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--Problem 17.3 (a)--  
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entity Counter_4 is  
  port (ClrN, LOAD, ENT, ENP, UP: std_logic; -- 1 bit inputs  
        D: in std_logic_vector(3 downto 0);  
        Q: out std_logic_vector(3 downto 0);  
        Co: out std_logic;  
  end Counter_4;  
  
architecture State_of Counter_4 is  
  
  signal qint: std_logic_vector(3 downto 0);  
  signal carry_int: std_logic;  
  signal appended_signal_load, appended_signal_decrease, appended_no_signal:  
    std_logic_vector(4 downto 0);  
  
begin  
  Q <= qint;  
  Co <= carry_int;  
  appended_signal_load <= (carry_int & qint) + ('0' & D);  
  appended_signal_decrease <= (carry_int & qint) - "00001";  
  appended_no_signal <= (carry_int & qint) + '1';  
  
  process (ClrN, Clk)  
  begin  
    if ClrN = '0' then  
      qint <= "0000";  
      carry_int <= '0';  
  
    elsif (Clk'event and Clk = 1) then  
  
      if LOAD = '1' then  
        qint <= appended_signal_load(3 downto 0);  
        carry_int <= appended_signal_load(4);  
  
      elsif (LOAD = '1' and ENT = '1' and ENP = '1' and UP = '1') then  
        qint <= appended_signal_decrease(3 downto 0);  
        carry_int <= appended_signal_decrease(4);  
  
      elsif (ENT = '1' and UP = '1' and qint = "1111") then -- state 15  
        carry_int <= '1';  
  
      elsif (ENT = '1' and UP = '0' and qint = "0000") then  
        carry_int <= '0';  
  
      else -- default case  
        qint <= appended_no_signal(3 downto 0);  
        carry_int <= appended_no_signal(4);  
  
      end if;  
  
    end if;  
  end process;  
end state;
```