🖥 xfrolk03 / **Digital-electronics-1-2021**

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🏁 **xfrolk03** Update README.md   ⟲

👥 **1** contributor

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787 lines (589 sloc) | 38.7 KB

Lab assignment

1. Preparation tasks (done before the lab at home). Submit:

   ○ Completed 2-bit comparator truth table.

2. A 2-bit comparator. Submit:

   ○ Karnaugh maps for all three functions,

   ○ Equations of simplified SoP form of the "greater than" function and simplified PoS form of the "less than" function.

   ○ Link to your public EDA Playground example in the form
     `https://www.edaplayground.com/...`

3. A 4-bit binary comparator. Submit:

   ○ Listing of VHDL architecture from design file (`design.vhd`) with syntax highlighting,

   ○ Listing of VHDL stimulus process from testbench file (`testbench.vhd`) with syntax highlighting,

   ○ Listing of simulator console output, i.e. with one reported error,

   ○ Link to your public EDA Playground example in the form
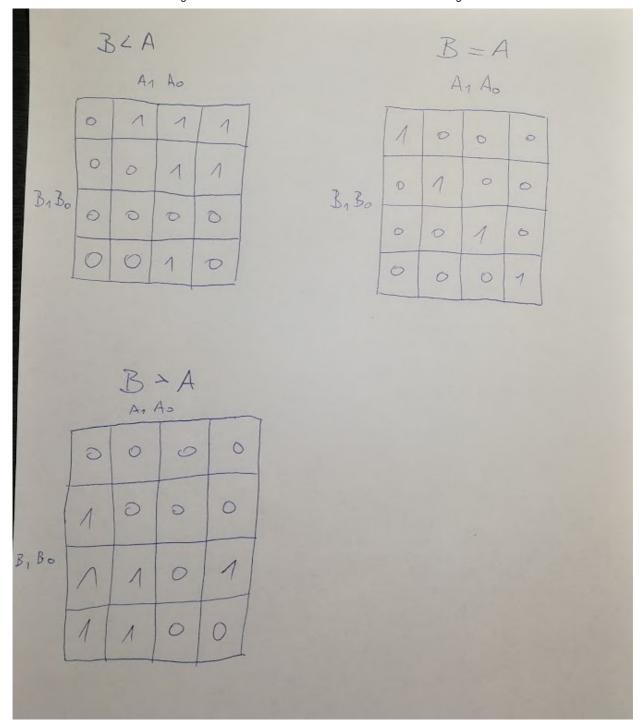   `https://www.edaplayground.com/...`

1.Preparation tasks
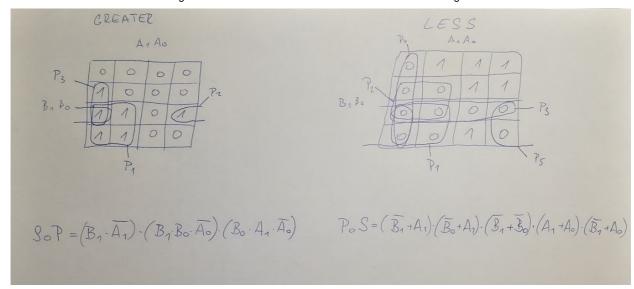
Completed 2-bit comparator truth table.

Dec. equivalent	B1	B0	A1	A0	B > A	B = A	B < A
0	0	0	0	0	0	1	0
1	0	0	0	1	0	0	1
2	0	0	1	0	0	0	1
3	0	0	1	1	0	0	1
4	0	1	0	0	1	0	0
5	0	1	0	1	0	1	0
6	0	1	1	0	0	0	1
7	0	1	1	1	0	0	1
8	1	0	0	0	1	0	0
9	1	0	0	1	1	0	0
10	1	0	1	0	0	1	0
11	1	0	1	1	0	0	1
12	1	1	0	0	1	0	0
13	1	1	0	1	1	0	0
14	1	1	1	0	1	0	0
15	1	1	1	1	0	1	0

2. A 2-bit comparator.

Karnaugh maps for all three functions

Equations of simplified SoP form of the "greater than" function and simplified PoS form of the "less than" function.

$$S_oP = \left(B_1 \cdot \overline{A_1}\right) \cdot \left(B_1 \cdot B_0 \cdot \overline{A_0}\right) \cdot \left(B_0 \cdot A_1 \cdot \overline{A_0}\right)$$

$$P_oS = \left(\overline{B_1} + A_1\right) \cdot \left(\overline{B_0} + A_1\right) \cdot \left(\overline{B_1} + \overline{B_0}\right) \cdot \left(A_1 + A_0\right) \cdot \left(\overline{B_1} + A_0\right)$$

This is link to my EDA plaground example of 2 bit comparator

3. A 4-bit binary comparator.

Listing of VHDL architecture from design file (`design.vhd`) with syntax highlighting

```vhdl
-------------------------------------------------------------------------
-- Architecture body for 4-bit binary comparator
-------------------------------------------------------------------------
architecture Behavioral of comparator_4bit is
begin

    B_greater_A_o <= '1' when (b_i > a_i) else '0';
    B_equals_A_o  <= '1' when (b_i = a_i) else '0';
    B_less_A_o    <= '1' when (b_i < a_i) else '0';

end architecture Behavioral;
```

