2-Bit Arithmetic Logic Unit

I have designed a 2-bit Arithmetic Logic Unit (ALU) which can perform the following logical & arithmetic operations:

Logical Operations:

1. AND
2. OR
3. NOT
4. XOR

Arithmetic Operations:

1. ADD
2. SUBTRACT
3. MULTIPLY
4. COMPARE

I have used 2 sets of 4 basic gates (AND gate, OR gate, NOT gate & XOR gate to do 4 logical expressions and Adder, Subtractor, Multiplier and Comparator for doing the arithmetic operations I mentioned above.

I have used a 3x8 Multiplexer to select which operation's output will be chosen to show in the final 2 bit output. 3x8 Mux has selector bits consisting of 3 bits and that can select upto 8 operations on different bits.

The OPCodes the used in this project can be shown in a table:

Operation	OPCode
AND	000
OR	001
NOT	010
XOR	011
ADD	100
SUB	101
MULTIPLY	110
COMPARE	111

When the consecutive 2 bits are compared using comparator then can produce greater than or Equals or less then outputs. So I have showed the outputs using LEDs.