Introduction to Digital Logic

- High Level State Machines

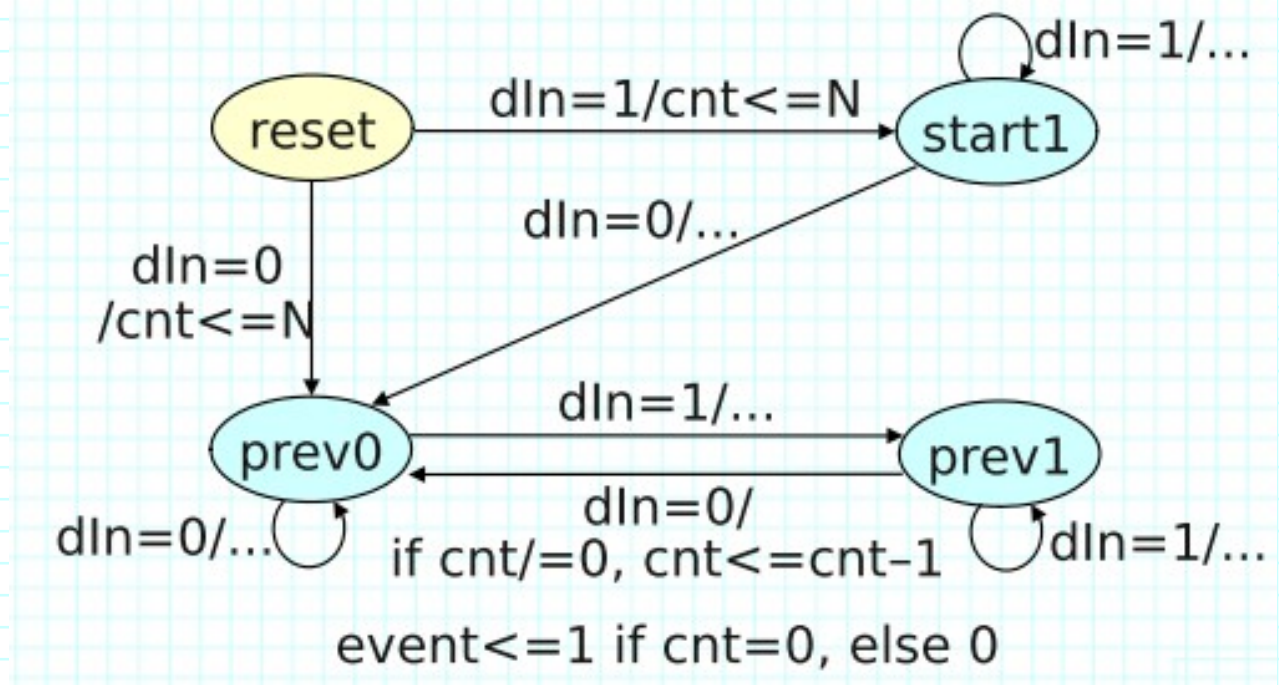
Doug Shook

Review Question

- Describe how a HLSM differs from an FSM:
  - Diagram
  - Circuit
  - VHDL

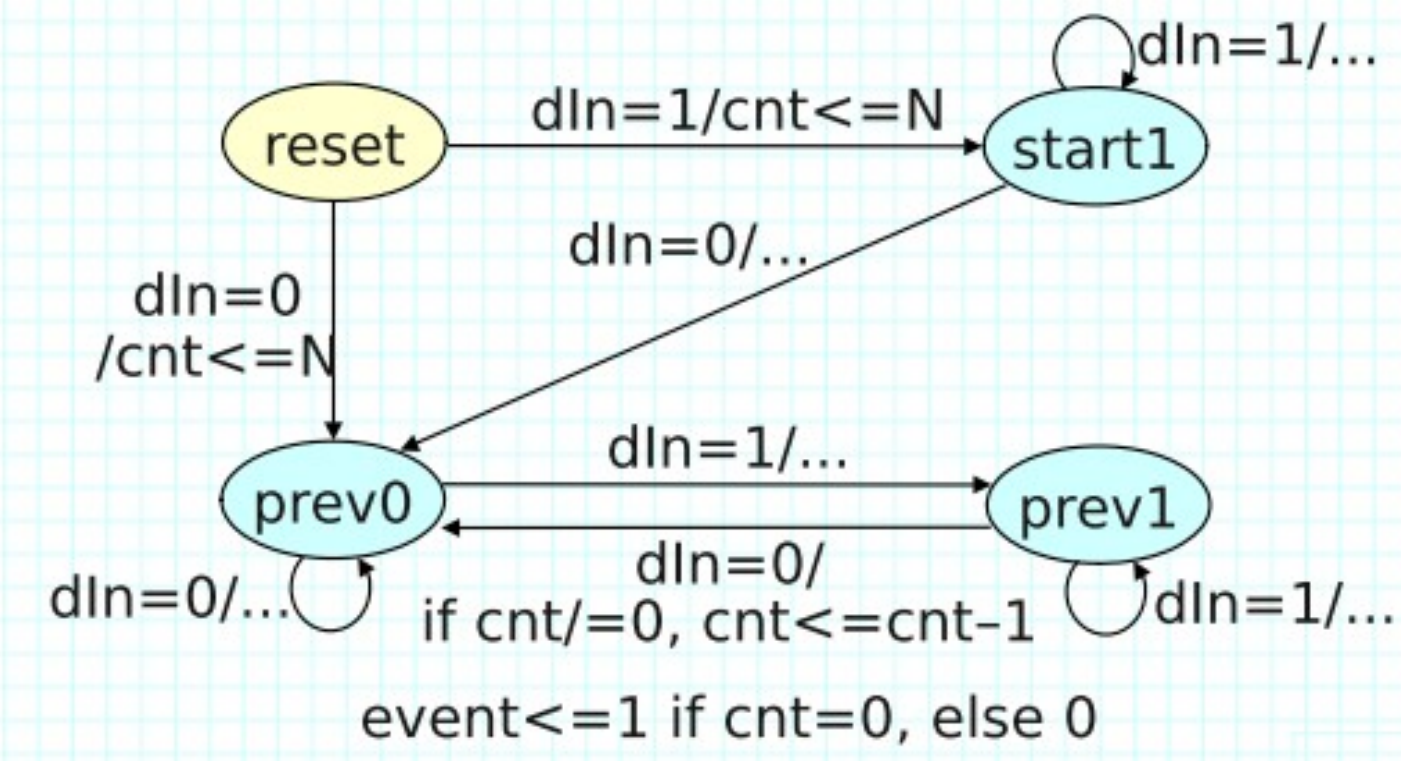
Review Questions

- The pulse counter output goes high and stays high when the N-th pulse is detected. After this happens, new pulses are not counted. Modify the state diagram so that when the circuit detects the N-th pulse, it raises the event output for one clock tick and reloads the counter, then resumes counting pulses.



Review Questions

- Draw a state diagram for a circuit that counts pairs of pulses, rather than individual pulses.



Review Questions

- Modify the VHDL below to implement the pulse pair counter.

```
entity pulseCount is ... end pulseCount;
architecture arch of pulseCount is
type stateType is (resetState, start1, prev0, prev1);
signal state: stateType;
signal cnt: std_logic_vector(3 downto 0);
begin
    process (clk) begin
       if rising_edge(clk) then
          if reset = '1' then
             state <= resetState; cnt <= x"F";