Listing of VHDL stimulus process from testbench file (`testbench.vhd`) with syntax highlighting

```vhdl
-------------------------------------------------------------------
-- Data generation process
-------------------------------------------------------------------
p_stimulus : process
begin
    -- Report a note at the begining of stimulus process
    report "Stimulus process started" severity note;

        s_b <= "0000"; s_a <= "0000"; wait for 100 ns;
        assert ((s_B_greater_A = '1') and (s_B_equals_A = '0') and (s_B_l
        report "Test failed for input combination: 0000, 0000... This is
```

```vhdl
                s_b <= "0000"; s_a <= "0001"; wait for 100 ns;
                assert ((s_B_greater_A = '0') and (s_B_equals_A = '0') and (s_B_l
                report "Test failed for input combination: 0000, 0001" severity e

                s_b <= "0000"; s_a <= "0010"; wait for 100 ns;
                assert ((s_B_greater_A = '0') and (s_B_equals_A = '0') and (s_B_l
                report "Test failed for input combination: 0000, 0010" severity e

                s_b <= "0000"; s_a <= "0011"; wait for 100 ns;
                assert ((s_B_greater_A = '0') and (s_B_equals_A = '0') and (s_B_l
                report "Test failed for input combination: 0000, 0011" severity e

                s_b <= "0000"; s_a <= "0100"; wait for 100 ns;
                assert ((s_B_greater_A = '0') and (s_B_equals_A = '0') and (s_B_l
                report "Test failed for input combination: 0000, 0100" severity e

                s_b <= "0000"; s_a <= "0101"; wait for 100 ns;
                assert ((s_B_greater_A = '0') and (s_B_equals_A = '0') and (s_B_l
                report "Test failed for input combination: 0000, 0101" severity e

                s_b <= "0000"; s_a <= "0110"; wait for 100 ns;
                assert ((s_B_greater_A = '0') and (s_B_equals_A = '0') and (s_B_l
                report "Test failed for input combination: 0000, 0110" severity e

                s_b <= "0000"; s_a <= "0111"; wait for 100 ns;
                assert ((s_B_greater_A = '0') and (s_B_equals_A = '0') and (s_B_l
                report "Test failed for input combination: 0000, 0111" severity e

                s_b <= "0000"; s_a <= "1000"; wait for 100 ns;
                assert ((s_B_greater_A = '0') and (s_B_equals_A = '0') and (s_B_l
                report "Test failed for input combination: 0000, 1000" severity e

                s_b <= "0000"; s_a <= "1001"; wait for 100 ns;
                assert ((s_B_greater_A = '0') and (s_B_equals_A = '0') and (s_B_l
                report "Test failed for input combination: 0000, 1001" severity e

                s_b <= "0000"; s_a <= "1010"; wait for 100 ns;
                assert ((s_B_greater_A = '0') and (s_B_equals_A = '0') and (s_B_l
                report "Test failed for input combination: 0000, 1010" severity e

                s_b <= "0000"; s_a <= "1011"; wait for 100 ns;
                assert ((s_B_greater_A = '0') and (s_B_equals_A = '0') and (s_B_l
                report "Test failed for input combination: 0000, 1011" severity e

                s_b <= "0000"; s_a <= "1100"; wait for 100 ns;
                assert ((s_B_greater_A = '0') and (s_B_equals_A = '0') and (s_B_l
                report "Test failed for input combination: 0000, 1100" severity e

                s_b <= "0000"; s_a <= "1101"; wait for 100 ns;
                assert ((s_B_greater_A = '0') and (s_B_equals_A = '0') and (s_B_l
                report "Test failed for input combination: 0000, 1101" severity e

                s_b <= "0000"; s_a <= "1110"; wait for 100 ns;
                assert ((s_B_greater_A = '0') and (s_B_equals_A = '0') and (s_B_l
```

```vhdl
                        report "Test failed for input combination: 0000, 1110" severity e

            s_b <= "0000"; s_a <= "1111"; wait for 100 ns;
            assert ((s_B_greater_A = '0') and (s_B_equals_A = '0') and (s_B_l
                        report "Test failed for input combination: 0000, 1111" severity e

            s_b <= "0001"; s_a <= "0000"; wait for 100 ns;
            assert ((s_B_greater_A = '1') and (s_B_equals_A = '0') and (s_B_l
                        report "Test failed for input combination: 0001, 0000" severity e

            s_b <= "0001"; s_a <= "0001"; wait for 100 ns;
            assert ((s_B_greater_A = '0') and (s_B_equals_A = '1') and (s_B_l
                        report "Test failed for input combination: 0001, 0001" severity e

            s_b <= "0001"; s_a <= "0010"; wait for 100 ns;
            assert ((s_B_greater_A = '0') and (s_B_equals_A = '0') and (s_B_l
                        report "Test failed for input combination: 0001, 0010" severity e

            s_b <= "0001"; s_a <= "0011"; wait for 100 ns;
            assert ((s_B_greater_A = '0') and (s_B_equals_A = '0') and (s_B_l
                        report "Test failed for input combination: 0001, 0011" severity e

            s_b <= "0001"; s_a <= "0100"; wait for 100 ns;
            assert ((s_B_greater_A = '0') and (s_B_equals_A = '0') and (s_B_l
                        report "Test failed for input combination: 0001, 0100" severity e

            s_b <= "0001"; s_a <= "0101"; wait for 100 ns;
            assert ((s_B_greater_A = '0') and (s_B_equals_A = '0') and (s_B_l
                        report "Test failed for input combination: 0001, 0101" severity e

            s_b <= "0001"; s_a <= "0110"; wait for 100 ns;
