Lab 01-gates

Verification of De Morgan's laws

Results table

c	b	a	f(c,b,a)
0	0	0	1
0	0	1	1
0	1	0	1
0	1	1	0
1	0	0	0
1	0	1	0
1	1	0	1
1	1	1	0

Link to EDA Playground project

Source VHDL code from *design.vhd*

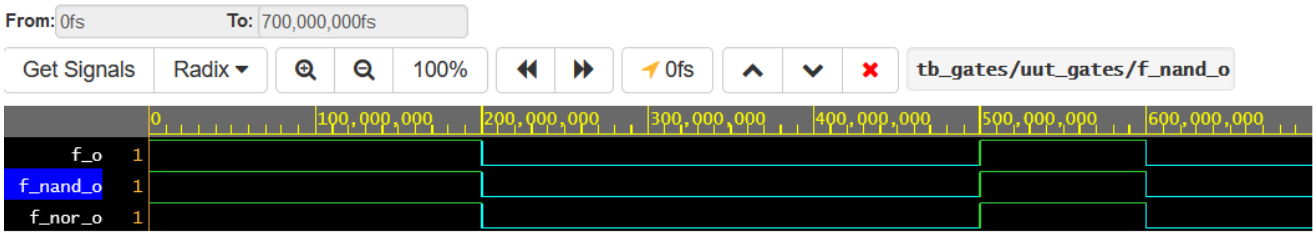
```
library ieee;                  -- Standard library
use ieee.std_logic_1164.all; -- Package for data types and logic operations

--------------------------------------------------------------------------
-- Entity declaration for basic gates
--------------------------------------------------------------------------
entity gates is
    port(
        a_i             : in  std_logic;         -- Data input
        b_i             : in  std_logic;         -- Data input
        c_i             : in  std_logic;         -- Data input
        f_o             : out std_logic;         -- base output function
        f_nand_o        : out std_logic;         -- NAND output function
        f_nor_o         : out std_logic          -- NOR output function
    );
end entity gates;
```

```
------------------------------------------------------------------------
-- Architecture body for basic gates
------------------------------------------------------------------------
architecture dataflow of gates is
begin
    f_o         <= (not b_i and a_i) or (not c_i and not b_i);
    f_nand_o    <= not (not (not b_i and a_i) and not(not b_i and not c_i));
    f_nor_o     <= not (b_i or not a_i) or not (c_i or b_i);

end architecture dataflow;
```

Simulation screenshot



Verification of Distributive laws

Link to EDA Playground project

Source VHDL code from *design.vhd*

```
library ieee;                -- Standard library
use ieee.std_logic_1164.all; -- Package for data types and logic operations

------------------------------------------------------------------------
-- Entity declaration for basic gates
------------------------------------------------------------------------
entity gates is
    port(
        a_i             : in  std_logic;         -- Data input
        b_i             : in  std_logic;         -- Data input
        c_i             : in  std_logic;         -- Data input
        f_or_left_o     : out std_logic;         -- OR LEFT SIDE output function
        f_or_right_o    : out std_logic;         -- OR LEFT SIDE output function
        f_and_left_o    : out std_logic;         -- AND LEFT SIDE output function
        f_and_right_o   : out std_logic          -- AND RIGHT SIDE output function
    );
```

```
end entity gates;

------------------------------------------------------------------------
-- Architecture body for basic gates
------------------------------------------------------------------------
architecture dataflow of gates is
begin
    f_or_left_o         <= (a_i and b_i) or (a_i and c_i);
    f_or_right_o        <= a_i and (b_i or c_i);
    f_and_left_o        <= (a_i or b_i) and (a_i or c_i);
    f_and_right_o       <= a_i or (b_i and c_i);

end architecture dataflow;
```

Simulation screenshot