

Lab 3 – CONFORMAL

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I. Perform LEC with Conformal

Step 1: Change directory to “lec_env” folder. In this Lab 4, we will work at this place:

Step 2: Link the RTL, Netlist and Library file from “synthesis_env” into this place:

Step 3: Confirm there has no broken link (link files successfully)

Step 4: Prepare the setup script for Conformal as below:

Step 5: Prepare the execution script as below:

Step 6: Execute

Step 7: It will automatically open the GUI and execute processes that we described in file “lec.tcl”

Result

```
0
// Command: compare
=====
Compared points      PO      DFF      DLAT      Total
-----
Equivalent           16      19       4         39
=====
0
// Command: exit
```

II. Debug Non-equivalent point

Step 1: Copy Netlist into this place:

Step 2: Confirm Netlist already copied (not link):

Step 3: Modify Netlist to make a “bug” intentionally:

```

324 NOR3BX1 g5623_1881(.A(N[2]), .B(N[1]), .C(N[3]), .Y(n_29));
325 NOR3BX1 g5624_5115(.A(N[1]), .B(N[4]), .C(n_144), .Y(n_28));
326 NOR2X1 g5625_7482(.A(n_141), .B(n_145), .Y(n_27));
327 OR2X1 g5626_4733(.A(state[2]), .B(state[5]), .Y(n_26));
328 OR2X1 g5627_6161(.A(state[1]), .B(state[0]), .Y(n_25));
329 OR2X1 g5628_9315(.A(state[3]), .B(state[4]), .Y(n_24));
330 BUF2X1 drc_bufs5661(.A(n_19), .Y(n_0));
331 INVX1 g5673(.A(state[4]), .Y(n_8));
332 INVX1 g5675(.A(state[0]), .Y(n_12));
333 //INVX2 drc_bufs5677(.A(n_4), .Y(n_6));
334 INVX2 drc_bufs5679(.A(n_4), .Y(n_7));
335 INVX2 drc_bufs5681(.A(n_4), .Y(n_5));
336 INVX1 drc_bufs5683(.A(n_22), .Y(n_1));
337 INVX2 drc_bufs5685(.A(n_56), .Y(n_4));
338 NAND3BXL g5689_9945(.A(n_34), .B(n_18), .C(n_55), .Y(n_23));
339 NAND3BXL g5691_2883(.A(n_143), .B(n_29), .C(n_27), .Y(n_14));
340 NAND3BXL g5693_2346(.A(n_36), .B(N[31]), .C(flick), .Y(n_15));
341 NOR2X1 g5695_1666(.A(n_31), .B(n_49), .Y(n_16));
342 INVX1 g5697(.A(n_54), .Y(n_18));
343 INVX1 g5699(.A(n_16), .Y(n_17));
344 XNOR2X1 sub_94_11_g1096_7410(.A(N[27]), .B(sub_94_11_n_564), .Y
(n_173));
345
346 XNOR2X1 sub_94_11_g1097_6417(.A(N[23]), .B(sub_94_11_n_572), .Y
(n_169));
347
348 XNOR2X1 sub_94_11_g1098_5477(.A(N[19]), .B(sub_94_11_n_579), .Y
(n_165));
349
350 OAI2BBI1X1 sub_94_11_g1099_2398(.A0N(N[26]), .A1N(sub_94_11_n_586),
.B0(sub_94_11_n_564), .Y(n_172));
351
352 XNOR2X1 sub_94_11_g1100_5107(.A(N[15]), .B(sub_94_11_n_589), .Y
(n_161));
353
354 OR2X1 sub_94_11_g1101_6260(.A(N[26]), .B(sub_94_11_n_586), .Y
(sub_94_11_n_564));
355

```

Step 4: Re-execute

Step 5: When execution is done, “Non-equivalent” points will appear:

The screenshot shows the Cadence Conformal(R) Logic Equivalence Checking interface. The 'Golden' design contains 42 library cells and 98 primitives, while the 'Revised' design contains 304 library cells. The comparison results are displayed in a table below the design lists.

