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LAB 1

1- Obtain the truth table of the encoder block.

A	B	C	S1.1	S1.2
0	0	0	0	0
0	0	1	0	1
0	1	0	1	0
0	1	1	0	0
1	0	0	1	1
1	0	1	0	0
1	1	0	0	0
1	1	1	0	0

A = scissors

B = rock

C = paper

Note: the ones with an arrow represent when multiple options are selected or none of them is selected.

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2- Obtain the truth table of the RESULT LOGIC block.

S1.1	**S1.2**	**S2.1**	**S2.2**	Z1	Z2
0	0	0	0	0	0
0	0	0	1	0	0
0	0	1	0	0	0
0	0	1	1	0	0
0	1	0	0	0	0
0	1	0	1	1	1
0	1	1	0	1	0
0	1	1	1	0	1
1	0	0	0	0	0
1	0	0	1	0	1
1	0	1	0	1	1
1	0	1	1	1	0
1	1	0	0	0	0
1	1	0	1	1	0
1	1	1	0	0	1
1	1	1	1	1	1

S1.1, S1.2 = Result of the first encoder.

S2.1, S2.2 = Result of the second encoder.

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3- Implement in VHDL the circuit that implements the game functionality described above. Do not forget to include the necessary comments in the code.

```
LIBRARY ieee;

USE ieee.std_logic_1164.all;


ENTITY lab1_2 IS

	PORT(

	--each group of inputs correstponds to a different encoder, to different players

	--a or x for scissors

	--b or y for stone

	--c or z for paper

		a,b,c: IN STD_LOGIC;

		x,y,z: IN STD_LOGIC;

		z1,z2: OUT STD_LOGIC

	--the z would be theoutputs ofour game, z1=1 for ply1 winning, z2=1 for py 2 winning, and 1 1 for a draw

	);

END lab1_2;


ARCHITECTURE arch1 of lab1_2 is


	--signal s0_1,s1_1,s0_2,s1_2: std_logic;

	signal s1,s2: std_logic_vector(1 downto 0);

begin


process(a,b,c,x,y,z)

--encoder process, gives s1 and s2 vectores

-- we are giving our inputs a binary output of the encoder

	begin

	if a = '1' and b='0' and c='0'then
```

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```
                s1 <= "11";
        elsif b = '1' and a='0' and c='0'then
                s1 <= "10";
        elsif c = '1' and b='0' and a='0' then
                s1 <= "01";
        else
                s1 <= "00";
        end if;

        if x= '1' and z='0' and y='0'then
                s2 <= "11";
        elsif y = '1' and x='0' and z='0' then
                s2 <= "10";
        elsif z = '1' and x='0' and y='0' then
                s2 <= "01";
        else
                s2 <= "00";
        end if;

end process;

process (s1,s2)
        begin
-- we preselect the values of the outputs so we only have to change when 1
        z1<='0';
        z2<='0';
-- we use priority
--case when no botton is pressed
                if s1="00" or s2="00" then
                        z1<='0';
```

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```
                z2<='0';
--both players select the same option, so tie
            elsif s1=s2 then
                z1<='1';
                z2<='1';
--first player selects scissors
            elsif s1="11" then
--second selects stone
                if s2="10" then
                    z2<='1';
-- the only option left for py 2 is '01', paper
                else
                    z1<='1';
                end if;
-- the first py selects stone
            elsif s1="10" then
-- py2 selects scissors
                if s2="11" then
                    z1<='1';
--py2 selects paper
                else
                    z2<='1';
                end if;
--py1 selects paper
            else
-- py2 selects scissors
                if s2="11" then
                    z2<='1';
--py2 selects stone
                else
```

