

HW5

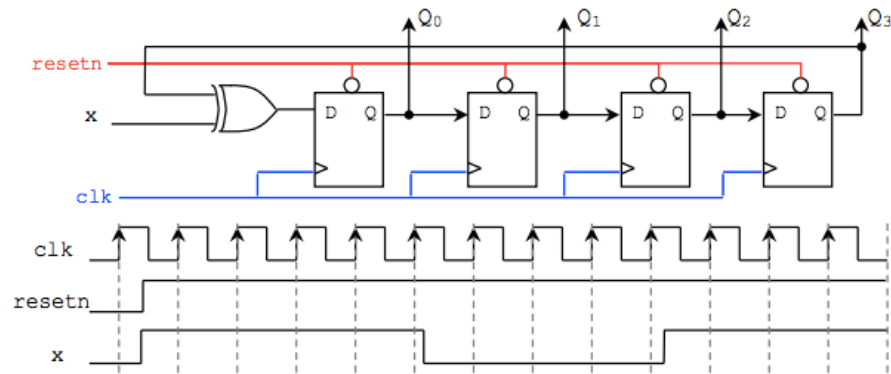
1. (20%) A sequential circuit with two D flip-flops A and B , two inputs x and y , and one output z is specified by the following next state equations and output equation:

$$A(t+1)=x'B(t)+xy', \quad B(t+1)=A'(t)+y'B(t), \quad z=yA'B$$

- (a) Draw the logic diagram of the circuit.
 - (b) Derive the state table.
 - (c) Derive the state diagram.
2. (20%) Design a synchronous finite state machine whose output is the sequence 0, 1, 3, 5, 7, 9, 0, 1, 3, 5, 7, 9, 0, The machine is controlled by a single input, **Run**, so that counting occurs while **Run** is 1, suspends while **Run** is 0, and resumes the count when **Run** is 1 again. Clearly state any assumptions that you make.
3. (20%) For the state table below:
- (a) Reduce the number of states in the following state table and tabulate the reduced state table. Assume the initial state is A.
 - (b) Draw the state diagram using the reduced state table.
 - (c) Draw the logic diagram of the logic.
 - (d) Show the output sequence when the input sequence is 111010101.

Present state	Next state		Output	
	$x = 0$	$x = 1$	$x = 0$	$x = 1$
A	F	B	0	0
B	D	E	1	0
C	F	E	0	0
D	G	A	1	0
E	D	E	1	0
F	F	B	1	1
G	G	A	1	0
H	G	C	0	0

4. (20%) Derive the timing diagram of the following circuit. Draw Q_3 , Q_2 , Q_1 , and Q_0 .



5. (20%) Design a sequential circuit with two D flip-flops A and B and two inputs X and Y . When $X = Y$, the state of the circuit remains the same. When $X \neq Y$, the circuit goes through the state transitions from 00 to 11 to 01 to 10, back to 00, and then repeats.