COE/EE 243

Sample Final Exam

From Fall 98

Show your work. Do **NOT** use a calculator!

1. (9 pts) Complete the following table of equivalent values.

Binary	Octal	Decimal	Hexadecimal
1011.0011			
		29.99	
	33.23		

2. (12 pts) Calculate the following
   a) $(11001)_2$ plus $(101)_2$
   b) $(11010)_2$ minus $(10101)_2$ using 1's complement representation
   c) $(1101)_2$ times $(1001)_2$
   d) $(101101)_2$ divided by $(110)_2$

3. (9 pts) Complete the following table of equivalent values. Use binary numbers with a sign bit and 5 bits for the value

Decimal	Signed Magnitude	Two's Complement	One's Complement
-11			
			111101
	100001		

4. (8 pts) Give the Characteristic equations and the Excitation tables for the *SR* and *JK* flip-flops.

5. (10 pts) Explain the difference between a **Moore** machine and a **Mealy** machine.

   What is the same about both kinds of state machines?

   Draw a block diagram indicating the structure of a general state machine. Indicate on the diagram where one can find the **present state** and **next state**.

6. (5 pts) Give a truth table and a standard sum of products expression that describes $F = A \oplus B \oplus C$

7. (8 pts) Indicate how a Nand gate can be used to implement:

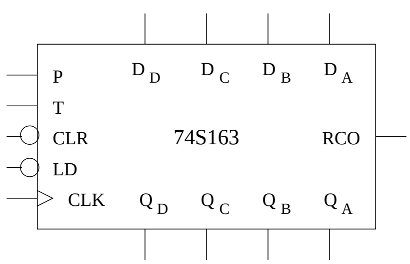
   (a) An Inverter:

   (b) An And Gate:

   (c) An Or Gate:

   (d) Because a Nand gate can be used to implement all three basic Boolean functions, how would we describe it?

8. (8 pts) Using the 74ALS163 counter shown below and logic gates design a counter that counts in the sequence 3,4, 5, 6, 7, 8, 9, 10, 11, 12, 3, ... Connect all unused inputs. The counter may cycle through several unwanted states before settling into the final count sequence. Q_d is the MSB of the counter output.



9. (6 pts) Find a minimum sum of products expresssion for $F = abc' + bc'd' + cd + a'b$

10. (10 pts) Create a state diagram for a sequence detector that outputs a 1 when it detects the final bit in the serial data stream 1101.

11. (10 pts) Determine the D flip-flop excitation equations for the system represented with in the state-transition table below. Assign states: $S0 = 00$, $S1 = 01$, $S2 = 10$ and $S3 = 11$.

Present	Next State		Output
S	X=0	X=1	Z
S0	S1	S2	0
S1	S1	S2	1
S2	S2	S3	1
S3	S3	S0	0

12. (5 pts) Give the output expression for the 8-to-1 MUX shown below.