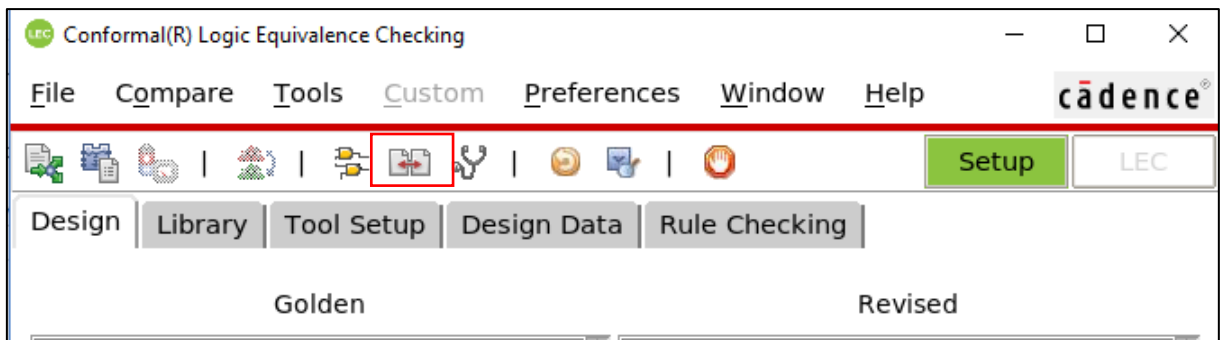
Compared points	PO	DFF	Total
Equivalent	16	30	46
Non-equivalent	0	8	8

The 'Non-equivalent' row is highlighted with a red box. Below the table, the command 'TCL_LEC> vpx diagnose 29 -golden // gate N_reg[28]' is shown, along with the diagnosis for non-equivalent key points: '(G) + 29 DFF /N reg[28]'. The status bar at the bottom indicates '100% completed'.

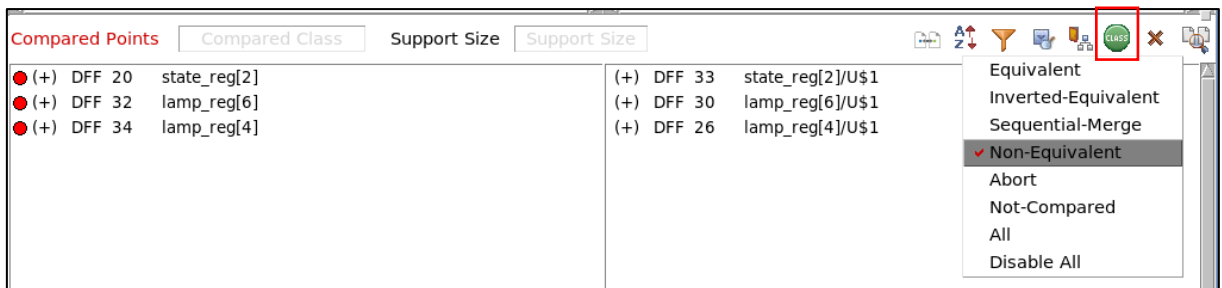
As you can see, i have total 8 Non-equivalent points

Step 6: There are many ways for debugging nonequivalent points. The following part is the debugging example using “Diagnosis Manager” and “Schematics Viewer” in GUI:

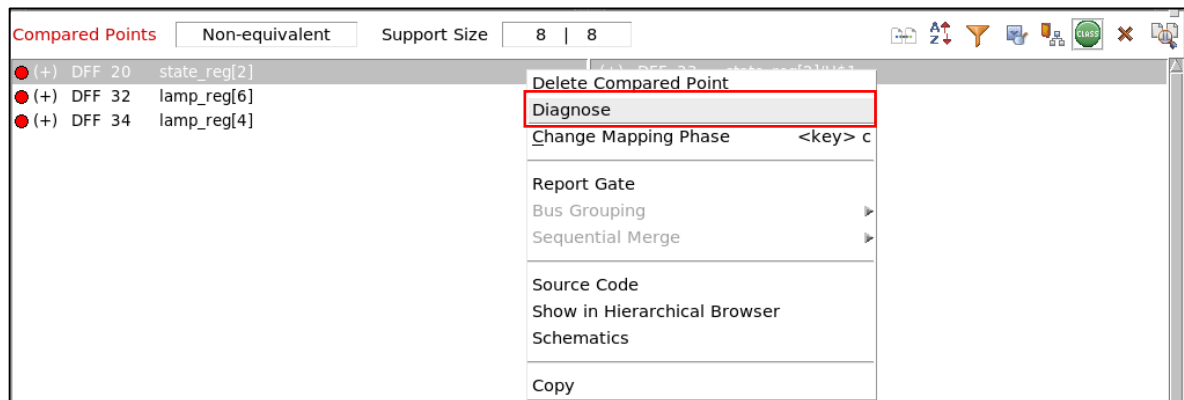
Click to open “Mapping Manager”



