AIM

To implement 4-bit, 5-bit and 8 bit comparator using given MSI

Software Required

Proteus Software

Theory

The comparison of two numbers is a logical operation that defines whether one number is greater than, less than, or equal to the other number. The result of the comparison is stated by three binary variables that indicate whether these two numbers are:

- A > B
- A = B
- A < B.

4-bit Comparator

Truth table of 4-bit Comparator:

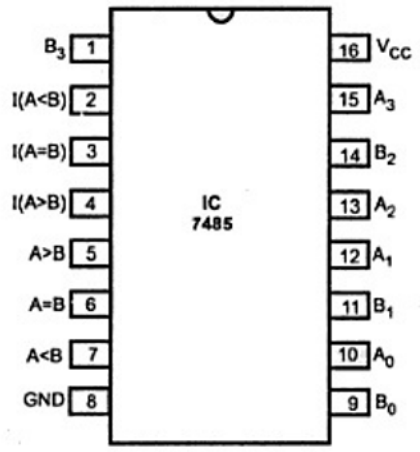
COMPARING INPUTS				OUTPUT		
A3, B3	**A2, B2**	**A1, B1**	**A0, B0**	**A > B**	**A < B**	**A = B**
A3 > B3	X	X	X	H	L	L
A3 < B3	X	X	X	L	H	L
A3 = B3	A2 >B2	X	X	H	L	L
A3 = B3	A2 < B2	X	X	L	H	L
A3 = B3	A2 = B2	A1 > B1	X	H	L	L
A3 = B3	A2 = B2	A1 < B1	X	L	H	L
A3 = B3	A2 = B2	A1 = B1	A0 > B0	H	L	L
A3 = B3	A2 = B2	A1 = B1	A0 < B0	L	H	L
A3 = B3	A2 = B2	A1 = B1	A0 = B0	H	L	L
A3 = B3	A2 = B2	A1 = B1	A0 = B0	L	H	L
A3 = B3	A2 = B2	A1 = B1	A0 = B0	L	L	H
H = High Voltage Level, L = Low Voltage, Level, X = Don't Care						

The terms (A > B) and (A < B) are binary output variables and they are equal to 1 when A > B and A < B, respectively.

The gate implementation of the three output variables that is not derived here but it is simpler than it looks because it contains a specific amount of repetition in it. The unequal outputs can also use the same gates that are needed to generate the equal output.

Pin diagram of 4-bit Comparator:

The 4-bit comparator is frequently available in IC form and common type of this IC is 74LS85. This IC can be used to compare two 4-bit binary digits by grounding I (A>B), I (A<B) and I (A=B) connector inputs is given to Vcc terminal. The figure below shows the pin diagram of IC 74LS85 comparator. In addition to the ordinary comparator, this IC is provided with cascading inputs in order to enable the cascading several comparators. We can compare any number of bits by cascading several of these comparator ICs.



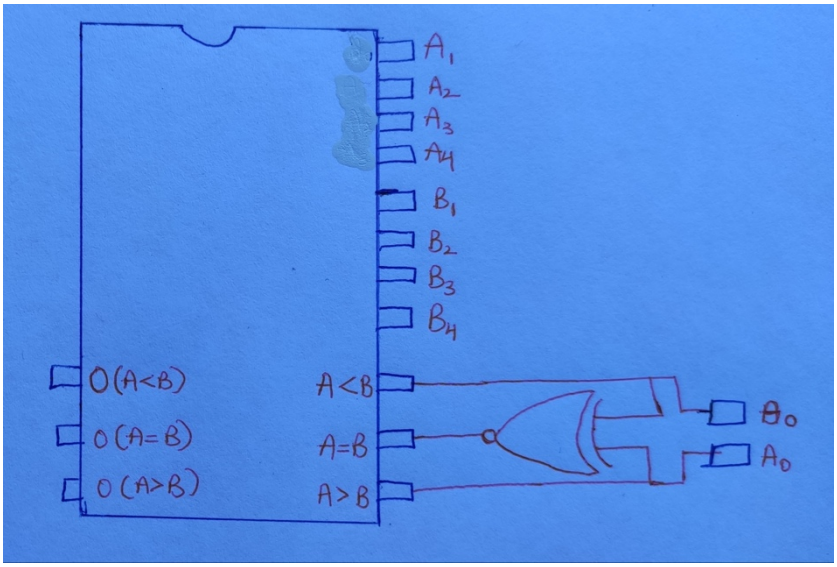
(a) Pin diagram (IC 7485)

5-bit Comparator

Truth table of 5-bit Comparator:

Comparing Input					Output		
A4,B4	A3,B3	A2,B2	A1,B1	A0,B0	A>B	A=B	A<B
A4>B4	X	X	X	X	H	L	L
A4<B4	X	X	X	X	L	L	H
A4=B4	A3>B3	X	X	X	H	L	L
A4=B4	A3<B3	X	X	X	L	L	H
A4=B4	A3=B3	A2>B2	X	X	H	L	L
A4=B4	A3=B3	A2<B2	X	X	L	L	H
A4=B4	A3=B3	A2=B2	A1>B1	X	H	L	L
A4=B4	A3=B3	A2=B2	A1<B1	X	L	L	H
A4=B4	A3=B3	A2=B2	A1=B1	A0>B0	H	L	L
A4=B4	A3=B3	A2=B2	A1=B1	A0<B0	L	L	H
A4=B4	A3=B3	A2=B2	A1=B1	A0=B0	L	H	L

Pin diagram of 5-bit Comparator:

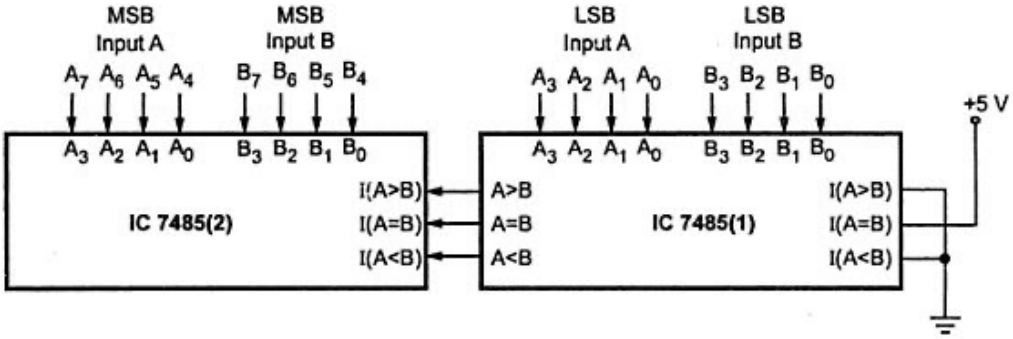


8-bit Comparator

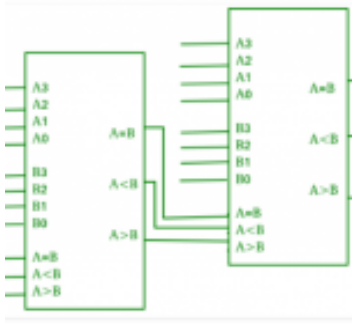
Truth table of 8-bit Comparator:

Comparing Input								Output		
A7,B7	A6,B6	A5,B5	A4,B4	A3,B3	A2,B2	A1,B1	A0,B0	A>B	A=B	A<B
A7>B7	X	X	X	X	X	X	X	H	L	L
A7<B7	X	X	X	X	X	X	X	L	L	H
A7=B7	A6>B6	X	X	X	X	X	X	H	L	L
A7=B7	A6<B6	X	X	X	X	X	X	L	L	H
A7=B7	A6=B6	A5>B5	X	X	X	X	X	H	L	L
A7=B7	A6=B6	A5<B5	X	X	X	X	X	L	L	H
A7=B7	A6=B6	A5=B5	A4>B4	X	X	X	X	H	L	L
A7=B7	A6=B6	A5=B5	A4<B4	X	X	X	X	L	L	H
A7=B7	A6=B6	A5=B5	A4=B4	A3>B3	X	X	X	H	L	L
A7=B7	A6=B6	A5=B5	A4=B4	A3<B3	X	X	X	L	L	H
A7=B7	A6=B6	A5=B5	A4=B4	A3=B3	A2>B2	X	X	H	L	L
A7=B7	A6=B6	A5=B5	A4=B4	A3=B3	A2<B2	X	X	L	L	H
A7=B7	A6=B6	A5=B5	A4=B4	A3=B3	A2=B2	A1>B1	X	H	L	L
A7=B7	A6=B6	A5=B5	A4=B4	A3=B3	A2=B2	A1<B1	X	L	L	H
A7=B7	A6=B6	A5=B5	A4=B4	A3=B3	A2=B2	A1=B1	A0>B0	H	L	L
A7=B7	A6=B6	A5=B5	A4=B4	A3=B3	A2=B2	A1=B1	A0<B0	L	L	H
A7=B7	A6=B6	A5=B5	A4=B4	A3=B3	A2=B2	A1=B1	A0=B0	L	H	L

Pin diagram of 8-bit Comparator:



Cascading Comparator:



A comparator executing the comparison operation to more than four bits by cascading. When there are **two or more 4-bit comparators they are called cascading comparator**. When two comparators are to be cascaded, the outputs of the lower-order comparator are connected with the corresponding given inputs of the higher-order comparator.