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```
                                    z1<='1';
                            end if;
                    end if;
end process;
end arch1;
```

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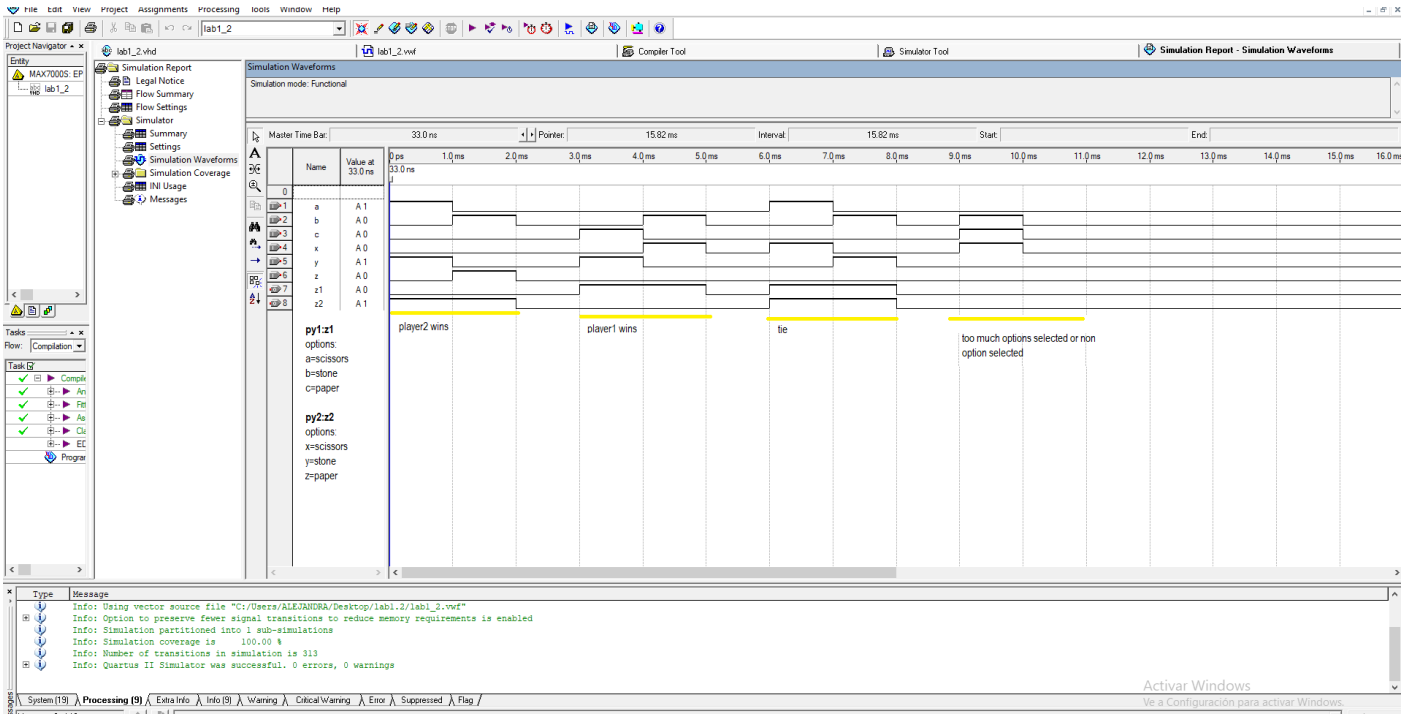
4- Simulate the VHDL code that implements the 'Scissors, Rock, Paper' game for two players. This simulation should be a functional simulation including the most relevant game situations. Make a screenshot of the simulation and comment on it.



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5- Starting from the previous vhdl code, create a new project and modify the VHDL code to provide the system with the corresponding inputs for 4 Players and a new 2-bit input (SEL) that will allow us to select which players will play against each other. The players will form 2 teams (Player0A, Player1A, Player0B and Player1B). The most significant bit of SEL will determine which player from team A plays. The least significant bit of SEL will determine which player from team B plays. Implement in VHDL the functionality described above and simulate some representative cases of the described game. Include in the VHDL code as comments the design decisions made.

