

# Digital Design

2018/19

# Process

```
<process_name>: process (<sensitivity_list>)
```

```
begin
```

```
    --process code
```

```
end
```

- <sensitivity\_list> is a list of all the signals that should change the outputs in a process

# if statement

- Only in a process block

```
if condition then
    --assignments
else
    --assignments
end if;
```

```
if condition then
    ----assignments
elsif condition then
    --assignments
else
    --assignments
end if;
```

# case statement

case s is

```
when val1 =>          output <= expr1;  
when val2 =>          output <= expr2;  
when val3 =>          output <= expr3;  
when others =>       output <= expr4;
```

end case;

- The default case is obligatory

# Example

- 4/1 mux

```
process (i,s)
begin
    case s is
        when "00" => o <= i(0);
        when "01" => o <= i(1);
        when "10" => o <= i(2);
        when "11" => o <= i(3);
        when others => o <= i(0);
    end case;
end process;
```

# Sequential circuit

- Changes happen on clock edges
- A clock edge is detected with `clk'event`
  - `clk` is the name of the clock signal
  - `'event` is `true` on rising and falling edge
- Rising edge
  - `clk'event and clk = '1'`
- Falling edge
  - `clk'event and clk = '0'`

# D flip flop

```
process(clk)
begin
    if clk'event and clk = '1' then
        q <= d ;
    end if ;
end process ;
```

- How to add a synchronous or asynchronous reset?

# Example - counter

```
process(clk)
begin
    if clk'event and clk = '1' then
        if(rst= '1 ') then
            --(others => '0') resets
            --all vector elements to 0
            count <= (others => '0');
        else
            count <= count + 1;
        end if;
    end if ;
end process ;
```

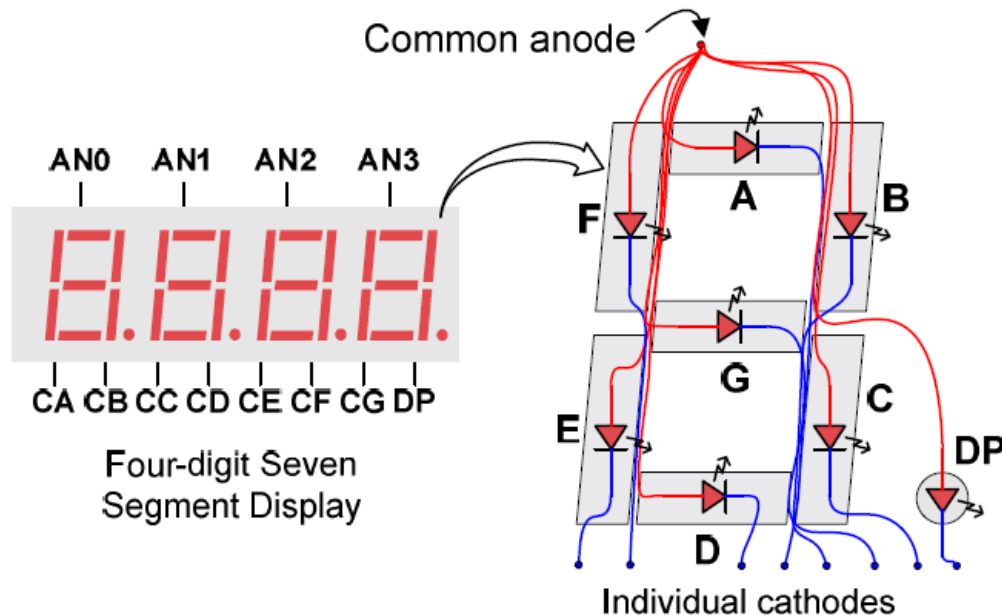


# Exercise

- a) Expand the counter to a 1s counter
  - Create a separate process that generates short (1 clock cycle) pulses each seconds
  - Use this pulses in the counter
- b) Show the values on the 7 segment display

# 7 segment display

- 7 inputs (cathode signals) to show one number
  - 0 -> segment on, 1 – segment off



# 7 segment display

- 4 anode signals that select one of the 7segment number
  - In order to use all of them at once cycle the anode signal

