1. It is required to design a Combinational circuit that compares two n-bit numbers, $A=A_{n-1}$-A_0 and $B=B_{n-1}$-B_0, to check if **A is less than B** or not. Design a circuit that has three inputs and one output that can be used for each of the n bits, such that the circuit is connected in cascade by carry-like signals. One of the inputs to each circuit is a carry input, and the single output is a carry output. If the final output from the last circuit is 1, then this indicates that A is less than B, otherwise A is greater than or equal to B. Using this circuit, show the design of a 4-bit less than comparator.
2. Design a circuit that accepts a 4-bit number and produces the 2's complement equivalent of the 4-bit number. It is NOT permitted to use a full-adder circuit for this implantation.

3. You are required to design a combinational circuit that computes the remainder of dividing a 4-bit number $N_3N_2N_1N_0$ by 3. For example, the remainder of dividing the number 1010 by 3 is 01 and the remainder of dividing the number 0101 by 3 is 10.
   a. Derive the truth table showing the relation between inputs and outputs
   b. Derive simplified sum of products expressions for the outputs.

4. Design a circuit that accepts two 2-bit unsigned numbers $A = A_1A_0$ and $B = B_1B_0$. The circuit produces $A \oplus B$ when $A \geq B$, and produces $A \odot B$ otherwise. Use **NOR gate(s)** and one **non-inverted-output** decoder to implement the circuit (other gates cannot be used for the implementation). Mark clearly the inputs and the outputs of the decoder.
5. Problems 3-10, 3-15, 3-16, 3-17 from the textbook.