            assert ((s_B_greater_A = '0') and (s_B_equals_A = '0') and (s_B_l
                        report "Test failed for input combination: 0001, 0110" severity e

            s_b <= "0001"; s_a <= "0111"; wait for 100 ns;
            assert ((s_B_greater_A = '0') and (s_B_equals_A = '0') and (s_B_l
                        report "Test failed for input combination: 0001, 0111" severity e

            s_b <= "0001"; s_a <= "1000"; wait for 100 ns;
            assert ((s_B_greater_A = '0') and (s_B_equals_A = '0') and (s_B_l
                        report "Test failed for input combination: 0001, 1000" severity e

            s_b <= "0001"; s_a <= "1001"; wait for 100 ns;
            assert ((s_B_greater_A = '0') and (s_B_equals_A = '0') and (s_B_l
                        report "Test failed for input combination: 0001, 1001" severity e

            s_b <= "0001"; s_a <= "1010"; wait for 100 ns;
            assert ((s_B_greater_A = '0') and (s_B_equals_A = '0') and (s_B_l
                        report "Test failed for input combination: 0001, 1010" severity e

            s_b <= "0001"; s_a <= "1011"; wait for 100 ns;
            assert ((s_B_greater_A = '0') and (s_B_equals_A = '0') and (s_B_l
                        report "Test failed for input combination: 0001, 1011" severity e

            s_b <= "0001"; s_a <= "1100"; wait for 100 ns;
```

```vhdl
                    assert ((s_B_greater_A = '0') and (s_B_equals_A = '0') and (s_B_l
                    report "Test failed for input combination: 0001, 1101" severity e

        s_b <= "0001"; s_a <= "1101"; wait for 100 ns;
                    assert ((s_B_greater_A = '0') and (s_B_equals_A = '0') and (s_B_l
                    report "Test failed for input combination: 0001, 1101" severity e

        s_b <= "0001"; s_a <= "1110"; wait for 100 ns;
                    assert ((s_B_greater_A = '0') and (s_B_equals_A = '0') and (s_B_l
                    report "Test failed for input combination: 0001, 1110" severity e

        s_b <= "0001"; s_a <= "1111"; wait for 100 ns;
                    assert ((s_B_greater_A = '0') and (s_B_equals_A = '0') and (s_B_l
                    report "Test failed for input combination: 0001, 1111" severity e

        s_b <= "0010"; s_a <= "1101"; wait for 100 ns;
                    assert ((s_B_greater_A = '0') and (s_B_equals_A = '0') and (s_B_l
                    report "Test failed for input combination: 0010, 1101" severity e

        s_b <= "0010"; s_a <= "1110"; wait for 100 ns;
                    assert ((s_B_greater_A = '0') and (s_B_equals_A = '0') and (s_B_l
                    report "Test failed for input combination: 0010, 1110" severity e

        s_b <= "0010"; s_a <= "1111"; wait for 100 ns;
                    assert ((s_B_greater_A = '0') and (s_B_equals_A = '0') and (s_B_l
                    report "Test failed for input combination: 0010, 1111" severity e

        s_b <= "0011"; s_a <= "0000"; wait for 100 ns;
                    assert ((s_B_greater_A = '1') and (s_B_equals_A = '0') and (s_B_l
                    report "Test failed for input combination: 0011, 0000" severity e

        s_b <= "0011"; s_a <= "0001"; wait for 100 ns;
                    assert ((s_B_greater_A = '1') and (s_B_equals_A = '0') and (s_B_l
                    report "Test failed for input combination: 0011, 0001" severity e

        s_b <= "0011"; s_a <= "0010"; wait for 100 ns;
                    assert ((s_B_greater_A = '1') and (s_B_equals_A = '0') and (s_B_l
                    report "Test failed for input combination: 0011, 0010" severity e

        s_b <= "0011"; s_a <= "0011"; wait for 100 ns;
                    assert ((s_B_greater_A = '0') and (s_B_equals_A = '1') and (s_B_l
                    report "Test failed for input combination: 0011, 0011" severity e

        s_b <= "0011"; s_a <= "0100"; wait for 100 ns;
                    assert ((s_B_greater_A = '0') and (s_B_equals_A = '0') and (s_B_l
                    report "Test failed for input combination: 0011, 0100" severity e

        s_b <= "0011"; s_a <= "0101"; wait for 100 ns;
                    assert ((s_B_greater_A = '0') and (s_B_equals_A = '0') and (s_B_l
                    report "Test failed for input combination: 0011, 0101" severity e

        s_b <= "0011"; s_a <= "0110"; wait for 100 ns;
                    assert ((s_B_greater_A = '0') and (s_B_equals_A = '0') and (s_B_l
                    report "Test failed for input combination: 0011, 0110" severity e
```

```
s_b <= "0011"; s_a <= "0111"; wait for 100 ns;
assert ((s_B_greater_A = '0') and (s_B_equals_A = '0') and (s_B_l
report "Test failed for input combination: 0011, 0111" severity e

s_b <= "0011"; s_a <= "1000"; wait for 100 ns;
assert ((s_B_greater_A = '0') and (s_B_equals_A = '0') and (s_B_l
report "Test failed for input combination: 0011, 1000" severity e

s_b <= "0011"; s_a <= "1001"; wait for 100 ns;
assert ((s_B_greater_A = '0') and (s_B_equals_A = '0') and (s_B_l
report "Test failed for input combination: 0011, 1001" severity e

s_b <= "0011"; s_a <= "1010"; wait for 100 ns;
assert ((s_B_greater_A = '0') and (s_B_equals_A = '0') and (s_B_l
report "Test failed for input combination: 0011, 1010" severity e

s_b <= "0011"; s_a <= "1011"; wait for 100 ns;
assert ((s_B_greater_A = '0') and (s_B_equals_A = '0') and (s_B_l
report "Test failed for input combination: 0011, 1011" severity e