Applications of Comparators:

- These are used in the address decoding circuitry in computers and microprocessor based devices to select a specific input/output device for the storage of data.
- These are used in control applications in which the binary numbers representing physical variables such as temperature, position, etc. are compared with a reference value. Then the outputs from the comparator are used to drive the actuators so as to make the physical variables closest to the set or reference value.
- Process controllers
- Servo-motor control

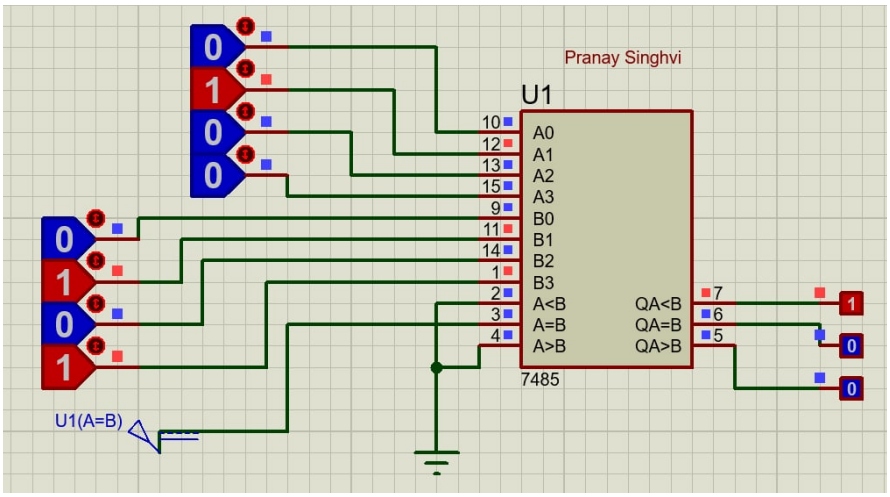
Procedure

1) Open a new project in protecus
2) Click on Device from the left-side tools.
3) Choose the of required IC device and place in its places.
4) Connect all the device and set the binary digit .
5) Note the binary digit of output.
6) Repeat it three times covering all possible outcomes.
7) Then Run Stimulation

