COE/EE 243 **Sample Exam #5** **Originally Nov 29, 2000**

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 can not 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:

$$\begin{aligned} D_a &= X' \cdot Y + X \cdot A \\ J_b &= X' \cdot B + X' \cdot A \\ K_b &= Y \cdot B \\ Z &= X \cdot B \end{aligned}$$

   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?

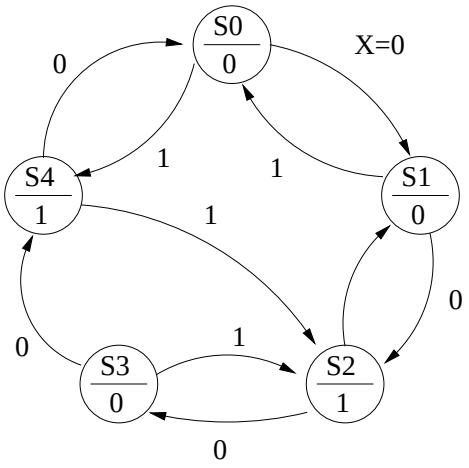
   D What are minimum and maximum number of output patterns that can appear?

   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