s_b <= "0011"; s_a <= "1100"; wait for 100 ns;
assert ((s_B_greater_A = '0') and (s_B_equals_A = '0') and (s_B_l
report "Test failed for input combination: 0011, 1100" severity e

s_b <= "0011"; s_a <= "1101"; wait for 100 ns;
assert ((s_B_greater_A = '0') and (s_B_equals_A = '0') and (s_B_l
report "Test failed for input combination: 0011, 1101" severity e

s_b <= "0011"; s_a <= "1110"; wait for 100 ns;
assert ((s_B_greater_A = '0') and (s_B_equals_A = '0') and (s_B_l
report "Test failed for input combination: 0011, 1110" severity e

s_b <= "0011"; s_a <= "1111"; wait for 100 ns;
assert ((s_B_greater_A = '0') and (s_B_equals_A = '0') and (s_B_l
report "Test failed for input combination: 0011, 1111" severity e

s_b <= "0100"; s_a <= "0000"; wait for 100 ns;
assert ((s_B_greater_A = '1') and (s_B_equals_A = '0') and (s_B_l
report "Test failed for input combination: 0100, 0000" severity e

s_b <= "0100"; s_a <= "0001"; wait for 100 ns;
assert ((s_B_greater_A = '1') and (s_B_equals_A = '0') and (s_B_l
report "Test failed for input combination: 0100, 0001" severity e

s_b <= "0100"; s_a <= "0010"; wait for 100 ns;
assert ((s_B_greater_A = '1') and (s_B_equals_A = '0') and (s_B_l
report "Test failed for input combination: 0100, 0010" severity e

s_b <= "0100"; s_a <= "0011"; wait for 100 ns;
assert ((s_B_greater_A = '1') and (s_B_equals_A = '0') and (s_B_l
report "Test failed for input combination: 0100, 0011" severity e

s_b <= "0101"; s_a <= "0000"; wait for 100 ns;
assert ((s_B_greater_A = '1') and (s_B_equals_A = '0') and (s_B_l
report "Test failed for input combination: 0101, 0000" severity e
```

```
s_b <= "0101"; s_a <= "0001"; wait for 100 ns;
assert ((s_B_greater_A = '1') and (s_B_equals_A = '0') and (s_B_l
report "Test failed for input combination: 0101, 0001" severity e

s_b <= "0101"; s_a <= "0010"; wait for 100 ns;
assert ((s_B_greater_A = '1') and (s_B_equals_A = '0') and (s_B_l
report "Test failed for input combination: 0101, 0010" severity e

s_b <= "0101"; s_a <= "0011"; wait for 100 ns;
assert ((s_B_greater_A = '1') and (s_B_equals_A = '0') and (s_B_l
report "Test failed for input combination: 0101, 0011" severity e

s_b <= "0101"; s_a <= "0100"; wait for 100 ns;
assert ((s_B_greater_A = '1') and (s_B_equals_A = '0') and (s_B_l
report "Test failed for input combination: 0101, 0100" severity e

s_b <= "0101"; s_a <= "0101"; wait for 100 ns;
assert ((s_B_greater_A = '0') and (s_B_equals_A = '1') and (s_B_l
report "Test failed for input combination: 0101, 0101" severity e

s_b <= "0101"; s_a <= "0110"; wait for 100 ns;
assert ((s_B_greater_A = '0') and (s_B_equals_A = '0') and (s_B_l
report "Test failed for input combination: 0101, 0110" severity e

s_b <= "0101"; s_a <= "0111"; wait for 100 ns;
assert ((s_B_greater_A = '0') and (s_B_equals_A = '0') and (s_B_l
report "Test failed for input combination: 0101, 0111" severity e


s_b <= "0110"; s_a <= "0110"; wait for 100 ns;
assert ((s_B_greater_A = '0') and (s_B_equals_A = '1') and (s_B_l
report "Test failed for input combination: 0110, 0110" severity e

s_b <= "0110"; s_a <= "0111"; wait for 100 ns;
assert ((s_B_greater_A = '0') and (s_B_equals_A = '0') and (s_B_l
report "Test failed for input combination: 0110, 0111" severity e

s_b <= "0110"; s_a <= "1000"; wait for 100 ns;
assert ((s_B_greater_A = '0') and (s_B_equals_A = '0') and (s_B_l
report "Test failed for input combination: 0110, 1000" severity e

s_b <= "0110"; s_a <= "1001"; wait for 100 ns;
assert ((s_B_greater_A = '0') and (s_B_equals_A = '0') and (s_B_l
report "Test failed for input combination: 0110, 1001" severity e

s_b <= "0110"; s_a <= "1010"; wait for 100 ns;
assert ((s_B_greater_A = '0') and (s_B_equals_A = '0') and (s_B_l
report "Test failed for input combination: 0110, 1010" severity e

s_b <= "0110"; s_a <= "1011"; wait for 100 ns;
assert ((s_B_greater_A = '0') and (s_B_equals_A = '0') and (s_B_l
report "Test failed for input combination: 0110, 1011" severity e

s_b <= "0110"; s_a <= "1100"; wait for 100 ns;
```

```vhdl
            assert ((s_B_greater_A = '0') and (s_B_equals_A = '0') and (s_B_l
            report "Test failed for input combination: 0110, 1100" severity e


            s_b <= "0110"; s_a <= "1101"; wait for 100 ns;
            assert ((s_B_greater_A = '0') and (s_B_equals_A = '0') and (s_B_l
            report "Test failed for input combination: 0110, 1101" severity e


            s_b <= "0110"; s_a <= "1110"; wait for 100 ns;
            assert ((s_B_greater_A = '0') and (s_B_equals_A = '0') and (s_B_l
            report "Test failed for input combination: 0110, 1110" severity e


            s_b <= "0110"; s_a <= "1111"; wait for 100 ns;
            assert ((s_B_greater_A = '0') and (s_B_equals_A = '0') and (s_B_l
            report "Test failed for input combination: 0110, 1111" severity e


            s_b <= "0111"; s_a <= "0000"; wait for 100 ns;
            assert ((s_B_greater_A = '1') and (s_B_equals_A = '0') and (s_B_l
            report "Test failed for input combination: 0111, 0000" severity e


            s_b <= "0111"; s_a <= "0001"; wait for 100 ns;
            assert ((s_B_greater_A = '1') and (s_B_equals_A = '0') and (s_B_l
            report "Test failed for input combination: 0111, 0001" severity e


            s_b <= "0111"; s_a <= "0010"; wait for 100 ns;
            assert ((s_B_greater_A = '1') and (s_B_equals_A = '0') and (s_B_l
            report "Test failed for input combination: 0111, 0010" severity e


