Logic Course Assignment #4

1 - Implement the function \( f(A,B,C,D) = \Sigma m(0,1,2,3,4,8,9,12) \) using the following two level forms by assuming that the 4 inputs and their complements are available:

a) NAND-AND  \{Reminder: that means a set of NAND gates (first level), whose outputs go to a single AND gate (second level)\}

b) AND-NOR

c) OR-NAND

d) NOR-OR

2 - A logic circuit is needed to convert a 4-bit input number \( (b_3b_2b_1b_0) \) which is in sign magnitude format to a 4-bit output number \( (d_3d_2d_1d_0) \) which is in two’s complement format.

a) Draw the truth table for each of the outputs and simplify them to SOP and POS forms using K-map.

b) Assuming that the inputs and their complements are available, use a NAND-NAND circuit for each of the four outputs.

c) Assuming that the inputs and their complements are available, use a NOR-NOR circuit for each of the four outputs.

3- For the same circuit as problem 2, and assuming that only the 4 inputs are available:

a) Implement each of the four outputs using only NAND2 gates (i.e. 2-input NAND.)

b) Implement each of the four outputs using only NOR2 gates (i.e. 2-input NOR.)

try to use the minimum number of gates in each case.