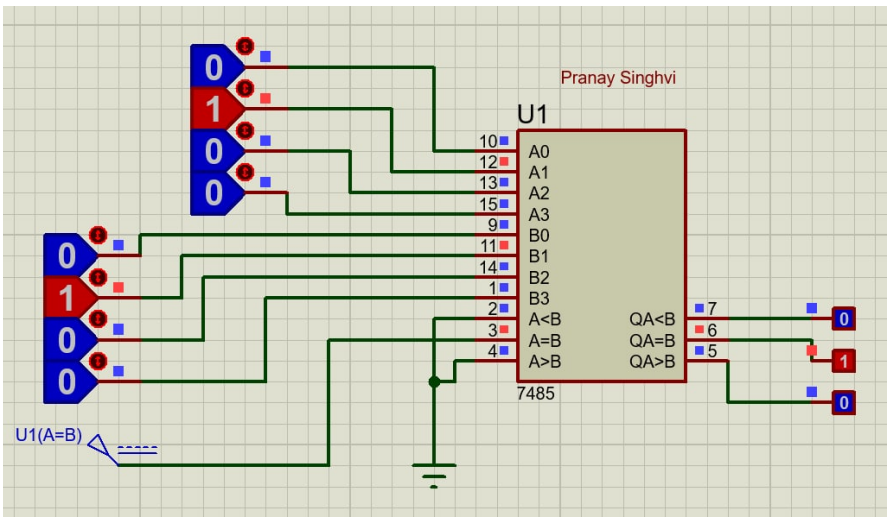
Results and Observations

4-bit Comparator

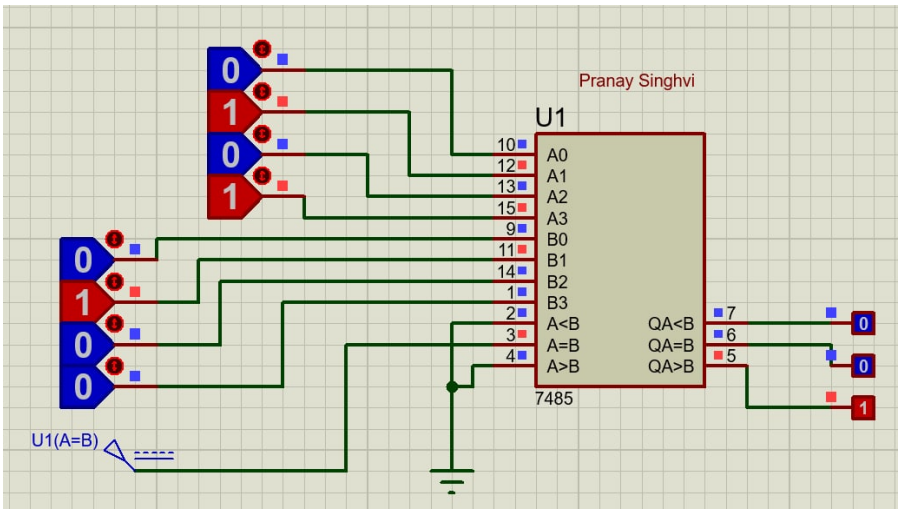
❖ A<B



❖ A=B

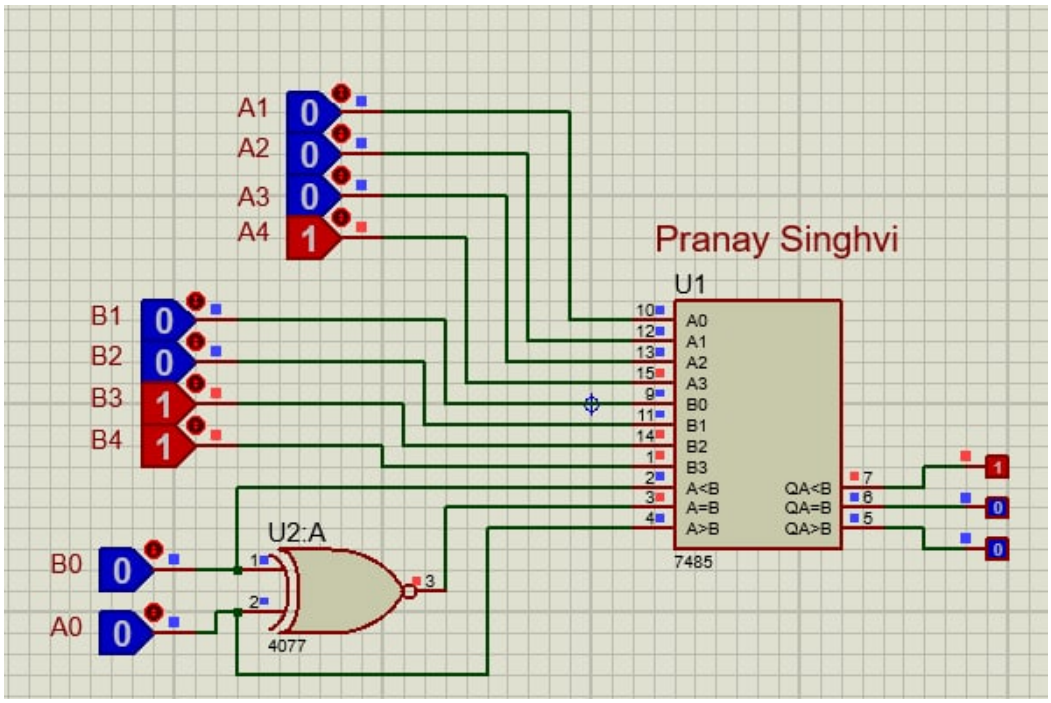