            s_b <= "0111"; s_a <= "0011"; wait for 100 ns;
            assert ((s_B_greater_A = '1') and (s_B_equals_A = '0') and (s_B_l
            report "Test failed for input combination: 0111, 0011" severity e


            s_b <= "0111"; s_a <= "0100"; wait for 100 ns;
            assert ((s_B_greater_A = '1') and (s_B_equals_A = '0') and (s_B_l
            report "Test failed for input combination: 0111, 0100" severity e


            s_b <= "0111"; s_a <= "0101"; wait for 100 ns;
            assert ((s_B_greater_A = '1') and (s_B_equals_A = '0') and (s_B_l
            report "Test failed for input combination: 0111, 0101" severity e


            s_b <= "0111"; s_a <= "0110"; wait for 100 ns;
            assert ((s_B_greater_A = '1') and (s_B_equals_A = '0') and (s_B_l
            report "Test failed for input combination: 0111, 0110" severity e


            s_b <= "0111"; s_a <= "0111"; wait for 100 ns;
            assert ((s_B_greater_A = '0') and (s_B_equals_A = '1') and (s_B_l
            report "Test failed for input combination: 0111, 0111" severity e


            s_b <= "0111"; s_a <= "1000"; wait xfor 100 ns;
            assert ((s_B_greater_A = '0') and (s_B_equals_A = '0') and (s_B_l
            report "Test failed for input combination: 0111, 1000" severity e


            s_b <= "0111"; s_a <= "1001"; wait for 100 ns;
            assert ((s_B_greater_A = '0') and (s_B_equals_A = '0') and (s_B_l
            report "Test failed for input combination: 0111, 1001" severity e
```

```
    s_b <= "0111"; s_a <= "1010"; wait for 100 ns;
    assert ((s_B_greater_A = '0') and (s_B_equals_A = '0') and (s_B_l
    report "Test failed for input combination: 0111, 1010" severity e


    s_b <= "0111"; s_a <= "1011"; wait for 100 ns;
    assert ((s_B_greater_A = '0') and (s_B_equals_A = '0') and (s_B_l
    report "Test failed for input combination: 0111, 1011" severity e


    s_b <= "0111"; s_a <= "1100"; wait for 100 ns;
    assert ((s_B_greater_A = '0') and (s_B_equals_A = '0') and (s_B_l
    report "Test failed for input combination: 0111, 1100" severity e


    s_b <= "0111"; s_a <= "1101"; wait for 100 ns;
    assert ((s_B_greater_A = '0') and (s_B_equals_A = '0') and (s_B_l
    report "Test failed for input combination: 0111, 1101" severity e


    s_b <= "0111"; s_a <= "1110"; wait for 100 ns;
    assert ((s_B_greater_A = '0') and (s_B_equals_A = '0') and (s_B_l
    report "Test failed for input combination: 0111, 1110" severity e


    s_b <= "0111"; s_a <= "1111"; wait for 100 ns;
    assert ((s_B_greater_A = '0') and (s_B_equals_A = '0') and (s_B_l
    report "Test failed for input combination: 0111, 1111" severity e


    s_b <= "1000"; s_a <= "0000"; wait for 100 ns;
    assert ((s_B_greater_A = '1') and (s_B_equals_A = '0') and (s_B_l
    report "Test failed for input combination: 1000, 0000" severity e


    s_b <= "1000"; s_a <= "0001"; wait for 100 ns;
    assert ((s_B_greater_A = '1') and (s_B_equals_A = '0') and (s_B_l
    report "Test failed for input combination: 1000, 0001" severity e


    s_b <= "1000"; s_a <= "0010"; wait for 100 ns;
    assert ((s_B_greater_A = '1') and (s_B_equals_A = '0') and (s_B_l
    report "Test failed for input combination: 1000, 0010" severity e


    s_b <= "1000"; s_a <= "0011"; wait for 100 ns;
    assert ((s_B_greater_A = '1') and (s_B_equals_A = '0') and (s_B_l
    report "Test failed for input combination: 1000, 0011" severity e


    s_b <= "1000"; s_a <= "0100"; wait for 100 ns;
    assert ((s_B_greater_A = '1') and (s_B_equals_A = '0') and (s_B_l
    report "Test failed for input combination: 1000, 0100" severity e


    s_b <= "1000"; s_a <= "0101"; wait for 100 ns;
    assert ((s_B_greater_A = '1') and (s_B_equals_A = '0') and (s_B_l
    report "Test failed for input combination: 1000, 0101" severity e


    s_b <= "1000"; s_a <= "0110"; wait for 100 ns;
    assert ((s_B_greater_A = '1') and (s_B_equals_A = '0') and (s_B_l
    report "Test failed for input combination: 1000, 0110" severity e


    s_b <= "1000"; s_a <= "0111"; wait for 100 ns;
    assert ((s_B_greater_A = '1') and (s_B_equals_A = '0') and (s_B_l
    report "Test failed for input combination: 1000, 0111" severity e
```

```vhdl
                    s_b <= "1000"; s_a <= "1000"; wait for 100 ns;
                    assert ((s_B_greater_A = '0') and (s_B_equals_A = '1') and (s_B_l
                    report "Test failed for input combination: 1000, 1000" severity e

                    s_b <= "1000"; s_a <= "1001"; wait for 100 ns;
                    assert ((s_B_greater_A = '0') and (s_B_equals_A = '0') and (s_B_l
                    report "Test failed for input combination: 1000, 1001" severity e

                    s_b <= "1000"; s_a <= "1010"; wait for 100 ns;
                    assert ((s_B_greater_A = '0') and (s_B_equals_A = '0') and (s_B_l
                    report "Test failed for input combination: 1000, 1010" severity e

                    s_b <= "1000"; s_a <= "1011"; wait for 100 ns;
                    assert ((s_B_greater_A = '0') and (s_B_equals_A = '0') and (s_B_l
                    report "Test failed for input combination: 1000, 1011" severity e

                    s_b <= "1000"; s_a <= "1100"; wait for 100 ns;
                    assert ((s_B_greater_A = '0') and (s_B_equals_A = '0') and (s_B_l
                    report "Test failed for input combination: 1000, 1100" severity e

