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Problem 1 (2,5 puntos)

A 4-bit data package is transmitted on a telecommunication channel. We want to design a combinational circuit that implements the following functionality:

- Compute the odd-parity bit of the transmitted data.
- Compute using 2s-complement the difference between 0's and 1's of the 4-bit transmitted.

a) Describe using VHDL the entity of the circuit. Explain the election of the data type.
b) Truth Table of the system.

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Problem 2 (4 puntos)

a) Obtain the equivalent schematic for the following VHDL code.

```
1  LIBRARY ieee;
2  USE ieee.std_logic_1164.all;
3
4  ENTITY exam IS
5      PORT
6      (
7          A :  IN  STD_LOGIC_VECTOR (1 downto 0);
8          B :  IN  STD_LOGIC_VECTOR (1 downto 0);
9          Y :  OUT  STD_LOGIC;
10         Z :  OUT  STD_LOGIC
11     );
12 END exam;
13
14 ARCHITECTURE bdf_type OF exam IS
15
16 SIGNAL AUX1,AUX3: STD_LOGIC;
17 SIGNAL S,AUX2:STD_LOGIC_VECTOR (1 downto 0);
18
19 BEGIN
20
21 S<=A(1)& B(1);
22 AUX1<=A(0) AND B(0);
23
24 PROCESS (S,AUX1,AUX2)
25 BEGIN
26 CASE S IS
27 WHEN "00" => z <= AUX1;
28 WHEN "01" => z <= AUX2(0);
29 WHEN "10" => z <= AUX2(1);
30 WHEN OTHERS => z <= S(0);
31 END CASE;
32 END PROCESS;
33
34
35
36 AUX2 <= "11" WHEN B(1) = '1' ELSE
37 "10" WHEN B(0) = '1' ELSE
38 "01" WHEN A(1) = '1' ELSE
39 "00";
40 AUX3 <= '1' WHEN A = "00" AND B = "00"  ELSE
41 '0';
42
43 Y<=AUX3;
44
45 END bdf_type;
```

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b) Draw the values of Z and Y in the following chronogram.

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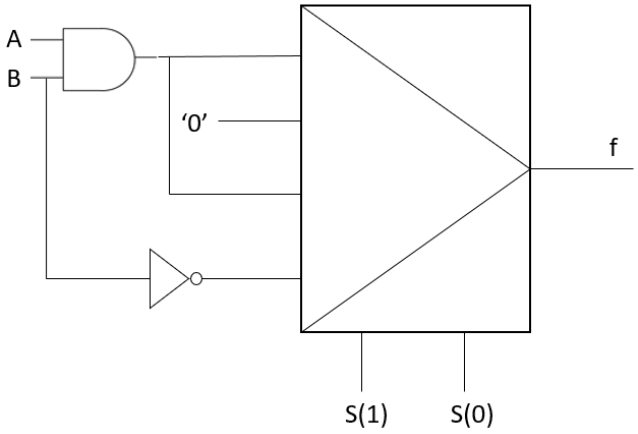
Problema 3(2 puntos)

Write a VHDL process that implements the functionality of the following schematic:



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Problema 4(1,5 puntos)

1) The binary representation of the decimal number 37,3125
   a) 100101,0110
   b) 101001,0101
   c) 100101,0101
   d) 101001,0110
2) Given the following numbers represented in CA2, A= 11000011 y B=01101100 determine their decimal value.

   A [ ] B [ ]

   Perform the following operations. There is overflow for the following operations? Why?

   A+B Overflow - YES - NO

   A-B Overflow - YES - NO

3) Fill the sensitivity list for the following process:

```
PROCESS (                                   )
        BEGIN
        X<= A OR B;
        IF X='1' then
            Y<='0';
        ELSE
            Y<='1';
        END IF;
        Z<= Y NAND C;
END PROCESS;
```