

CSE140 Midterm 2, November 14, 2012, Name _____

1. Universal Set of Gates:

1.1. State the definition of universal set of gates (8 points).

1.2. Check if the set in the following list is universal and explain your decision. Assuming constants 0 and 1 are available as inputs (12 points).

1.2.1. {OR, NOT}

1.2.2. {NAND, NOR}

1.2.3. $\{f(x, y)\}$, where $f(x, y) = x'y$

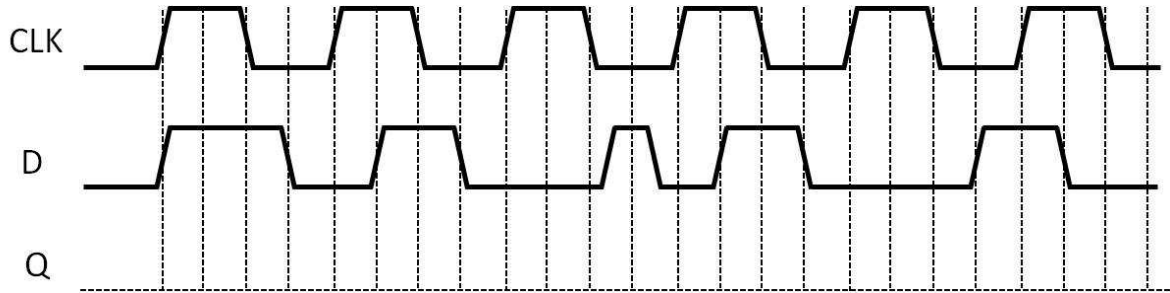
1.2.4. $\{f(x, y, z)\}$, where $f(x, y, z) = (x'y' + xy)z$

2. Other Types of Gates: Prove or disprove using Boolean algebra the following statement (15 points).

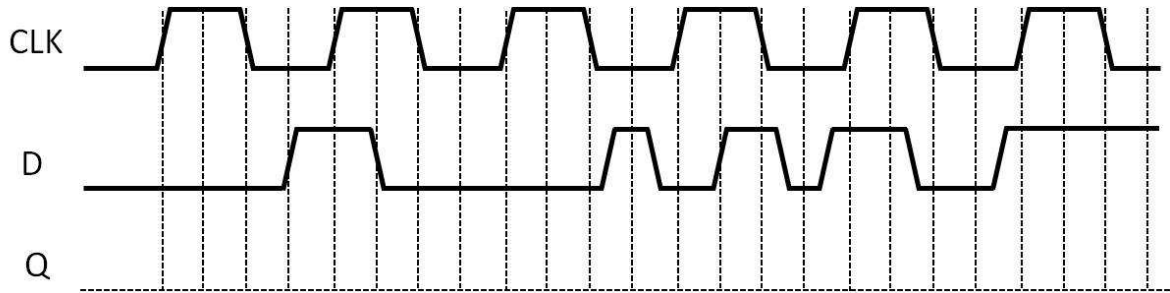
If $AB = 0$ then $A \oplus B = A + B$.

3. Timing Diagram of Latch and Flip-Flop:

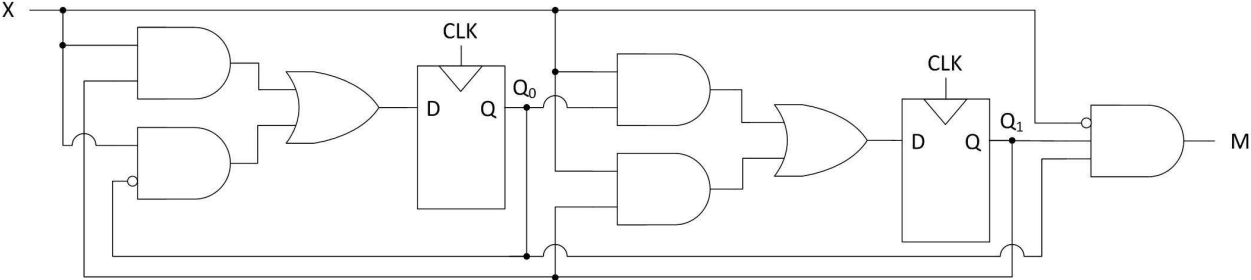
3.1 Given the input waveforms shown below, sketch the output, Q, of a **D latch** (10 points).



3.2 Given the input waveforms shown below, sketch the output, Q, of a **D flip-flop** (10 points).



4. (Finite State Machine Specification) Analyze the following circuit.



4.1 Write the transition(excitation) table (8 points).

4.2 Sketch the state diagram. Assign the initial state S_0 as 00. (7 points).

4.3 Fill the following table and describe in words what the finite state machine does (5 points).

cycle	1	2	3	4	5	6	7	8	9	10
X	1	1	1	0	0	0	1	1	1	0
state	S_0									
M										

5. (Flip-Flops) Implement a T flip-flop with a D flip-flop and a minimal AND-OR-NOT network. Let us assume that the complements of T, D and Q signals are available. Draw the logic diagram to show your design (25 points).