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 6 points.

1. Construct the truth tale for both the half adder and the full adder. Also, give their logical equations.
2. Explain what an encoder circuit does. That is, what are the inputs, outputs, and function.
3. Explain what a decoder circuit does. That is, what are the inputs, outputs, and function.
4. Explain what a multiplexer circuit does. That is, what are the inputs, outputs, and function.
5. Explain what a demultiplexer circuit does. That is, what are the inputs, outputs, and function.
6. Draw the circuit diagram for a clocked SR flip-flop.
7. Using a clocked SR flip-flop, draw the diagram for a D flip-flop.
8. Using a clocked SR flip-flop, draw the diagram for a JK flip-flop.
9. Using a clocked JK flip-flop, draw the diagram for a T flip-flop.
10. Using clocked JK flip-flops, construct a 4-bit counter.

2 Circuit Analysis

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

11. For the following circuit, the top flip-flop is a T flip-flop and the bottom flip-flop is a JK flip-flop.

    (a) Create the transition tables for the two flip-flops.

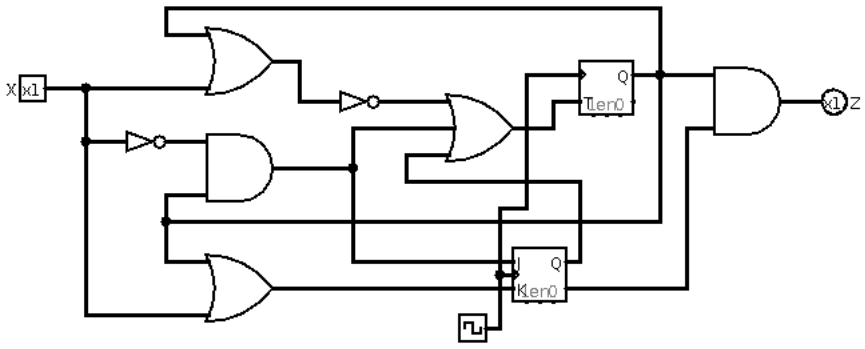
    (b) Create the transition table.

    (c) Create the next state table.

    (d) Create the output table.

    (e) Create the next state/output table.

(f) Create the state diagram.



12. Design a sequential circuit that detects an input sequence of 1001 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