                    s_b <= "1000"; s_a <= "1101"; wait for 100 ns;
                    assert ((s_B_greater_A = '0') and (s_B_equals_A = '0') and (s_B_l
                    report "Test failed for input combination: 1000, 1101" severity e

                    s_b <= "1000"; s_a <= "1110"; wait for 100 ns;
                    assert ((s_B_greater_A = '0') and (s_B_equals_A = '0') and (s_B_l
                    report "Test failed for input combination: 1000, 1110" severity e

                    s_b <= "1000"; s_a <= "1111"; wait for 100 ns;
                    assert ((s_B_greater_A = '0') and (s_B_equals_A = '0') and (s_B_l
                    report "Test failed for input combination: 1000, 1111" severity e

                    s_b <= "1001"; s_a <= "0000"; wait for 100 ns;
                    assert ((s_B_greater_A = '1') and (s_B_equals_A = '0') and (s_B_l
                    report "Test failed for input combination: 1001, 0000" severity e

                    s_b <= "1001"; s_a <= "0001"; wait for 100 ns;
                    assert ((s_B_greater_A = '1') and (s_B_equals_A = '0') and (s_B_l
                    report "Test failed for input combination: 1001, 0001" severity e

                    s_b <= "1001"; s_a <= "0010"; wait for 100 ns;
                    assert ((s_B_greater_A = '1') and (s_B_equals_A = '0') and (s_B_l
                    report "Test failed for input combination: 1001, 0010" severity e

                    s_b <= "1001"; s_a <= "0011"; wait for 100 ns;
                    assert ((s_B_greater_A = '1') and (s_B_equals_A = '0') and (s_B_l
                    report "Test failed for input combination: 1001, 0011" severity e

                    s_b <= "1001"; s_a <= "0100"; wait for 100 ns;
                    assert ((s_B_greater_A = '1') and (s_B_equals_A = '0') and (s_B_l
                    report "Test failed for input combination: 1001, 0100" severity e

                    s_b <= "1001"; s_a <= "0101"; wait for 100 ns;
                    assert ((s_B_greater_A = '1') and (s_B_equals_A = '0') and (s_B_l
```

```
                    report "Test failed for input combination: 1001, 0101" severity e

          s_b <= "1001"; s_a <= "0110"; wait for 100 ns;
          assert ((s_B_greater_A = '1') and (s_B_equals_A = '0') and (s_B_l
          report "Test failed for input combination: 1001, 0110" severity e

          s_b <= "1001"; s_a <= "0111"; wait for 100 ns;
          assert ((s_B_greater_A = '1') and (s_B_equals_A = '0') and (s_B_l
          report "Test failed for input combination: 1001, 0111" severity e

          s_b <= "1001"; s_a <= "1000"; wait for 100 ns;
          assert ((s_B_greater_A = '1') and (s_B_equals_A = '0') and (s_B_l
          report "Test failed for input combination: 1001, 1000" severity e

          s_b <= "1001"; s_a <= "1001"; wait for 100 ns;
          assert ((s_B_greater_A = '0') and (s_B_equals_A = '1') and (s_B_l
          report "Test failed for input combination: 1001, 1001" severity e

          s_b <= "1001"; s_a <= "1010"; wait for 100 ns;
          assert ((s_B_greater_A = '0') and (s_B_equals_A = '0') and (s_B_l
          report "Test failed for input combination: 1001, 1010" severity e

          s_b <= "1001"; s_a <= "1011"; wait for 100 ns;
          assert ((s_B_greater_A = '0') and (s_B_equals_A = '0') and (s_B_l
          report "Test failed for input combination: 1001, 1011" severity e

          s_b <= "1001"; s_a <= "1100"; wait for 100 ns;
          assert ((s_B_greater_A = '0') and (s_B_equals_A = '0') and (s_B_l
          report "Test failed for input combination: 1001, 1101" severity e

          s_b <= "1001"; s_a <= "1101"; wait for 100 ns;
          assert ((s_B_greater_A = '0') and (s_B_equals_A = '0') and (s_B_l
          report "Test failed for input combination: 1001, 1101" severity e

          s_b <= "1001"; s_a <= "1110"; wait for 100 ns;
          assert ((s_B_greater_A = '0') and (s_B_equals_A = '0') and (s_B_l
          report "Test failed for input combination: 1001, 1110" severity e

          s_b <= "1001"; s_a <= "1111"; wait for 100 ns;
          assert ((s_B_greater_A = '0') and (s_B_equals_A = '0') and (s_B_l
          report "Test failed for input combination: 1001, 1111" severity e

          s_b <= "1010"; s_a <= "0000"; wait for 100 ns;
          assert ((s_B_greater_A = '1') and (s_B_equals_A = '0') and (s_B_l
          report "Test failed for input combination: 1010, 0000" severity e

          s_b <= "1010"; s_a <= "0001"; wait for 100 ns;
          assert ((s_B_greater_A = '1') and (s_B_equals_A = '0') and (s_B_l
          report "Test failed for input combination: 1010, 0001" severity e

          s_b <= "1010"; s_a <= "0010"; wait for 100 ns;
          assert ((s_B_greater_A = '1') and (s_B_equals_A = '0') and (s_B_l
          report "Test failed for input combination: 1010, 0010" severity e

          s_b <= "1010"; s_a <= "0011"; wait for 100 ns;
```

```vhdl
            assert ((s_B_greater_A = '1') and (s_B_equals_A = '0') and (s_B_l
            report "Test failed for input combination: 1010, 0011" severity e

            s_b <= "1010"; s_a <= "0100"; wait for 100 ns;
            assert ((s_B_greater_A = '1') and (s_B_equals_A = '0') and (s_B_l
            report "Test failed for input combination: 1010, 0100" severity e

            s_b <= "1010"; s_a <= "0101"; wait for 100 ns;
            assert ((s_B_greater_A = '1') and (s_B_equals_A = '0') and (s_B_l
