EE5311 Tutorial 9 Report - EE22B070

Verilog Code:

https://drive.google.com/file/d/1yGhtHqhMH1ooY-RuR3ZniJKEtLuyrvLm/view?usp=drive_link

Measurements:

Before false paths:

```
  Delay    Time   Description
---------------------------------------------------------
   0.00    0.00   clock clk (rise edge)
   0.00    0.00   clock network delay (ideal)
   0.00    0.00 ^ _33_/CLK (sky130_fd_sc_hd__dfxtp_1)
   0.30    0.30 v _33_/Q (sky130_fd_sc_hd__dfxtp_1)
   0.37    0.67 v x1/x1/_10_/X (sky130_fd_sc_hd__maj3_1)
   0.38    1.06 v x1/x2/_10_/X (sky130_fd_sc_hd__maj3_1)
   0.38    1.44 v x1/x3/_10_/X (sky130_fd_sc_hd__maj3_1)
   0.34    1.78 v x1/x4/_10_/X (sky130_fd_sc_hd__maj3_1)
   0.32    2.10 v x1/x17/_4_/X (sky130_fd_sc_hd__mux2_1)
   0.38    2.48 v x1/x5/_10_/X (sky130_fd_sc_hd__maj3_1)
   0.38    2.87 v x1/x6/_10_/X (sky130_fd_sc_hd__maj3_1)
   0.38    3.25 v x1/x7/_10_/X (sky130_fd_sc_hd__maj3_1)
   0.34    3.60 v x1/x8/_10_/X (sky130_fd_sc_hd__maj3_1)
   0.32    3.91 v x1/x18/_4_/X (sky130_fd_sc_hd__mux2_1)
   0.38    4.30 v x1/x9/_10_/X (sky130_fd_sc_hd__maj3_1)
   0.38    4.68 v x1/x10/_10_/X (sky130_fd_sc_hd__maj3_1)
   0.38    5.06 v x1/x11/_10_/X (sky130_fd_sc_hd__maj3_1)
   0.34    5.41 v x1/x12/_10_/X (sky130_fd_sc_hd__maj3_1)
   0.32    5.73 v x1/x19/_4_/X (sky130_fd_sc_hd__mux2_1)
   0.38    6.11 v x1/x13/_10_/X (sky130_fd_sc_hd__maj3_1)
   0.38    6.49 v x1/x14/_10_/X (sky130_fd_sc_hd__maj3_1)
   0.38    6.88 v x1/x15/_10_/X (sky130_fd_sc_hd__maj3_1)
   0.34    7.22 v x1/x16/_10_/X (sky130_fd_sc_hd__maj3_1)
   0.27    7.49 v x1/x20/_4_/X (sky130_fd_sc_hd__mux2_1)
   0.00    7.49 v _16_/D (sky130_fd_sc_hd__dfxtp_1)
           7.49   data arrival time

   3.00    3.00   clock clk (rise edge)
   0.00    3.00   clock network delay (ideal)
   0.00    3.00   clock reconvergence pessimism
           3.00 ^ _16_/CLK (sky130_fd_sc_hd__dfxtp_1)
  -0.12    2.88   library setup time
           2.88   data required time
---------------------------------------------------------
           2.88   data required time
          -7.49   data arrival time
---------------------------------------------------------
          -4.61   slack (VIOLATED)
```

Time period = 3 – (-4.61) = 7.61ns

Max frequency = 131.40 MHz

After false paths:

```
% set_false_path -through x1/x1/_10_/X
% set_false_path -through x1/x5/_10_/X
% set_false_path -through x1/x9/_10_/X
% set_false_path -through x1/x20/_4_/X
% report_checks -path_delay max
Startpoint: _34_ (rising edge-triggered flip-flop clocked by clk)
Endpoint: _15_ (rising edge-triggered flip-flop clocked by clk)
Path Group: clk
Path Type: max

  Delay    Time   Description
---------------------------------------------------------
   0.00    0.00   clock clk (rise edge)
   0.00    0.00   clock network delay (ideal)
   0.00    0.00 ^ _34_/CLK (sky130_fd_sc_hd__dfxtp_1)
   0.30    0.30 v _34_/Q (sky130_fd_sc_hd__dfxtp_1)
   0.37    0.67 v x1/x2/_10_/X (sky130_fd_sc_hd__maj3_1)
   0.38    1.06 v x1/x3/_10_/X (sky130_fd_sc_hd__maj3_1)
   0.34    1.40 v x1/x4/_10_/X (sky130_fd_sc_hd__maj3_1)
   0.32    1.72 v x1/x17/_4_/X (sky130_fd_sc_hd__mux2_1)
   0.34    2.06 v x1/x18/_4_/X (sky130_fd_sc_hd__mux2_1)
   0.34    2.39 v x1/x19/_4_/X (sky130_fd_sc_hd__mux2_1)
   0.38    2.78 v x1/x13/_10_/X (sky130_fd_sc_hd__maj3_1)
   0.38    3.16 v x1/x14/_10_/X (sky130_fd_sc_hd__maj3_1)
   0.38    3.54 v x1/x15/_10_/X (sky130_fd_sc_hd__maj3_1)
   0.18    3.72 v x1/x16/_11_/X (sky130_fd_sc_hd__xor3_1)
   0.00    3.72 v _15_/D (sky130_fd_sc_hd__dfxtp_1)
           3.72   data arrival time

   3.00    3.00   clock clk (rise edge)
   0.00    3.00   clock network delay (ideal)
   0.00    3.00   clock reconvergence pessimism
           3.00 ^ _15_/CLK (sky130_fd_sc_hd__dfxtp_1)
  -0.13    2.87   library setup time
           2.87   data required time
---------------------------------------------------------
           2.87   data required time
          -3.72   data arrival time
---------------------------------------------------------
          -0.85   slack (VIOLATED)
```

Time period = 3 – (-0.85) = 3.85ns

Max frequency = 259.74 MHz