on pages 23-24 of handout #3.
Problem 4: Perform the unsigned binary multiplication with multiplicand $X = 110_2 = 13_{10}$ and multiplier $Y = 1110_2 = 14_{10}$.

Problem 5: Perform the signed two's complement binary multiplication with multiplicand $X = 1010_2 = -6_{10}$ and multiplier $Y = 1001_2 = -7_{10}$. 

Problem 6: Perform in BCD the addition $7 + 9$.

Problem 7: Perform in BCD the addition $5 + 4$. 

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Problem 8: Prove theorems (CT1'), (CT2'), (CT3'), (CT3'), (CT4), (CT5') found in handout #5.

Problem 9: Prove theorem (CT7) of handout #5 by using a truth table.

Problem 10: Prove theorem (CT10') of handout #5. You are not allowed to use a truth table.

Problem 11: Prove theorem (CT13') of handout #5 using the finite induction technique.

Problem 12: Prove the theorem that states \((X+Y) \cdot (X'+Z) = X \cdot Z + X' \cdot Y\). You are not allowed to use a truth table. Hint: Use theorem (CT11).
Problem 13: Prove that theorem (T10) is a special case of theorem (T11). Look at handout #5 for theorems (T10), (T11).

Problem 14: Use the theorems of switching algebra to simplify the following:

(a) \( F = W \cdot X \cdot Y \cdot Z \cdot (W \cdot X \cdot Y \cdot Z' + W \cdot X \cdot Y \cdot Z' + W' \cdot X \cdot Y \cdot Z + W \cdot X \cdot Y' \cdot Z) \)

(b) \( F = A \cdot B + A \cdot B \cdot C' \cdot D + A \cdot B \cdot D \cdot E' + A \cdot B \cdot C \cdot E' + C' \cdot D \cdot E \)