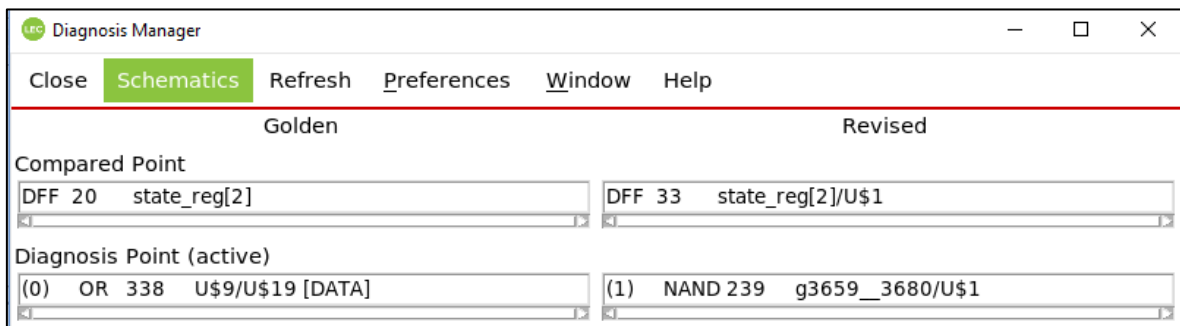
In “Mapping Manager” window, click “Class”, choose “Disable All” then choose “Non-Equivalent” to display only nonequivalent points



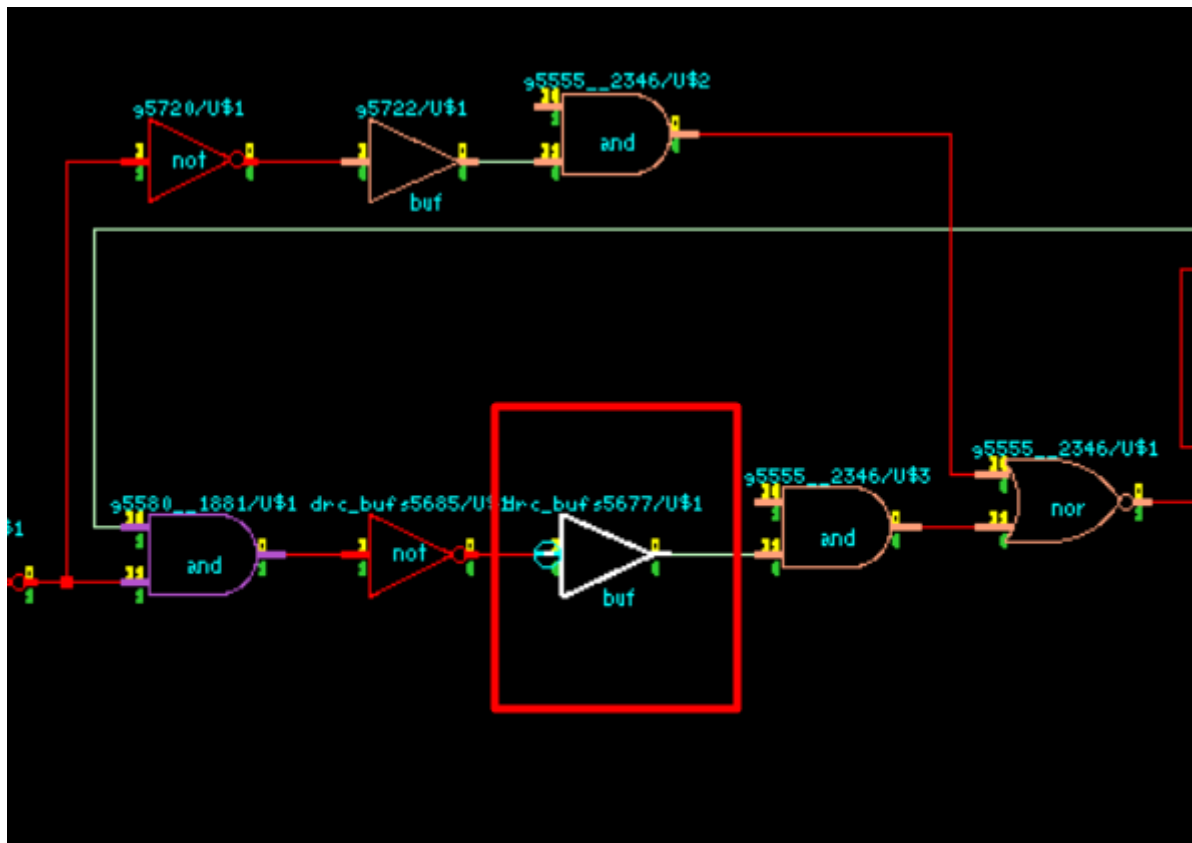
Right-click to first nonequivalent key point and choose “Diagnose” to open “Diagnosis Manager”



