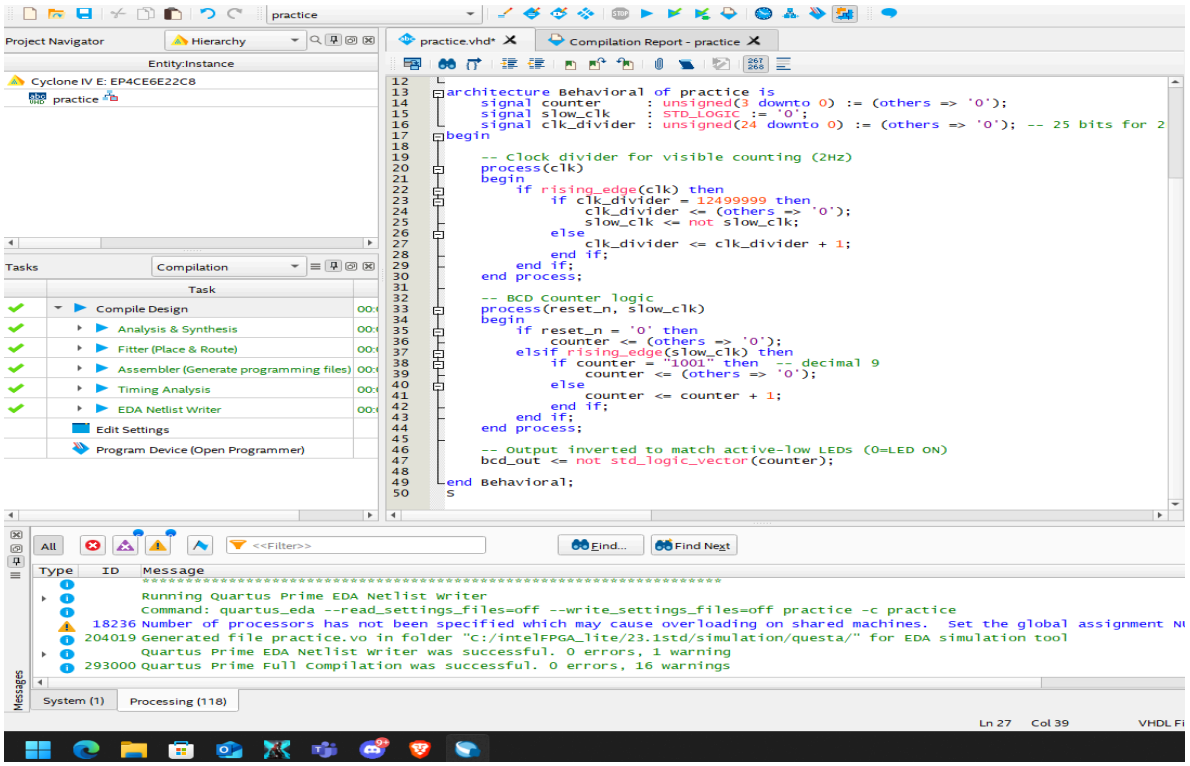
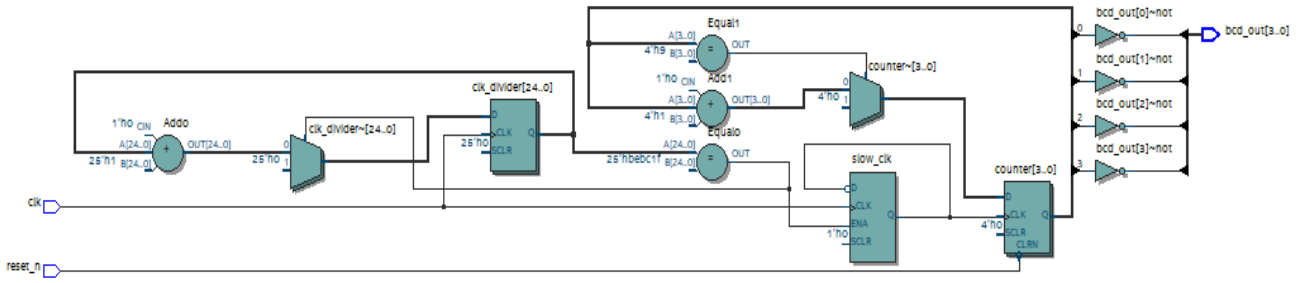
EMMAN ACE G. MENION
BSCPE 3A

BCD UP COUNTER:

```
library IEEE;
use IEEE.STD_LOGIC_1164.ALL;
use IEEE.NUMERIC_STD.ALL;

entity practice is
Port (
   clk     : in  STD_LOGIC;                -- Clock (PIN_23)
   reset_n : in  STD_LOGIC;                -- Active-low reset (PIN_25)
   bcd_out : out STD_LOGIC_VECTOR(3 downto 0) -- QD,QC,QB,QA (MSB to LSB)
);
end practice;

architecture Behavioral of practice is
   signal counter     : unsigned(3 downto 0) := (others => '0');
   signal slow_clk    : STD_LOGIC := '0';
   signal clk_divider : unsigned(24 downto 0) := (others => '0'); -- 25 bits for 2Hz @ 50MHz
begin

   -- Clock divider for visible counting (2Hz)
   process(clk)
   begin
      if rising_edge(clk) then
         if clk_divider = 12499999 then
            clk_divider <= (others => '0');
            slow_clk <= not slow_clk;
         else
            clk_divider <= clk_divider + 1;
         end if;
      end if;
   end process;

   -- BCD Counter logic
   process(reset_n, slow_clk)
   begin
      if reset_n = '0' then
         counter <= (others => '0');
      elsif rising_edge(slow_clk) then
         if counter = "1001" then  -- decimal 9
            counter <= (others => '0');
         else
            counter <= counter + 1;
         end if;
      end if;
   end process;
```

```
    -- Output inverted to match active-low LEDs (0=LED ON)
    bcd_out <= not std_logic_vector(counter);

end Behavioral;
```





Clock	QD	QC	QB	QA
0	0	0	0	0
1	0	0	0	1
2	0	0	1	0
3	0	0	1	1
4	0	1	0	0
5	0	1	0	1
6	0	1	1	0
7	0	1	1	1
8	1	0	0	0
9	1	0	0	1
10	0	0	0	0