Section and Group No:

Name:

Signature:

EXP #7: COMBINATIONAL LOGIC USING MULTIPLEXERS

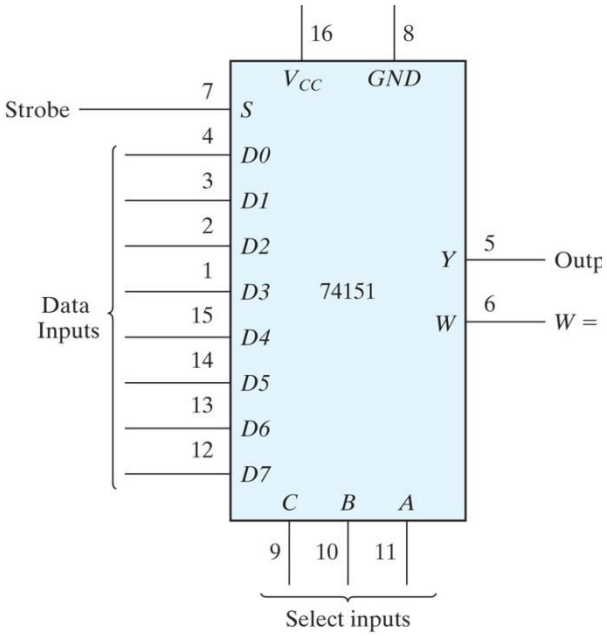
Components that will be ensured by the students: IC 74151, 7404

Objective(s):

After completing this experiment, you will be able to use a multiplexer to construct a comparator and test the circuit.

Introduction:

The *multiplexer* (MUX) or *data selector* connects any one of several inputs to a single output. Control is determined by additional logic signals called the *select* (or *address)* inputs. One useful application for MUXs is implementation of combinational logic functions directly from the truth table. The IC 74151 is a 8×1 multiplexer and its internal construction is given in Fig. 1.



Function table

Strobe	Select			Output
S	*C*	*B*	*A*	*Y*
1	X	X	X	0
0	0	0	0	*D0*
0	0	0	1	*D1*
0	0	1	0	*D2*
0	0	1	1	*D3*
0	1	0	0	*D4*
0	1	0	1	*D5*
0	1	1	0	*D6*
0	1	1	1	*D7*

Fig. 1 IC type 74151 38 × 1 multiplexer

The eight inputs are designated *D0* through *D7*. The three selection lines— *C*, *B*, and *A* — select the particular input to be multiplexed and applied to the output. A strobe control *S* acts as an enable signal. The function table specifies the value of output *Y* as a function of the selection

lines. Output *W* is the complement of *Y*. For proper operation, the strobe input *S* must be connected to ground.

Preliminary Work:

1) Assume we need to compare two 2-bit numbers called A and B to find whether A is equal to or greater than B. Using the 8:1 MUX, design a 2-bit comparator. For this purpose first complete the partially given truth table in Table 1. The inputs, A_1, A_2 and B_1, B_2, are representing the two numbers to be compared. Connect A_1, A_2 and B_1 bits to the SELECT inputs of the MUX. The B_2 bit is to be connected as needed. It is therefore listed in a separate column of the truth table.

2) Determine the logic in which the output represents $A \geq B$ and complete the *X* column of truth Table 1. The first two entries are completed as an example.

3) Look at the output X, in groups of two. The first pair of entries in X is the complement of the corresponding entries in B_2; therefore, the data should be connected to B'_2, as shown in the first line. Complete Table 1 by filling in the last column with either 0, 1, B_2, or B'_2.

4) Using the data from Table 1, design the circuit that implements 2-bit comparator. The X output on the truth table is equivalent to the Y output on the 74151 A.

Inputs				**Output**	**Connect Data to:**
A_1	A_2	B_1	B_2	X	
0	0	0	0	1	B'_2
0	0	0	1	0	
0	0	1	0		
0	0	1	1		
0	1	0	0		
0	1	0	1		
0	1	1	0		
0	1	1	1		
1	0	0	0		
1	0	0	1		
1	0	1	0		
1	0	1	1		
1	1	0	0		
1	1	0	1		
1	1	1	0		
1	1	1	1		

Table 1. Truth table for 2-bit comparator, $A \geq B$.

Laboratory Work:

1) Construct the circuit you designed in your preliminary work and test its operation by checking every possible input.