In “Diagnosis Manager” window, choose “Schematics” to open “Schematics Viewer”



After finding bug, the bug is:



As you can see at the input of the Not gate is 0 but the output is 0 too. It must be 1 to be right

```

322 OR4X1 g5622__6131(.A (state[2]), .B (n_9), .C (n_24), .D (n_25), .Y
323   (n_31));
324 NOR3BX1 g5623__1881(.AN (N[2]), .B (N[1]), .C (N[3]), .Y (n_29));
325 NOR3BX1 g5624__5115(.AN (N[1]), .B (N[4]), .C (n_144), .Y (n_28));
326 NOR2X1 g5625__7482(.A (n_141), .B (n_145), .Y (n_27));
327 OR2X1 g5626__4733(.A (state[2]), .B (state[5]), .Y (n_26));
328 OR2X1 g5627__6161(.A (state[1]), .B (state[0]), .Y (n_25));
329 OR2X1 g5628__9315(.A (state[3]), .B (state[4]), .Y (n_24));
330 BUF2 drc_bufs5661(.A (n_19), .Y (n_0));
331 INVX1 g5673(.A (state[4]), .Y (n_8));
332 INVX1 g5675(.A (state[0]), .Y (n_12));
333 //INVX2 drc_bufs5677(.A (n_4), .Y (n_6));
334 BUF2 drc_bufs5677(.A (n_4), .Y (n_6));
335 INVX2 drc_bufs5679(.A (n_4), .Y (n_7));
336 INVX2 drc_bufs5681(.A (n_4), .Y (n_5));
337 INVX1 drc_bufs5683(.A (n_22), .Y (n_1));
338 INVX2 drc_bufs5685(.A (n_56), .Y (n_4));
339 NAND3BXL g5689__9945(.AN (n_34), .B (n_18), .C (n_55), .Y (n_23));
340 NAND3BXL g5691__2883(.AN (n_143), .B (n_29), .C (n_27), .Y (n_14));
341 NAND3BXL g5693__2346(.AN (n_36), .B (N[31]), .C (flick), .Y (n_15));
342 NOR2X1 g5695__1666(.A (n_31), .B (n_49), .Y (n_16));
343 INVX1 g5697(.A (n_54), .Y (n_18));
344 INVX1 g5699(.A (n_16), .Y (n_17));
345 XNOR2X1 sub_94_11_g1096__7410(.A (N[27]), .B (sub_94_11_n_564), .Y
346   (n_173));

```

After debug, the final result

```

// mapping key points ...
=====
Mapped points: SYSTEM class
-----
Mapped points    PI    PO    DFF    DLAT    Total
-----
Golden           3    16    19     4     42
-----
Revised          3    16    19     4     42
=====
0
// Command: map_key_points
// Mapping key points ...
=====
Mapped points: SYSTEM class
-----
Mapped points    PI    PO    DFF    DLAT    Total
-----
Golden           3    16    19     4     42
-----
Revised          3    16    19     4     42
=====
0
// Command: add_compared_points -all
// 39 compared points added to compare list
0
// Command: compare
=====
Compared points    PO    DFF    DLAT    Total
-----
Equivalent         16    19     4     39
=====
0
// Command: exit

```