National University of Computer and Emerging Sciences, Lahore Campus

Course Name:	Digital Logic Design	Course Code:	EE227
Program:	BCS & BDS	Semester:	Spring 2022
Duration:	150 Minutes	Total Marks:	80
Paper Date:	23-June-22	Weight	40%
Section:	ALL	Page(s):	9
Exam Type:	Final		

Name:_____ Roll No._____ Section:_____

Instruction/Notes:

1. *Attempt all the questions on **this** answer booklet. **You can do your scratch work on rough sheets but they will not be collected and marked.***
2. ***Properly label** all blocks and inputs/outputs to get credit.*
3. ***Provide only "one" final solution in the given space**. Otherwise, both solutions will be cancelled and no mark will be given.*

Question # 1: [Marks: 10]

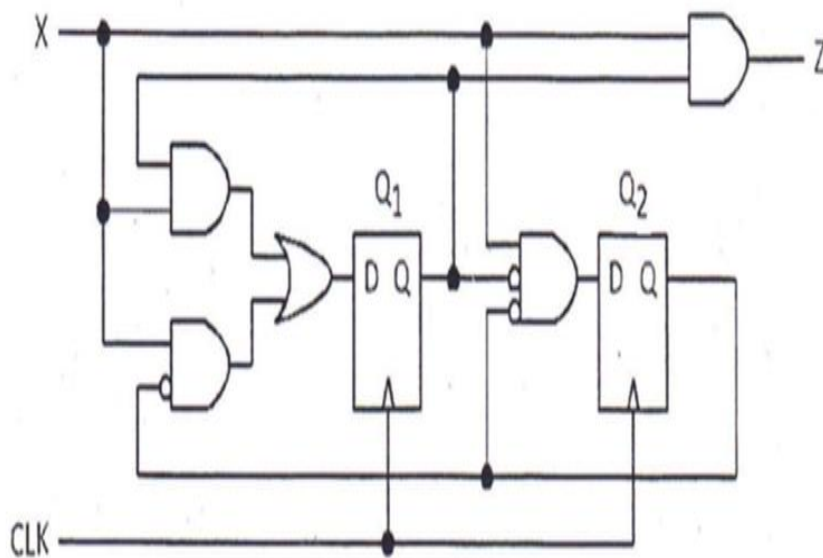a) Design and implement a sequential circuit which counts the following sequence using D flip flops:

0, 2, 4, 5, 7, 0 and repeat

State Table and State Diagram

Name:_____   Roll No._____

Question # 2:   **[Marks: 15]**

Analyze the following circuit to derive the **equations, state table** and the **state diagram** of the sequential circuit shown below**.**

Note: Show complete solution of state table, equations, state diagrams to get full credit.

Equations

State Table and State Diagram

Question # 3:   **[15 Marks]**

A synchronous sequential circuit is to be designed for generating the parity of a continuous stream of binary digits. The output of the circuit produces a logic "1" if the number of 1's received at the input is even. The output is "0" otherwise. Implement the circuit using D flip-flops as memory elements.

Question # 4:   **[Marks: 20]**

Design and implement a sequential circuit that receives a continuous stream of BCD input digits and counts the frequency of digit 6 (binary 0110) received at its input. e.g., if the input BCD stream is 4326590662618, then the count is 4 (binary 0100) because there are four 6's in this stream. In the input stream, digit 6 can appear up to five times.

Note: the BCD numbers are arriving serially; so, every BCD digit takes four clock cycles to arrive.

Question # 5:   **[Marks: 20]**

Design a 4-bit mini-Process Unit that works according to the given functionality:

M_1	M_0	F(A,B) = Operation	Function Description
0	0	**A – 2*B**	Subtract 2 times B from A
0	1	**A + 4*B**	Add 4 times B to A
1	0	**A + B**	Add A and B
1	1	**A + 1**	Increment A

Where A and B are two 4-bit numbers. M inputs to your mini processor are control inputs. **Your task is to add required logic in the design given below in order to make mini-processor fully functional.**

Note: Assume that you already have Adder, Subtractor, Decoder(s), Encoder(s), MUX(s), DMUX(s) and Multiplier(s) blocks available. **Properly label all blocks and inputs/outputs to get full credit.**

Rough Sheet