❖ A>B

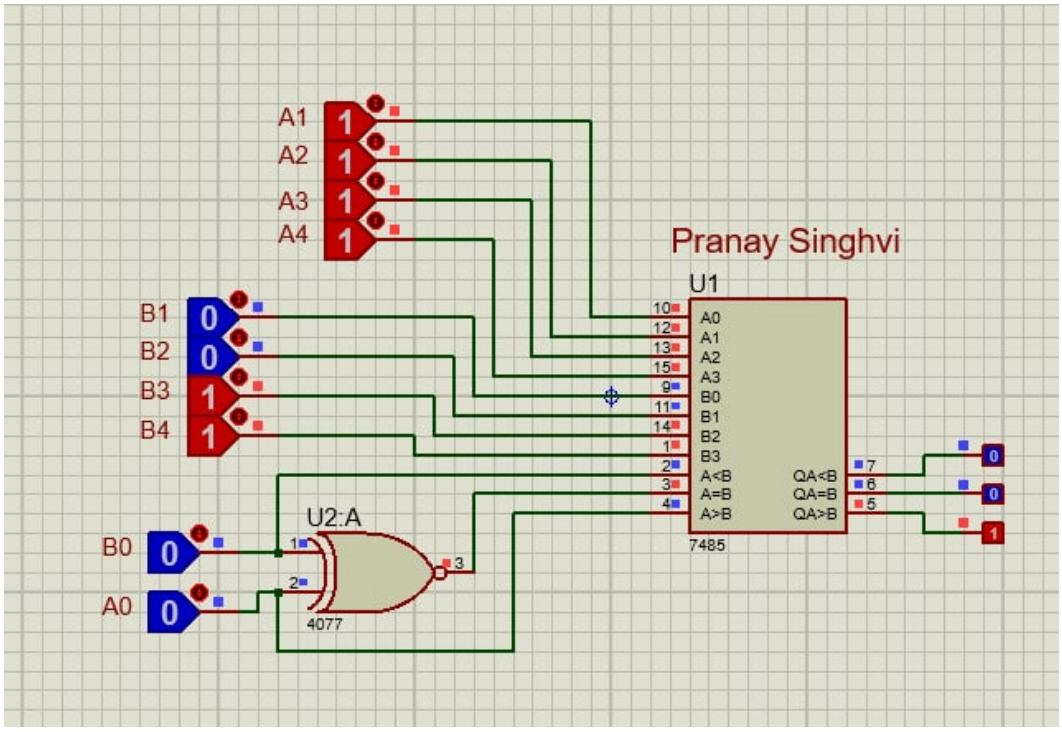


5-bit Comparator

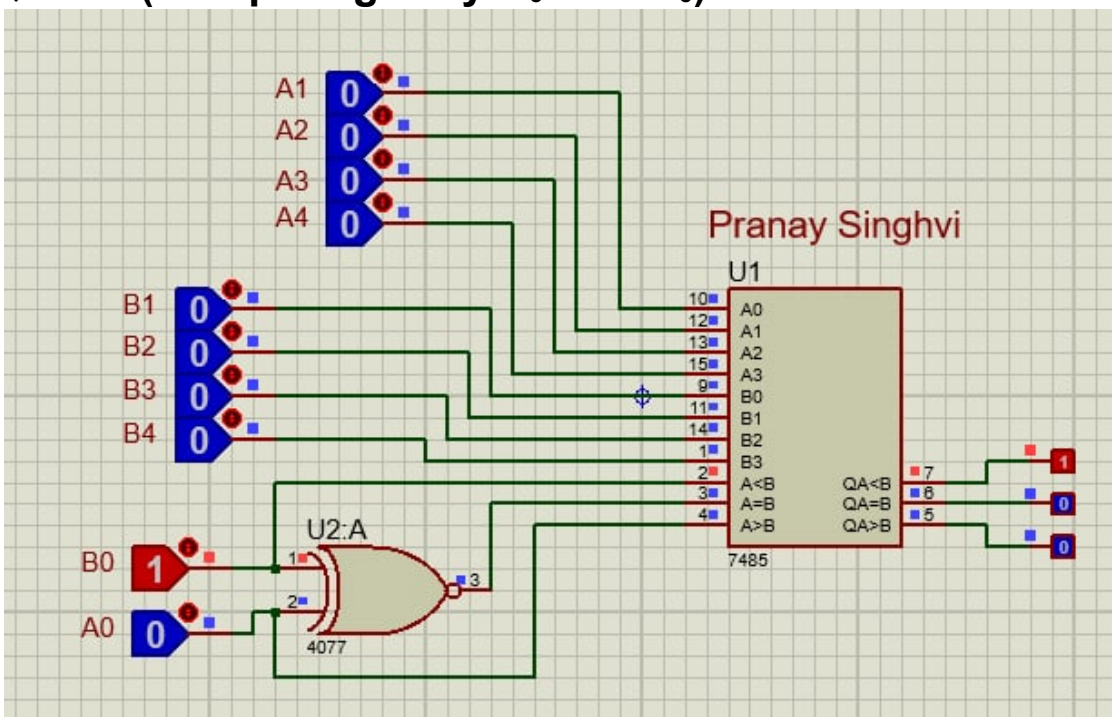
❖ **A<B**



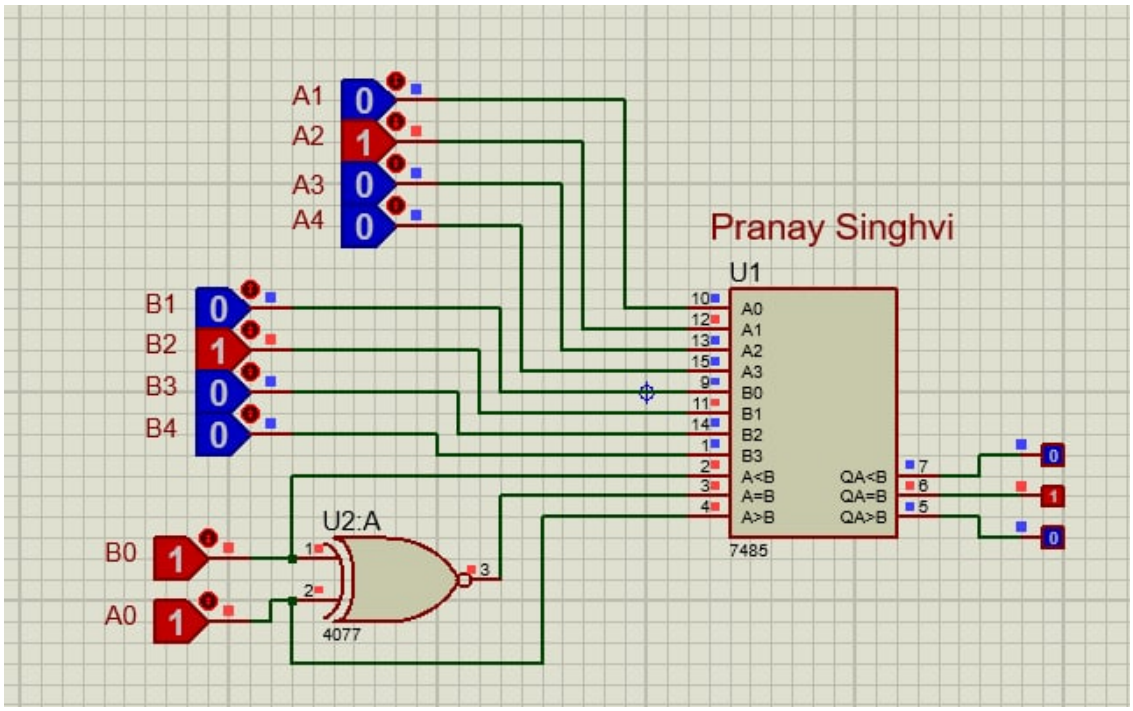
