

Name: _____

Write all of your responses on the extra paper provided. Hand in this exam paper along with your solutions, please place your name on the top of each page. Show all of your work.

1 Short Answer

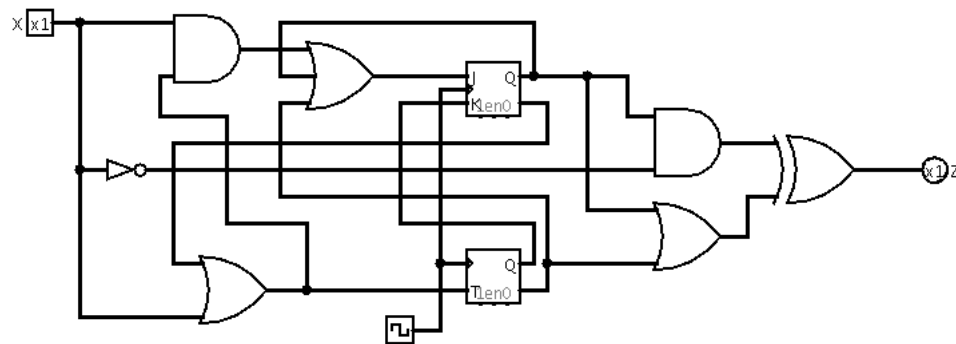
Each question is worth 10 points.

1. Construct the truth table, logical expressions, and circuit (using AND, OR, and NOT gates) for the half-adder.
2. Construct the truth table and logical expressions for the full-adder.
3. Use a 3-8 decoder to create a circuit with three inputs A , B , and C (thought of as the binary number ABC) and two outputs, Even and Odd. If the number ABC is even the Even output should be 1 and the Odd output should be 0. Similarly, if the number ABC is odd the Even output should be 0 and the Odd output should be 1.
4. Construct two clocked 4-bit counters, one using JK flip-flops and the other using T flip-flops.
5. Draw the circuit diagram for a clocked SR flip-flop, with asynchronous preset and clear. Use only NOR and AND gates.
6. Using an SR flip-flop and AND gates create a clocked JK flip-flop.

2 Circuit Analysis

Do only one exercise in this section, it is worth 50 points.

7. For the following circuit, the top flip-flop is a JK flip-flop and the bottom flip-flop is a T flip-flop.
 - (a) Create the transition tables for the two flip-flops.
 - (b) Create the transition table.
 - (c) Create the next state table.
 - (d) Create the output table.
 - (e) Create the next state/output table.
 - (f) Create the state diagram.



8. Design a sequential circuit that detects an input sequence of 1101 with overlap. Use only JK flip-flops in your construction.

Flip-Flop Characteristic Tables

$Q(t)$	SR	$Q(t+1)$
0	00	0
0	01	0
0	10	1
0	11	—
1	00	1
1	01	0
1	10	1
1	11	—

$Q(t)$	JK	$Q(t+1)$
0	00	0
0	01	0
0	10	1
0	11	1
1	00	1
1	01	0
1	10	1
1	11	0

$Q(t)$	D	$Q(t+1)$
0	0	0
0	1	1
1	0	0
1	1	1

$Q(t)$	T	$Q(t+1)$
0	0	0
0	1	1
1	0	1
1	1	0

Flip-Flop Excitation Tables

$Q(t)$	$Q(t+1)$	SR	D	JK	T
0	0	0d	0	0d	0
0	1	10	1	1d	1
1	0	01	0	d1	1
1	1	d0	1	d0	0