

Assignment 2
(Full Score: 100 points)
 (Due in class, 2/25/Friday,)

Your name:	Score:
------------	--------

1. Design a comparator circuit that compares two 2-bit unsigned binary numbers A and B . The output of the comparator is defined as shown below. For each case, derive a block diagram and a truth table for the circuit to be designed.
 - (a) The output is represented with R_1R_0 such that
 - a. $R_1R_0 = 10$ if $A > B$,
 - b. $R_1R_0 = 01$ if $A < B$,
 - c. $R_1R_0 = 00$ if $A = B$.
 - (b) The output is represented with L , S , and E such that
 - a. $L = 1$ if $A > B$,
 - b. $S = 1$ if $A < B$,
 - c. $E = 1$ if $A = B$.

For each case, derive a truth table and a block diagram (logic circuit) as your design.

2. Design a 16x1 multiplexer with five 4x1 multiplexers. Draw the logic circuit block diagram.
3. Design a 16x1 multiplexer with four 4x1 multiplexers and basic AND, OR, NOT gates (use as much as you would these basic gates). Draw the logic circuit block diagram.
4. Design a 3-bit multi-functional bidirectional shift register with a shift right serial input, a shift left serial input, 3 inputs and 2 control inputs AB such that (1) $AB = 00$, no change/shift; (2) $AB = 01$ shift left; (3) $AB = 10$, shift right; and (4) $AB = 11$, parallel load. Draw the logic circuit/block diagram (with use of D flip-flops and NAND gates. NO other gates!).
5. Design a binary sequence detector that recognizes four consecutive 1s, using D flip-flops. Provide state diagram, state table, excitation table, and logic circuit. You may use the following input and output sequences for your design:
 - Input sequence: 0011111011001110001111101...
 - Output sequence: 0000011000000000000011100....