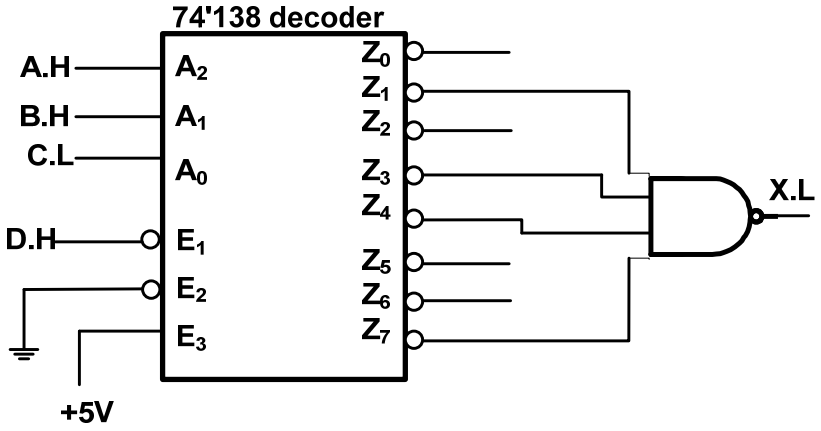
Tutorial 5 - Questions (Part 1)

Combinational MSI circuits

1. Use a 74'283 adder chip and some logic gates to find the magnitude of a 4-bit number represented in the 2's complement notation.

2. Find the Boolean expression for X in the circuit below



3. $S_3S_2S_1S_0$ is a 4-bit number in the 2's complement representation, and **S** is the corresponding decimal number.

   (a) Write down a table showing the value of **S** for all combinations of $S_3S_2S_1S_0$.

   (b) It is required to compare two 4-bit signed numbers, **A** and **B**, represented in the 2's complement notation. If a 4-bit *magnitude* comparator is available, design a circuit based on this comparator to yield the relationship between the two *signed* numbers (i.e. greater than, less than, equal). Show a neat, clearly labeled circuit diagram and give a brief explanation of your design (*Hint*: use gates?).

4. Z is a Boolean function of 3 input variables A, B and C. Z = B, if A = C; else Z = 0.
   (a) Design and draw a clearly labeled circuit diagram to implement Z using only one 8-bit multiplexer.
   (b) Can problem in part (a) be done with only one 4-bit MUX instead of the 8-bit MUX?

5. Table below shows the relationship between two 4-bit codes B and N. Design a circuit to convert from code B to code N. For example, if the input B codeword is "0001", the circuit should output N codeword "0111" by using some combination of decoders, encoders, multiplexers, de-multiplexers and comparators, without using any gates at all. Draw a neatly labeled circuit diagram and provide a brief explanation of circuit operation.

B_3	B_2	B_1	B_0	N_3	N_2	N_1	N_0
0	0	0	0	0	0	1	1
0	0	0	1	0	1	1	1
0	0	1	0	1	0	0	0
0	0	1	1	0	0	1	0
0	1	0	0	0	1	1	0
0	1	0	1	1	0	0	1
0	1	1	0	0	0	0	0
0	1	1	1	1	1	1	1
1	0	0	0	0	1	0	1
1	0	0	1	0	0	0	1
1	0	1	0	1	0	1	0
1	0	1	1	0	1	0	0
1	1	0	0	1	0	1	1
1	1	0	1	1	1	0	1
1	1	1	0	1	1	0	0
1	1	1	1	1	1	1	0