Switching Circuits and Logic Design

Quiz 1

14:20 ~ 15:10, October 16, 2008

1. Add the following numbers in binary using 2's complement to represent negative numbers. Use a word length of 6 bits (including sign) and indicate if an overflow occurs.
   a) **[10 points]** $(-23)+11$
   b) **[10 points]** $(-18)+(-17)$

2. **[15 points]** Factor the following expression to obtain a minimum product-of-sums.

$$F = AB' + CD' + E$$

3. **[15 points]** Prove $(x \oplus y) \oplus z = x \oplus (y \oplus z)$ and **[15 points]** find its minimum sum-of-products expression.

4. A full adder has three inputs (X, Y, C_{in}) and two outputs (Sum, C_{out}).
   a) **[10 points]** Please write the Boolean expression of C_{out} in minimum sum-of-products.
   b) **[15 points]** Please write the minterm expansion of $Sum = \sum m(?)$. Suppose that X is the most significant bit and C_{in} is the least significant bit. That means:
   $(X, Y, C_{in}) = (1,0,0)$ represents m_4. $(X, Y, C_{in}) = (0,0,1)$ represents m_1.

5. **[10 points]** Suppose that $F(A,B,C,D) = \prod M(0,2,3,4,5,10,11,12,13,15)$. Please show F' in minterm expansion.