Q1) Design a circuit that has four inputs (A,B,C,D) and one output F as follows: F=1 if the decimal equivalent of the input is even and less than or equal 6, and F=0 if the decimal equivalent of the input is odd and greater than or equal 10. Find the minimal F in SOP form.

A	B	C	D	F

Q2) Consider the following circuit. (a) Draw the truth table (b) In one sentence explain the main task of the circuit
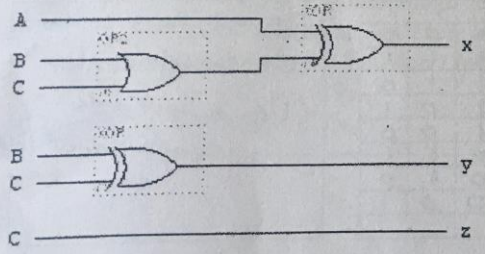
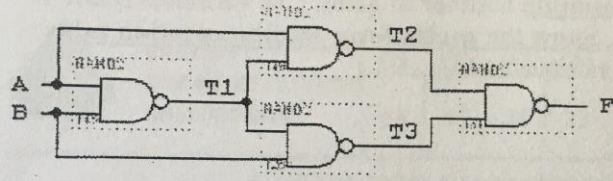| A	B	C	x	y	z

The main task is

Inputs: A,B,C (A is the MSB)
Outputs: x,y,z (x is the MSB)

Q3)

Consider the following logic circuit:

A	B	T_1	T_2	T_3	F

a) Analyze the circuit and fill in the above Truth-Table

b) **Write** F in its simplest form, and **reimplement** it using minimum number of Full-Adders **only**.

F =

Augend   Addend

C_{out} ← Full-Adder ← C_{in}

Sum
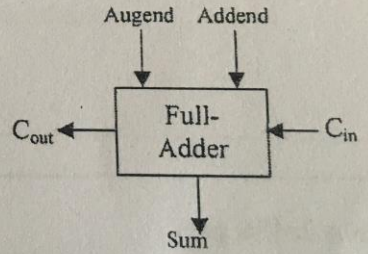
Using minimum number of gates, design a combinational circuit that has 4 inputs (A,B,C,D) and whose output is to be determined as follows: For each input combination, the output represents the total number of consecutively equal bit pairs. Overlapping is allowed. For example, for the input combination 0101, the output is 0; For the input combination 0000, the output is 3; For the input 1100, the output is 2 etc... Show the details of your work. Assume that the complements of all inputs, except input A, are **not** **available**.

📄 **Question 5: [15 pts]**

Consider the function $F(A,B,C,D) = \Sigma(4,7,8,11) + d(1,2,13,14)$

Implement F using **two 2×4 decoders, two 2-input OR gates**, and **one** 2-input **AND** gate **only**.