            report "Test failed for input combination: 1010, 0101" severity e

            s_b <= "1010"; s_a <= "0110"; wait for 100 ns;
            assert ((s_B_greater_A = '1') and (s_B_equals_A = '0') and (s_B_l
            report "Test failed for input combination: 1010, 0110" severity e

            s_b <= "1010"; s_a <= "0111"; wait for 100 ns;
            assert ((s_B_greater_A = '1') and (s_B_equals_A = '0') and (s_B_l
            report "Test failed for input combination: 1010, 0111" severity e

            s_b <= "1010"; s_a <= "1000"; wait for 100 ns;
            assert ((s_B_greater_A = '1') and (s_B_equals_A = '0') and (s_B_l
            report "Test failed for input combination: 1010, 1000" severity e

            s_b <= "1010"; s_a <= "1001"; wait for 100 ns;
            assert ((s_B_greater_A = '1') and (s_B_equals_A = '0') and (s_B_l
            report "Test failed for input combination: 1010, 1001" severity e

            s_b <= "1011"; s_a <= "1001"; wait for 100 ns;
            assert ((s_B_greater_A = '1') and (s_B_equals_A = '0') and (s_B_l
            report "Test failed for input combination: 1011, 1001" severity e

            s_b <= "1100"; s_a <= "1010"; wait for 100 ns;
            assert ((s_B_greater_A = '1') and (s_B_equals_A = '0') and (s_B_l
            report "Test failed for input combination: 1100, 1010" severity e

            s_b <= "1100"; s_a <= "1011"; wait for 100 ns;
            assert ((s_B_greater_A = '1') and (s_B_equals_A = '0') and (s_B_l
            report "Test failed for input combination: 1100, 1011" severity e

            s_b <= "1100"; s_a <= "1100"; wait for 100 ns;
            assert ((s_B_greater_A = '0') and (s_B_equals_A = '1') and (s_B_l
            report "Test failed for input combination: 1100, 1100" severity e

            s_b <= "1100"; s_a <= "1101"; wait for 100 ns;
            assert ((s_B_greater_A = '0') and (s_B_equals_A = '0') and (s_B_l
            report "Test failed for input combination: 1100, 1101" severity e

            s_b <= "1100"; s_a <= "1110"; wait for 100 ns;
            assert ((s_B_greater_A = '0') and (s_B_equals_A = '0') and (s_B_l
            report "Test failed for input combination: 1100, 1110" severity e

            s_b <= "1100"; s_a <= "1111"; wait for 100 ns;
            assert ((s_B_greater_A = '0') and (s_B_equals_A = '0') and (s_B_l
            report "Test failed for input combination: 1100, 1111" severity e
```

```vhdl
            s_b <= "1101"; s_a <= "0000"; wait for 100 ns;
            assert ((s_B_greater_A = '1') and (s_B_equals_A = '0') and (s_B_l
            report "Test failed for input combination: 1101, 0000" severity e

            s_b <= "1101"; s_a <= "0001"; wait for 100 ns;
            assert ((s_B_greater_A = '1') and (s_B_equals_A = '0') and (s_B_l
            report "Test failed for input combination: 1101, 0001" severity e

            s_b <= "1101"; s_a <= "0010"; wait for 100 ns;
            assert ((s_B_greater_A = '1') and (s_B_equals_A = '0') and (s_B_l
            report "Test failed for input combination: 1101, 0010" severity e

            s_b <= "1101"; s_a <= "0011"; wait for 100 ns;
            assert ((s_B_greater_A = '1') and (s_B_equals_A = '0') and (s_B_l
            report "Test failed for input combination: 1101, 0011" severity e

            s_b <= "1101"; s_a <= "0100"; wait for 100 ns;
            assert ((s_B_greater_A = '1') and (s_B_equals_A = '0') and (s_B_l
            report "Test failed for input combination: 1101, 0100" severity e

            s_b <= "1101"; s_a <= "0101"; wait for 100 ns;
            assert ((s_B_greater_A = '1') and (s_B_equals_A = '0') and (s_B_l
            report "Test failed for input combination: 1101, 0101" severity e

            s_b <= "1101"; s_a <= "0110"; wait for 100 ns;
            assert ((s_B_greater_A = '1') and (s_B_equals_A = '0') and (s_B_l
            report "Test failed for input combination: 1101, 0110" severity e

            s_b <= "1101"; s_a <= "0111"; wait for 100 ns;
            assert ((s_B_greater_A = '1') and (s_B_equals_A = '0') and (s_B_l
            report "Test failed for input combination: 1101, 0111" severity e

            s_b <= "1101"; s_a <= "1000"; wait for 100 ns;
            assert ((s_B_greater_A = '1') and (s_B_equals_A = '0') and (s_B_l
            report "Test failed for input combination: 1101, 1000" severity e

            s_b <= "1101"; s_a <= "1001"; wait for 100 ns;
            assert ((s_B_greater_A = '1') and (s_B_equals_A = '0') and (s_B_l
            report "Test failed for input combination: 1101, 1001" severity e

            s_b <= "1101"; s_a <= "1010"; wait for 100 ns;
            assert ((s_B_greater_A = '1') and (s_B_equals_A = '0') and (s_B_l
            report "Test failed for input combination: 1101, 1010" severity e

            s_b <= "1101"; s_a <= "1011"; wait for 100 ns;
            assert ((s_B_greater_A = '1') and (s_B_equals_A = '0') and (s_B_l
            report "Test failed for input combination: 1101, 1011" severity e

            s_b <= "1101"; s_a <= "1100"; wait for 100 ns;
            assert ((s_B_greater_A = '1') and (s_B_equals_A = '0') and (s_B_l
            report "Test failed for input combination: 1101, 1101" severity e

            s_b <= "1110"; s_a <= "1010"; wait for 100 ns;
            assert ((s_B_greater_A = '1') and (s_B_equals_A = '0') and (s_B_l