          else
             case state is
             when resetState =>  cnt <= N;
                                 if dIn = '0' then state <= prev0;
                                 else state <= start1;
                                 end if;
             when start1 =>if dIn = '0' then state <= prev0; end if;
             when prev0 => if dIn = '1' then state <= prev1; end if;
             when prev1 => if dIn = '0' then
                              state <= prev0;
                              if cnt /= 0 then cnt <= cnt - 1; end if;
                           end if;
             when others =>
             end case;
          end if;
       end if;
    end process;
    event <= '1' when cnt = x"0" else '0';
end arch;
```

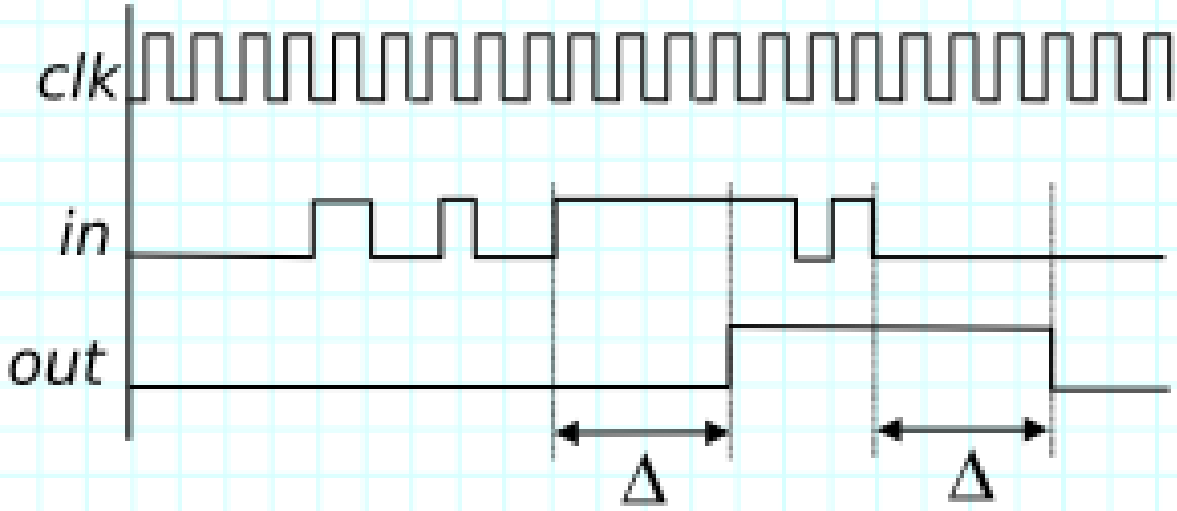
Designing HLSMs

- Let's adapt the FSM design process to work with HLSMs

Review Questions

- Mechanical buttons can vibrate as they are pressed and released
  - Problem?

- Design a HLSM for a debouncer.
  - Implement it in VHDL



Review Questions

- Design a HLSM for turning a knob:

