EXAMINATION RULES

1. This is an open-book/open-note take-home exam.

2. Do your own work on this examination. You are on your honor. Therefore, you will neither give nor receive aid on this examination, except from the course instructor. If you violate this trust, you will receive the grade of zero for this examination.

3. Show all of your work! Do all your work on separate paper. Make it neat. No partial credit will be given if I cannot easily follow your work.

4. The completed examination is to be handed in by 4:30pm on Friday, December 1, 2000.

5. Please read and sign the following statement when you finish the exam:

   I certify that I have neither given nor have I received any help on this examination, except from the course instructor.

   SIGNED: ____________________________________________________________

   PRINT NAME: _______________________________________________________

   DATE: ____________

   1 _____________ / 12 pts

   2 _____________ / 6 pts

   3 _____________ / 14 pts

   4 _____________ / 18 pts

   Total _____________ / 50 pts
1. (12 pts) A sequential circuit has 2 rising edge triggered flip-flops (outputs A and B), two inputs (X and Y) and one output Z. The logic expressions for this circuit are:

\[
\begin{align*}
D_a &= X' \cdot Y + X \cdot A \\
J_b &= X' \cdot B + X' \cdot A \\
K_b &= Y \cdot B \\
Z &= X \cdot B
\end{align*}
\]

A Sketch a circuit diagram  
B Construct a transition table  
C Construct a state diagram

2. (6 pts) Suppose a Moore machine has three flip-flops, two inputs, and five outputs. Answer the following.

A What is the maximum and minimum number of states in the state diagram?  
B What are the maximum and minimum numbers of transition arrows starting at a particular state?  
C What are the maximum and minimum numbers of transition arrows ending at a particular state?  
D What are minimum and maximum number of output patterns that can appear?  
E Are the outputs synchronous or asynchronous?  
F Which of the above will change for a Mealy Machine? (give the letter and the new answer)
3. (14 pts) Draw the state diagram for a Mealy state machine with two inputs (X and Y) and two outputs (Z1 and Z2). The two inputs represent a two bit binary number (N). If the present value of N is greater than the previous value of N then Z1=0 and Z2=1. And if the present value of N is less than the previous of N then Z1=1 and Z2=0. Otherwise Z1=Z2=0.

4. (18 pts) Complete the design for the state machine described in the state diagram below.

A. Write out the state table
B. Assign states using a simple binary order (S0 = ABC = 000) and assign the unused states to go to State S2 as their next state if X=1 and S1 if X=0. The write out the transition table.
C. Write out the flip-flop input excitation table assuming JK flip-flops are used
D. Sketch the circuit diagram