❖ **A>B**



❖ **A<B(Comparing Only A_0 and B_0)**

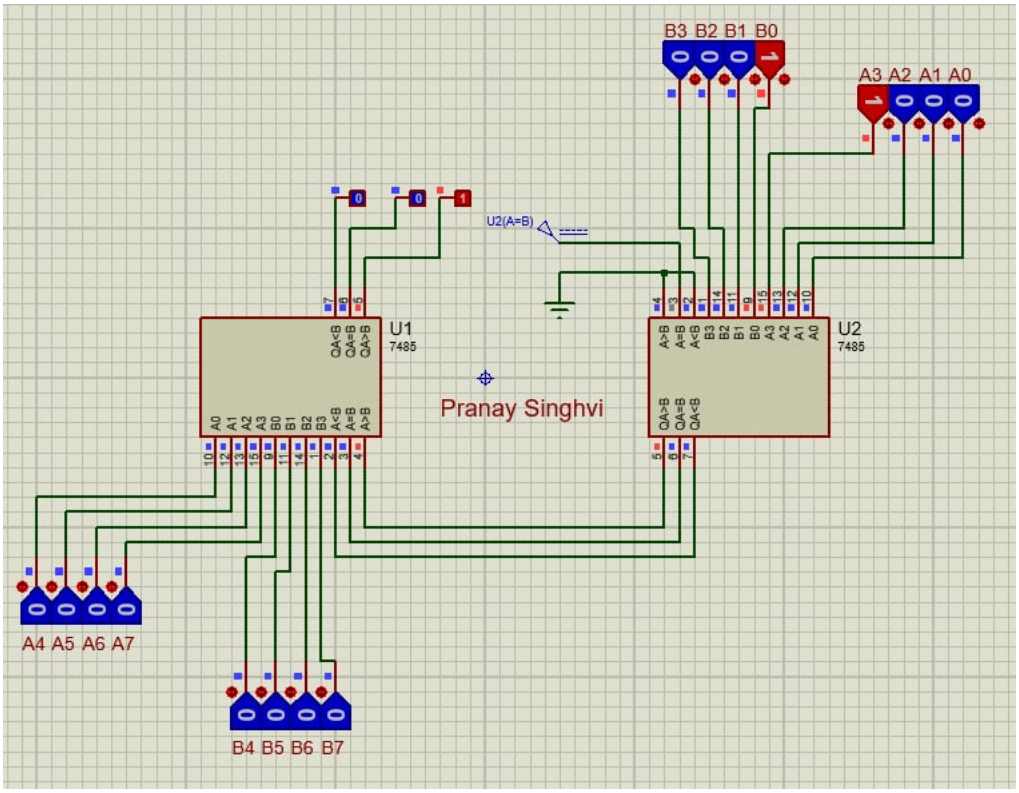


❖ **A=B**

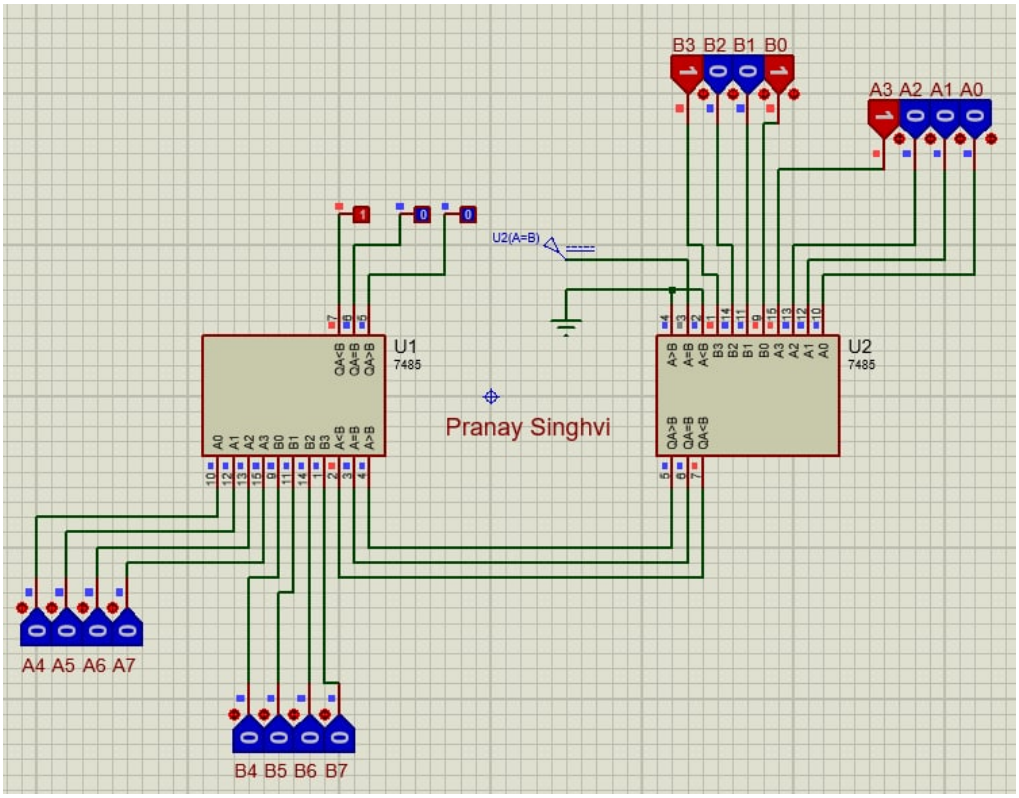


8-bit Comparator

