HOMEWORK 6

Revision 0

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1. Do the following non-textbook problems:
   a. Obtain the 1's and 2's complements of the following unsigned binary numbers: 10001000, 10011001, 10101100, 00000000, and 10000000.
   b. Perform the indicated subtraction with the following **unsigned** binary numbers by taking the 2's complement of the subtrahend:
      a) 11011 – 10000
      b) 10110 – 1011
      c) 100 – 101000
      d) 1011100 – 1011100

      Note: You must choose a size for your 2's complement numbers.
   c. The following binary numbers are **6-bit 2's complement** numbers. Perform the indicated arithmetic operations and verify the answers.
      a) 101111 + 111011
      b) 001011 + 100010
      c) 110001 – 001110
      d) 101010 – 110111
   d. Construct a 4-to-16 decoder with an enable input using five 2-to-4 decoders with enable inputs.
   e. A combinational circuit is defined by the following three Boolean functions:

      $F_1(X,Y,Z) = /(X+Y) + X\ Y\ /Z$
      $F_2(X,Y,Z) = /(X+Y) + /X\ Y\ Z$
      $F_3(X,Y,Z) = /(X+Y) + X\ Y\ Z$

      Design the circuit with a decoder and external OR gates.
   f. Construct a 9-input multiplexer using a single 8-input multiplexers and one single 2-input multiplexer. The multiplexers should be interconnected and inputs labeled so that the selection codes 0000 through 1000 can be directly applied to the multiplexer selection inputs without added logic.
   g. Implement a binary full adder with a dual 4-input multiplexer and a single inverter

2. Find a) SOP (using minterms), b) POS (using maxterms, c) MSOP, and d) MPOS for the following function. Use K-maps for c) and d). Note: The SOP using minterms is called a Canonical SOP; the POS using maxterms is a Canonical POS.
   F = A C + B D' + A' C' D + A B' C D + A' B' C D'

3. Do the following Roth textbook problems:
   - K-map problems:
     5th edition: 5.4, 5.9, 5.25 (this last problem should say ABCD = 1001 for the middle "never occurs")
     6th edition: 5.4, 5.9, 5.30 (this last problem should say ABCD = 1001 for the middle "never occurs")
     7th edition: 5.4, 5.9, 5.30 (this last problem should say ABCD = 1001 for the middle "never occurs")
   - Use K-maps to find the MSOP and MPOS of the following problems:

     5th, 6th and 7th: 4.6a, 4.6b (MSOP and MPOS)
   - Use K-maps to find the MSOP or MPOS of the following problems:
     5th edition: 4.25a, c (MSOP and MPOS)
     6th and 7th edition: 4.32a, c (MSOP and MPOS)
   - MSI
     5th, 6th and 7th: 9.1 a-c, 9.5 (call the outputs X_1, X_0, and W, where indicates that at least one-input is true)

Do the below problems before exam 1, but they are **NOT** required for this homework.

4. Do the following Lam textbook problems:
   - 4.6, 4.9, 4.13
   - [4.15 in Lam is reworded here]: Design a 16-input MUX using 74'253 MUXs (as many as you need) and **no** decoders. 74'253 MUXs have tri-state enables, i.e., when the enable is false, the outputs are high-impedance.
   - 4.16: Note that Figure 4.18 is available on the homework page of our website.