### Digital Design: Tutorial-3 (without Quiz)

**Q1.** Minimize the logical expression using a K-Map.

$$f(A,B,C,D) = \prod(0,1,2,4,5,7,10,15)$$

**Q2.** Design a combinational circuit with three inputs and one output under the following conditions
   a. The output is 1 when the binary value of the inputs is less than 3. The output is 0 otherwise. Use only NOR-NOR logic to design the circuit. Use only two-input gates.
   b. The output is 1 when the binary value of the input is an even number. The output is 0 otherwise. Use only NOR-NOR logic (use only two-input gates) to design the circuit.

**Q3.** Design a combinational circuit with three inputs x, y, and z and three outputs A, B, and C. When the value (in decimal) of the input is 0, 1, 2, or 3, the output is 2 greater than the input. Whereas, when the input is 4, 5, 6, or 7, the output is 3 less than the input. Realize the circuit with NAND-NAND logic (use only two-input gates).

**Q4.** Design a combinational circuit that generates the 9's complement of a BCD Digit. Use AND-OR-NOT logic (with only two-input gates) to realize the circuit.

**Q5.** Design a four-bit "2's Complementer" circuit. Show that the circuit can be designed with the help of exclusive OR logic/gates. You may use any input, any logic gate.