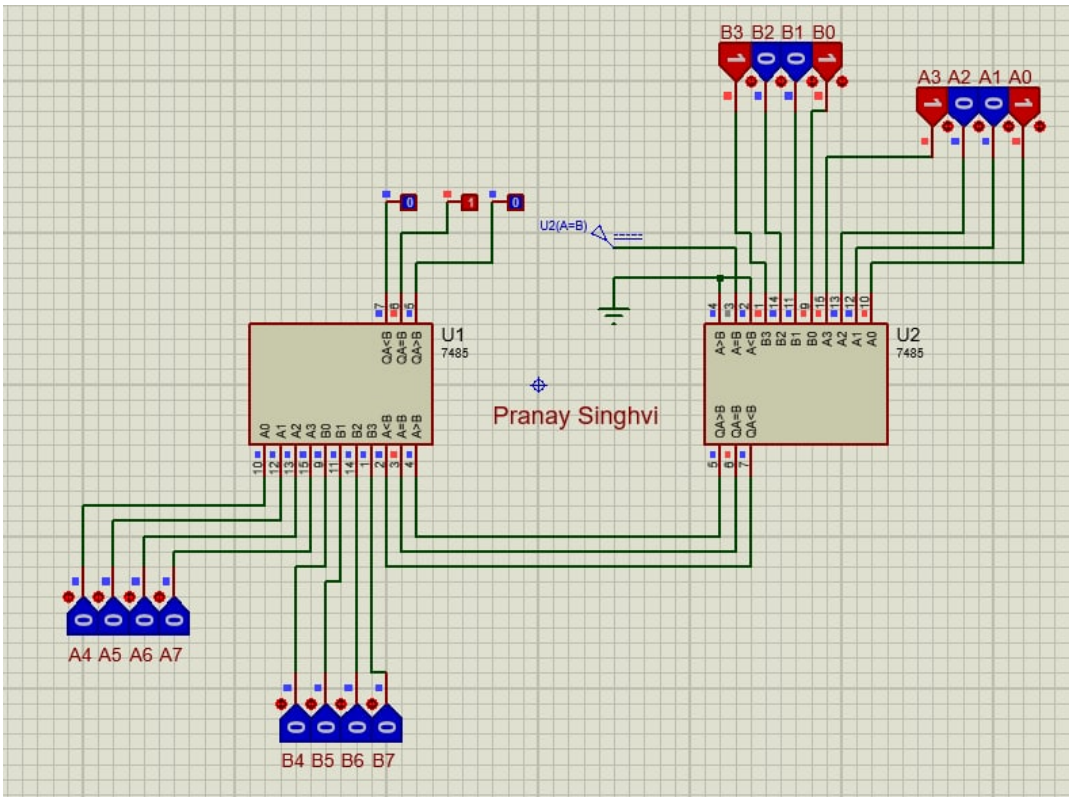
❖ A>B



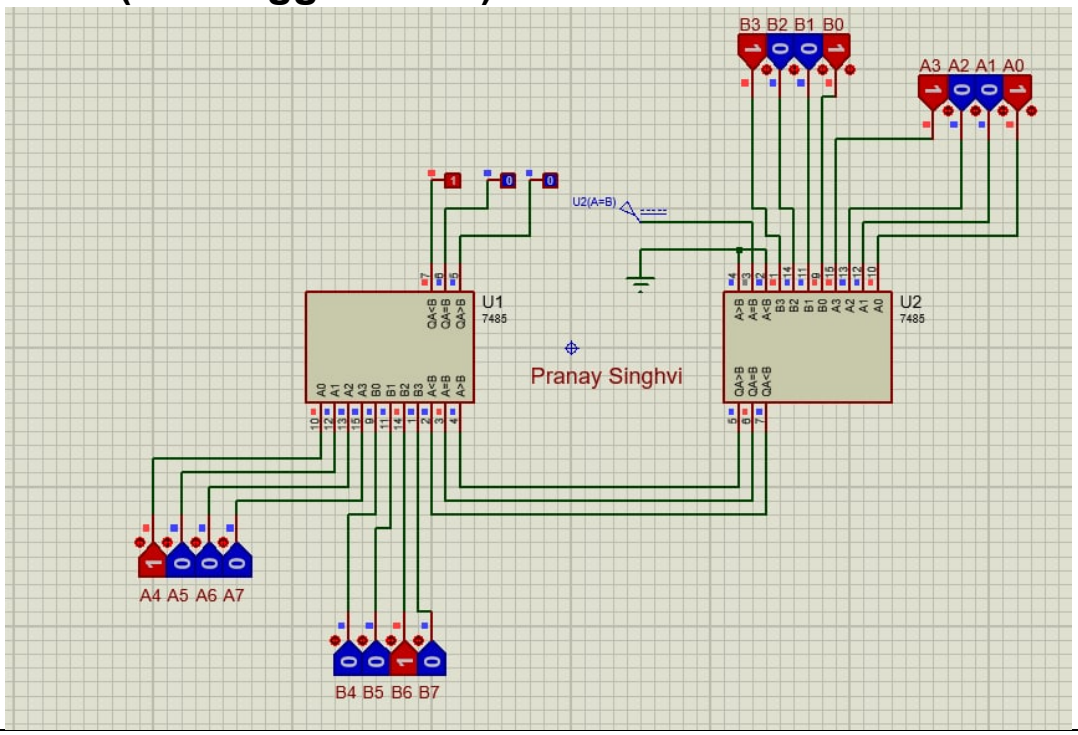
❖ A<B



❖ **A=B**



❖ **A<B(with bigger value)**



Conclusion

We Conclude that IC 7485 is used to implement 4-Bit, 5-bit and 8-bit comparator. 5-bit comparator also use XNOR Gate (IC4077) which is connected with IC 7485 and A_0 and B_0.