```
LIBRARY ieee;

USE ieee.std_logic_1164.all;


ENTITY lab1_2_4jug IS

	PORT(

	--each group of inputs correstponds to a different encoder, to different players

	--a or x for scissors

	--b or y for stone

	--c or z for paper

		t1,s1,p1: IN STD_LOGIC;--0A

		t2,s2,p2: IN STD_LOGIC;--0B

		t3,s3,p3: IN STD_LOGIC;--1A

		t4,s4,p4: IN STD_LOGIC;--1B

		SEL: IN STD_logic_vector(1 downto 0);


		z1,z2: OUT STD_LOGIC

	--the z would be theoutputs ofour game, z1=1 for ply1 winning, z2=1 for py 2 winning, and 1 1 for a draw

	);

END lab1_2_4jug;


ARCHITECTURE arch1 of lab1_2_4jug is
```

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```
        --signal s0_1,s1_1,s0_2,s1_2: std_logic;
        signal s_1,s_2,s_3,s_4,x1,x2: std_logic_vector(1 downto 0);
begin

process(t1,s1,p1,t2,s2,p2,t3,s3,p3,t4,s4,p4)
--encoder process, gives s1 and s2 vectores
-- we are giving our inputs a binary output of the encoder
        begin
        if t1 = '1' and s1='0' and p1='0'then
                s_1 <= "11";
        elsif s1 = '1' and t1='0' and p1='0'then
                s_1 <= "10";
        elsif p1 = '1' and s1='0' and t1='0' then
                s_1 <= "01";
        else
                s_1 <= "00";
        end if;

        if t2= '1' and p2='0' and s2='0'then
                s_2 <= "11";
        elsif s2 = '1' and t2='0' and p2='0' then
                s_2 <= "10";
        elsif p2 = '1' and t2='0' and s2='0' then
                s_2 <= "01";
        else
                s_2 <= "00";
        end if;

        if t3 = '1' and s3='0' and p3='0'then
                s_3 <= "11";
```

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```
        elsif s3 = '1' and t3='0' and p3='0'then
                s_3 <= "10";
        elsif p3 = '1' and s3='0' and t3='0' then
                s_3 <= "01";
        else
                s_3 <= "00";
        end if;


        if t4 = '1' and s4='0' and p4='0'then
                s_4 <= "11";
        elsif s4 = '1' and t4='0' and p4='0'then
                s_4 <= "10";
        elsif p4 = '1' and s4='0' and t4='0' then
                s_4 <= "01";
        else
                s_4 <= "00";
        end if;



end process;

--we add this process to select the signal that we are using taking into account the Selection of participants

process (s_1,s_2,s_3,s_4)

begin

case SEL is

when "00" =>

x1<=s_1;

x2<=s_2;

when "01" =>

x1<=s_1;

x2<=s_4;
```

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```
when "10" =>
x1<=s_3;
x2<=s_2;
when others =>
x1<=s_3;
x2<=s_4;
end case;
end process;


process (x1,x2)
        begin
-- we preselect the values of the outputs so we only have to change when 1
        z1<='0';
        z2<='0';
-- we use priority
--case when no botton is pressed
                if x1="00" or x2="00" then
                        z1<='0';
                        z2<='0';
--both players select the same option, so tie
                elsif x1=x2 then
                        z1<='1';
                        z2<='1';
--first player selects scissors
                elsif x1="11" then
--second selects stone
                        if x2="10" then
                                z2<='1';
-- the only option left for py 2 is '01', paper
                        else
```

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```
                                z1<='1';
                        end if;
-- the first py selects stone
                elsif x1="10" then
-- py2 selects scissors
                        if x2="11" then
                                z1<='1';
--py2 selects paper
                        else
                                z2<='1';
                        end if;
--py1 selects paper
                else
-- py2 selects scissors
                        if x2="11" then
                                z2<='1';
--py2 selects stone
                        else
                                z1<='1';


                        end if;
                end if;
end process;


end arch1;
```

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