            report "Test failed for input combination: 1110, 1010" severity e
```

```vhdl
            s_b <= "1110"; s_a <= "1011"; wait for 100 ns;
            assert ((s_B_greater_A = '1') and (s_B_equals_A = '0') and (s_B_l
            report "Test failed for input combination: 1110, 1011" severity e

            s_b <= "1110"; s_a <= "1100"; wait for 100 ns;
            assert ((s_B_greater_A = '1') and (s_B_equals_A = '0') and (s_B_l
            report "Test failed for input combination: 1110, 1100" severity e

            s_b <= "1110"; s_a <= "1101"; wait for 100 ns;
            assert ((s_B_greater_A = '1') and (s_B_equals_A = '0') and (s_B_l
            report "Test failed for input combination: 1110, 1101" severity e

            s_b <= "1110"; s_a <= "1110"; wait for 100 ns;
            assert ((s_B_greater_A = '0') and (s_B_equals_A = '1') and (s_B_l
            report "Test failed for input combination: 1110, 1110" severity e

            s_b <= "1110"; s_a <= "1111"; wait for 100 ns;
            assert ((s_B_greater_A = '0') and (s_B_equals_A = '0') and (s_B_l
            report "Test failed for input combination: 1110, 1111" severity e

            s_b <= "1111"; s_a <= "0000"; wait for 100 ns;
            assert ((s_B_greater_A = '1') and (s_B_equals_A = '0') and (s_B_l
            report "Test failed for input combination: 1111, 0000" severity e

            s_b <= "1111"; s_a <= "0001"; wait for 100 ns;
            assert ((s_B_greater_A = '1') and (s_B_equals_A = '0') and (s_B_l
            report "Test failed for input combination: 1111, 0001" severity e

            s_b <= "1111"; s_a <= "0010"; wait for 100 ns;
            assert ((s_B_greater_A = '1') and (s_B_equals_A = '0') and (s_B_l
            report "Test failed for input combination: 1111, 0010" severity e

            s_b <= "1111"; s_a <= "0011"; wait for 100 ns;
            assert ((s_B_greater_A = '1') and (s_B_equals_A = '0') and (s_B_l
            report "Test failed for input combination: 1111, 0011" severity e

            s_b <= "1111"; s_a <= "0100"; wait for 100 ns;
            assert ((s_B_greater_A = '1') and (s_B_equals_A = '0') and (s_B_l
            report "Test failed for input combination: 1111, 0100" severity e

            s_b <= "1111"; s_a <= "0101"; wait for 100 ns;
            assert ((s_B_greater_A = '1') and (s_B_equals_A = '0') and (s_B_l
            report "Test failed for input combination: 1111, 0101" severity e

            s_b <= "1111"; s_a <= "0110"; wait for 100 ns;
            assert ((s_B_greater_A = '1') and (s_B_equals_A = '0') and (s_B_l
            report "Test failed for input combination: 1111, 0110" severity e

            s_b <= "1111"; s_a <= "0111"; wait for 100 ns;
            assert ((s_B_greater_A = '1') and (s_B_equals_A = '0') and (s_B_l
            report "Test failed for input combination: 1111, 0111" severity e

            s_b <= "1111"; s_a <= "1000"; wait for 100 ns;
            assert ((s_B_greater_A = '1') and (s_B_equals_A = '0') and (s_B_l
```

```
                    report "Test failed for input combination: 1111, 1000" severity e

              s_b <= "1111"; s_a <= "1001"; wait for 100 ns;
              assert ((s_B_greater_A = '1') and (s_B_equals_A = '0') and (s_B_l
                    report "Test failed for input combination: 1111, 1001" severity e

              s_b <= "1111"; s_a <= "1010"; wait for 100 ns;
              assert ((s_B_greater_A = '1') and (s_B_equals_A = '0') and (s_B_l
                    report "Test failed for input combination: 1111, 1010" severity e

              s_b <= "1111"; s_a <= "1011"; wait for 100 ns;
              assert ((s_B_greater_A = '1') and (s_B_equals_A = '0') and (s_B_l
                    report "Test failed for input combination: 1111, 1011" severity e

              s_b <= "1111"; s_a <= "1100"; wait for 100 ns;
              assert ((s_B_greater_A = '1') and (s_B_equals_A = '0') and (s_B_l
                    report "Test failed for input combination: 1111, 1100" severity e

              s_b <= "1111"; s_a <= "1101"; wait for 100 ns;
              assert ((s_B_greater_A = '1') and (s_B_equals_A = '0') and (s_B_l
                    report "Test failed for input combination: 1111, 1101" severity e

              s_b <= "1111"; s_a <= "1110"; wait for 100 ns;
              assert ((s_B_greater_A = '1') and (s_B_equals_A = '0') and (s_B_l
                    report "Test failed for input combination: 1111, 1110" severity e

              s_b <= "1111"; s_a <= "1111"; wait for 100 ns;
              assert ((s_B_greater_A = '1') and (s_B_equals_A = '0') and (s_B_l
                    report "Test failed for input combination: 1111, 1111" severity e


          -- Report a note at the end of stimulus process
          report "Stimulus process finished" severity note;
          wait;
      end process p_stimulus;
```

Listing of simulator console output, i.e. with one reported error

```
 Log      Share

[2021-02-23 16:20:07 EST] ghdl -i design.vhd testbench.vhd  && ghdl -m  tb_comparator_4bit && ghdl -r  tb_comparator_4bit
analyze design.vhd
analyze testbench.vhd
elaborate tb_comparator_4bit
testbench.vhd:51:9:@0ms:(report note): Stimulus process started
testbench.vhd:54:16:@100ns:(assertion error): Test failed for input combination: 0000, 0000... This is a mistake
testbench.vhd:747:9:@17300ns:(report note): Stimulus process finished
Done
```

This is link to my EDA plaground example of 4 bit comparator