Digital Logic

2023 Fall Assignment 4

- Write neatly and submit an e-copy to Blackboard on time.
- Do write down ALL procedures. Only presenting the final answer will lead to a zero, even the answer is correct.

1. (20 points) Design a 4-bit register with four D flip-flops and four 4 × 1 multiplexers with mode selection inputs s1 and s0. The register operates according to the following function table. Derive the function table of the 4-bit register and draw the logic diagram.

S1	S0	Register Operation
0	0	No change
0	1	Complement the four outputs
1	0	Clear register to 0
1	1	Load parallel data

2. (25 points) Design a sequence generator to generate the sequence 1011110. Write down all the steps and draw the logic diagram.

3. (25 points) Design a synchronous counter using DFFs that has the following sequence: 0010, 0110, 1001, 1000, 1100, 1101, and repeat. From the undesired states the counter must always go to 0010 on the next clock pulse. Write down all the steps and draw the logic diagram.

4. (30 points) Design a counter with T flip-flops that goes through the following binary repeated sequence: 0, 1, 3, 7, 6, 4. Derive the input equations for the FFs. Show that when binary states 010 and 101 are considered as don't care conditions, the counter may not operate properly. Find a way to correct the design.